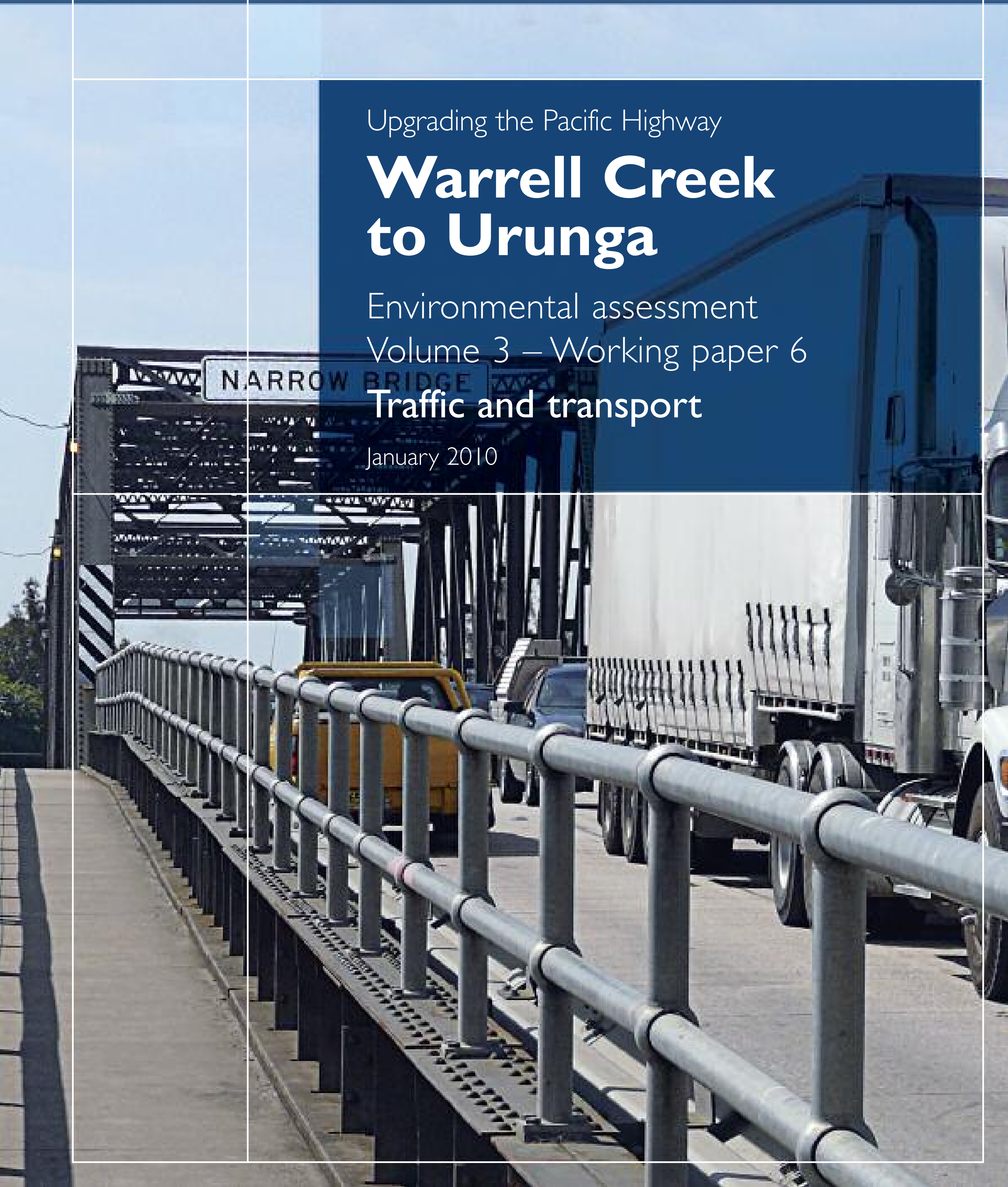
Upgrading the Pacific Highway

Warrell Creek to Urunga

Environmental assessment
Volume 3 – Working paper 6
Traffic and transport

January 2010



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SKM

Warrell Creek to Urunga Upgrading the Pacific Highway

WORKING PAPER NO 6 - TRAFFIC AND TRANSPORT

- Final Rev 8
- 14 January 2010

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Glossary of Terms

AADT	Annual Average Daily Traffic (total volume of traffic in a calendar year, divided by 365 to obtain average volume per day).
ADT	Average Daily Traffic (total volume of traffic during a particular period, divided by the number of days in that period)
Classified count	A traffic count that distinguishes between the types of vehicles. Commonly the counters are two parallel tubes across the roadway, recording the time between axles.
Vehicle class	Vehicles can be categorised according to their axle configuration. **Appendix A** presents the classification specified by Austroads and used for this study.
Light vehicles	Cars and utilities, including towing a trailer or caravan (Austroads Class 1 & 2).
B-Doubles	Eight or nine axle articulated vehicles (Austroads Class 10), restricted to approved routes.
Heavy vehicles	Vehicles over 3.0 tonnes gross weight (Austroads Classes 3 to 12)
MVKT	Million vehicle kilometres of travel (volume of traffic multiplied by the distance). Used in the calculation of crash rates for a length of road.
Growth rate	The growth rates expressed in this report are linear, ie the absolute change calculated for the first year is applied to each subsequent year.
Level of Service (LoS)	A performance measure used in planning design and operation of roads. It provides the basis for determining the number of lanes to be provided in the road network. The design peak hour LoS is the level of service corresponding ot the actual service flow rate in the design peak hour. The actual service flow/rate is calculated taking into account factors relating to traffic composition, road geometry, development and driver population. **Appendix B** provides the definitions for the LoS criteria.
Local traffic	Trips with both origin and destination in the study area.
Regional traffic	Trips with either origin or destination in the study area.
Long distance / Through traffic	Traffic with both origin and destination outside the study area.

1. Introduction

1.1. Overview

Sinclair Knight Merz (SKM) has been commissioned by the New South Wales (NSW) Roads and Traffic Authority (RTA) to conduct an environmental assessment (EA) of the Proposal for the Pacific Highway upgrade between Warrell Creek and Urunga, which forms part of the RTA's Pacific Highway Upgrading (PHU) Program. The Proposal corridor is located in the Mid-North Coast region of NSW and extends for approximately 42 km from the northern end of the existing Allgomera deviation, south of Warrell Creek, to the southern end of the existing Raleigh deviation, north of Urunga.

Traffic and transport is identified as a key issue in the Department of Planning (DoP) Director-General's Requirements. A detailed traffic and transport assessment of the Proposal was undertaken and is presented in this Working Paper.

1.2. Background to the Proposal

The Pacific Highway is one of the main corridors linking NSW and Queensland. This 42 km section of the highway services the townships of Macksville, Nambucca Heads and Urunga, and other smaller hamlets in between. The corridor has a daily volume of approximately 11,000 vehicles, including just below 20 percent heavy vehicles.

The Pacific Highway has a history of a high number of road-related fatalities, with historical accident data showing higher than average crash rates in many locations. The highway is also considered to be inappropriate for the traffic needs of today, resulting in widespread recognition of the need to provide a high quality road that will serve existing and future road users. The condition of the road between Hexham and the Queensland border varies significantly, from divided carriageways to sections of narrow two-lane road.

This detailed traffic and transportation assessment focuses on:

- Traffic volume forecasts reflecting historical traffic, population and economic growth of the area, and increased usage of the Pacific Highway as a principal corridor between Sydney and Brisbane;
- Understanding existing crash patterns and rates;
- Assessment of impact from the corridor options on traffic and accessibility to bypassed townships;
- An assessment of likely improvements to travel times for through traffic;
- Evaluating any change in the safety performance of the corridor; and

- Identification of any impacts on other users of the corridor, including local traffic, public transport and non-motorised corridor users.

2. Existing conditions in the study area

2.1. Population centres

The main population centres within the study area, and their 2006 populations (based on Census data) are Nambucca Heads (6,136), Macksville (2,155), Urunga (1,919), Valla Beach (1,055) and Scotts Head (789).

2.2. Traffic volumes

Volumes are presented for light and heavy vehicles. Heavy vehicles are all vehicles over 3 tonnes gross mass (Class 3 – 12 of Austroads classification – see **Appendix A**).

2.2.1. Existing traffic

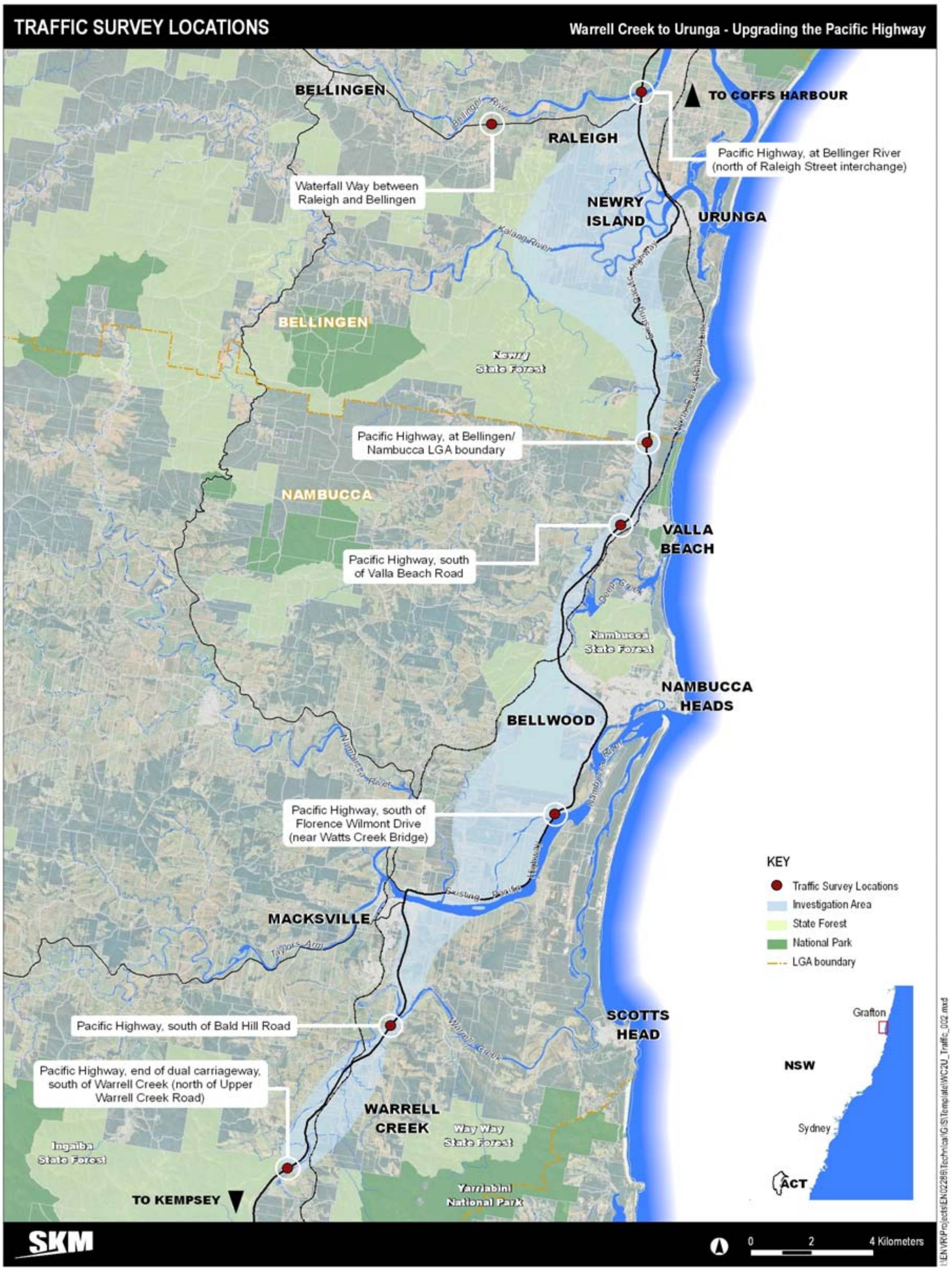
The RTA has a number of traffic count stations in the study area, along the Pacific Highway and on other main roads. The most recent published data available from these stations is for 2004, and all data collected is in terms of axle pairs[1]. The RTA data was supplemented with classified vehicle counts undertaken for the Proposal, for 7 days starting 21 November 2007, at the same locations as many of the RTA count stations (count locations are shown in **Figure 2-1**). Using the relationship between the average daily traffic (ADT) at the end of November and the annual average daily traffic (AADT) volume recorded by the RTA, the survey results were converted to an estimated AADT value (counting vehicles). AADT estimates for all the survey points are shown in **Table 2-1**.

- **Table 2-1 2007 AADT estimates (vehicles)**

Location	2007 AADT Estimates
Pacific Highway, end of dual carriageway, south of Warrell Creek (north of Upper Warrell Creek Road)	9000
Pacific Highway ,south of Bald Hill Road	10,400
Pacific Highway, south of Florence Wilmont Drive (near Watts Creek Bridge)	12,400
Pacific Highway, south of Valla Beach Road	11,000
Pacific Highway, at Bellingen / Nambucca LGA boundary	10,550
Pacific Highway, at Bellinger River (north of Raleigh interchange)	13,550
Waterfall Way between Raleigh and Bellingen	6,750

[1] A 2-axle car is the equivalent of 1 axle pair. A 3-axle truck is the equivalent of 1.5 axle pairs.

Figure 2-1 Traffic survey locations

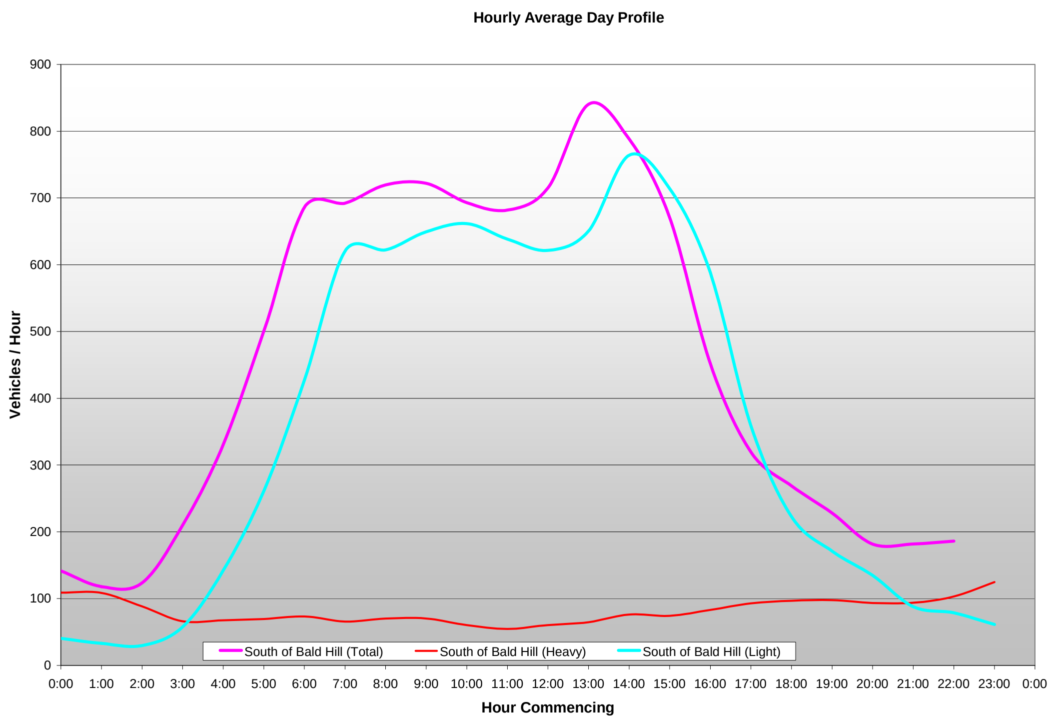


2.2.2. Heavy vehicles

The classified counts undertaken for this Proposal provide details of heavy vehicle activity.

Figure 2-2 shows the daily profile of light and heavy vehicles on the Pacific Highway south of Macksville, for an average day during the survey week**.** A similar pattern was observed at the other Pacific Highway survey sites**.** Heavy vehicles constitute the majority of traffic during the early morning and late at night**.** The percentage of heavy vehicles is as high as 77 percent in the early hours of the morning, and as low as eight percent at around 10am**.** Overall, heavy vehicles make up around 19 percent of total daily traffic on the highway at this location. Articulated vehicles make up around 17 percent of total traffic on the highway, and around 90 percent of heavy vehicles.

- **Figure 2-2 Hourly traffic profile on the Pacific Highway, south of Bald Hill Road Macksville, November 2007**



2.2.3. Daily and seasonal variations in traffic volume

Traffic volumes vary by day of week, with noticeable differences between weekdays and weekend traffic volumes. **Table 2-2** shows a comparison between the annual average daily traffic volume and the annual average traffic volumes for weekdays (AAWT), weekends (AAWE) and public holidays (AAPH). This indicates that normal weekend traffic volume is lower than traffic volumes on weekdays and public holidays.

Table 2-2 Daily variations in traffic

Location	% of AADT		
	AAWT	AAWE	AAPH
North of Scotts Head Road	105%	88%	98%
North of Raleigh	105%	86%	101%

Source: RTA Traffic Volume Data for Northern Region 2004

The weekly traffic volumes from the RTA permanent count stations located at the Pacific Highway north of Scotts Head Road and north of Raleigh were utilised to estimate the seasonal variation of traffic during the year.

Figure 2-3 shows the seasonal profile of traffic in 2004 at the selected locations. There are peaks in traffic volume coinciding with the Christmas / New Year period and the Easter and October school holidays, as well as a lesser peak in the June/July school holidays. The average daily traffic of the busiest week during the Christmas period is over 34 percent higher than AADT. The two count stations reveal similar seasonal fluctuation in traffic.

The average daily traffic in the week commencing 21 November 2004, the equivalent of the 2007 survey week, is 99 to 101 percent of the AADT. The survey data were adjusted to AADT values using this relationship between ADT and AADT.

2.2.4. The 30th and 100th highest hourly volumes

The 30th highest hourly volume (HHV) is the hourly traffic volume that is exceeded in only 29 hours of a year, while the 100th HHV is exceeded in only 99 hours. These volumes are used to inform the design process.

The RTA permanent count station data were utilised to estimate the 30th and 100th HHV, as presented in **Table 2-3**.

Table 2-3 30th and 100th highest hourly volumes

Location	30th HHV	100th HHV
	% of AADT	% of AADT
North of Scotts Head Road	10.9%	9.4%
North of Raleigh	10.4%	9.4%

- **Figure 2-3 Seasonal profile of Pacific Highway traffic north of Scotts Head Road and north of Raleigh - 2004**

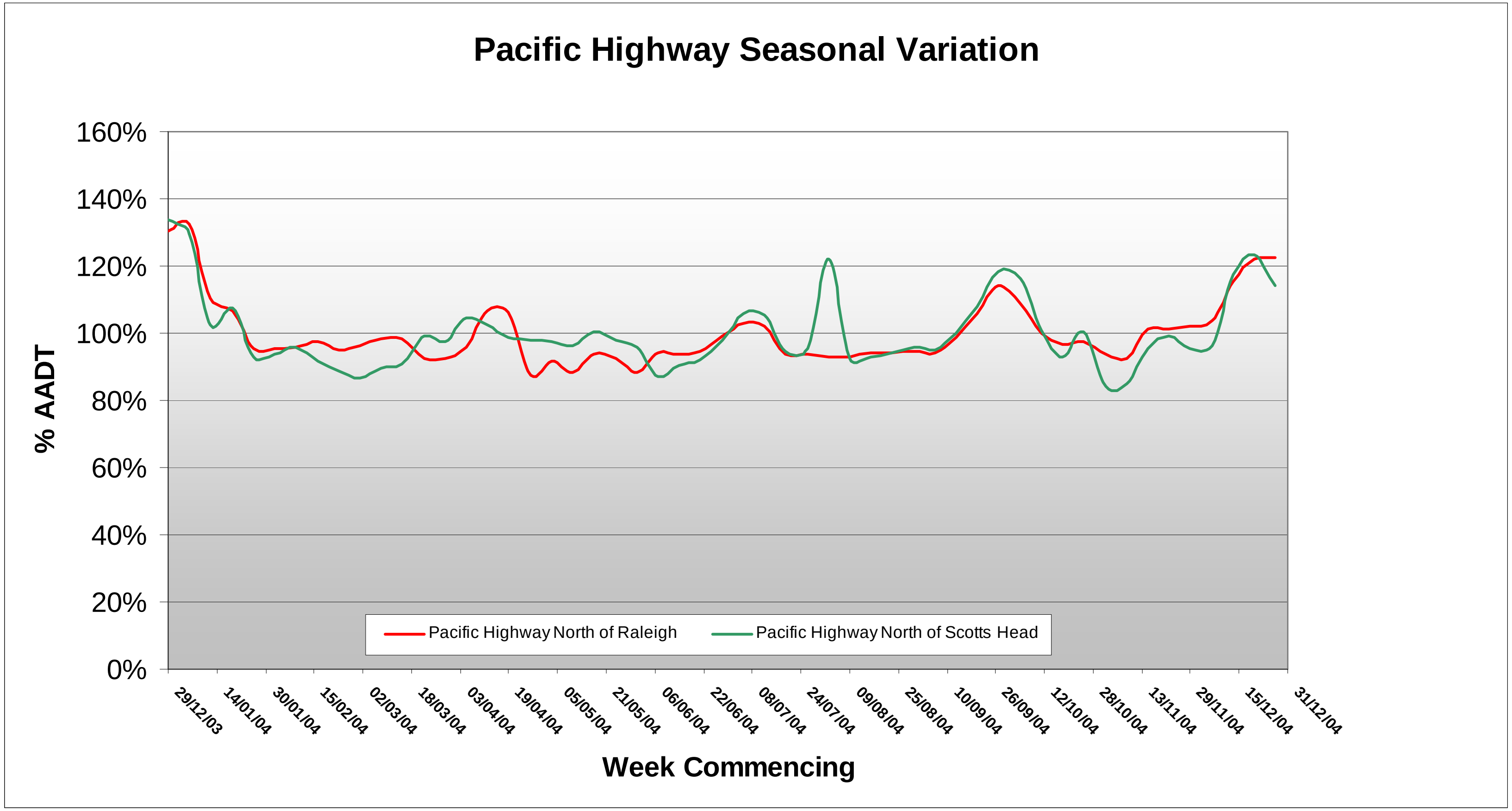


Table 2-3 indicates that the 30^{th} and 100^{th} HHVs are between 9 and 11 percent of the AADT value. These volumes are likely to occur during the school holiday periods of December / January, Easter (April) and September / October. The average of this proportion of AADT and HHVs for the two permanent count stations have been utilised to estimate the current HHVs for each of the survey sites as shown in **Table 2-4**.

- **Table 2-4 30^{th} and 100^{th} highest hourly volumes – 2007**

Location	AADT	30^{th} HHV Volume	100^{th} HHV Volume
Pacific Highway, end of dual carriageway, south of Warrell Creek (north of Upper Warrell Creek Road)	8,550	910	800
Pacific Highway ,south of Bald Hill Road	10,650	1,130	1,000
Pacific Highway, south of Florence Wilmont Drive (near Watts Creek Bridge)	12,600	1,340	1,180
Pacific Highway, south of Valla Beach Road	11,250	1,190	1,060
Pacific Highway, at Bellingen / Nambucca LGA Boundary	10,800	1,150	1,020
Pacific Highway, at Bellinger River (north of Raleigh Street interchange)	14,150	1,500	1,330
Waterfall Way between Raleigh and Bellingen	6,550	690	620

2.3. Overall traffic growth on the Pacific Highway

The RTA publishes historical AADT data for various Pacific Highway count stations, which have been used to provide an indication of historical traffic growth in the study area.

Figure 2-4 shows traffic growth between 1982 and 2007 at three Pacific Highway locations in the study area. Note that in this graph, AADT is measured in terms of axle pairs. The high proportion of heavy vehicles at these locations means that the actual number of vehicles is 25 to 30 percent less than indicated.

- **Figure 2-4 Traffic growth on the Pacific Highway 1982-2007 in the study area**

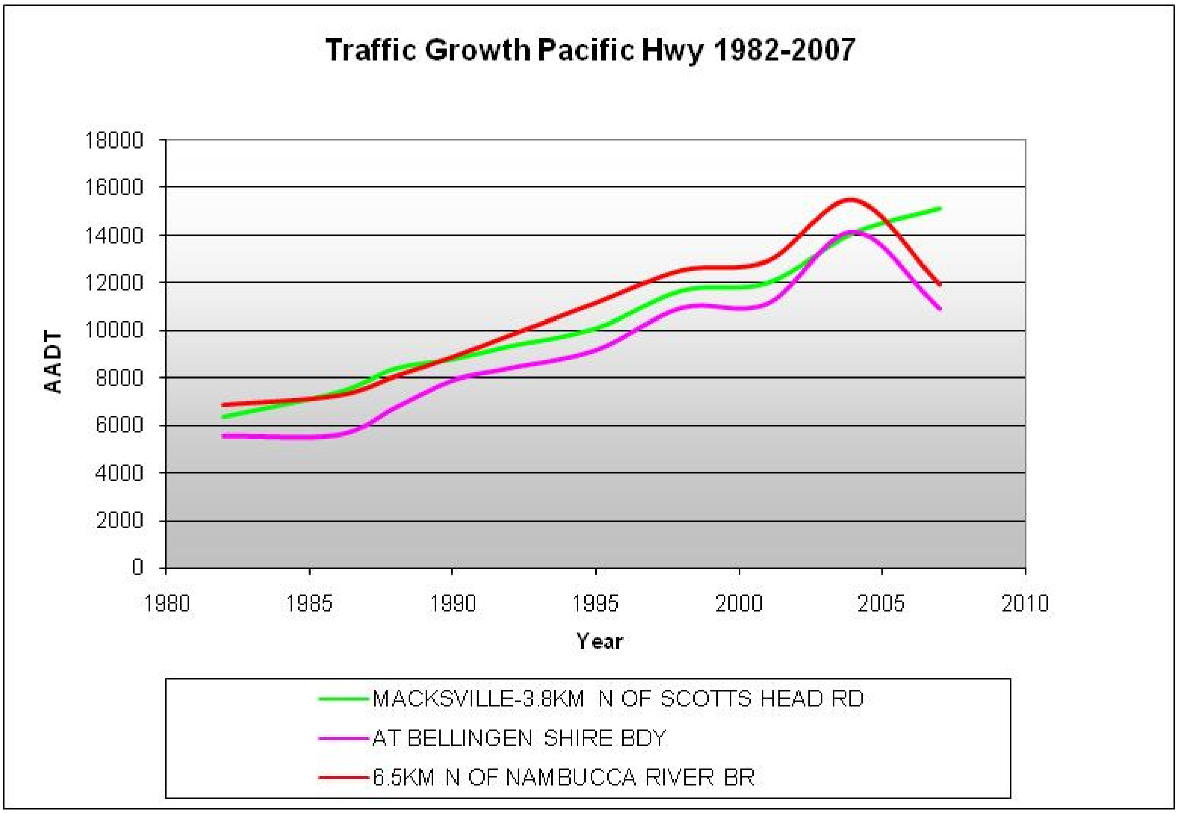


Figure 2-4 shows traffic has generally increased steadily over the period from 1982 to 2007. It also shows that the volume of traffic on the Pacific Highway is highest near the middle of the study area.

The estimated distance weighted average growth rate for overall traffic in the study area from 1982 to 2007 is 2.1 percent per annum (base year 2007). This is discussed in detail in **Section 6.1** of this report.

2.3.1. Highway capacity and Level of Service

The Pacific Highway within the study area varies in its capacity between one lane and two lanes in each direction. The nominal capacity of the single-lane sections is approximately 2,800 vehicles per hour (two-way), but this is reduced when taking into account such factors as the terrain, road shoulder provision and the proportion of heavy vehicles in the traffic stream.

The performance of a road during a particular hour can be measured by the Level of Service, which is estimated from the capacity of the road and the volume using the road. The Level of Service (LoS) of a section of road varies from A (good) to E (poor), and describes the ease with which drivers are free to select their desired speed and manoeuvre within the traffic stream[2]. The LoS at all Pacific Highway survey sites during both the 30th and 100th Highest Hours is currently at E.

2.4. Traffic patterns

To examine traffic patterns in the study area, an origin-destination (O-D) survey was undertaken in the study area on Wednesday 21 November, 2007**.** The number plates of white cars and all trucks were recorded at seven locations and subsequently matched to provide an indication of the origin and destination of traffic within the study area. A sample of 60-80 percent light vehicles and close to 100 percent heavy vehicles was achieved. The survey locations are schematically indicated in **Figure 2-5.** A zonal system was developed for communicating the results**.** The zones adopted are also shown on **Figure 2-5.**

Traffic in both directions was recorded for 24 hours**.** A classified tube count was undertaken at each of the survey sites to provide an indication of sample size and to allow expansion to AADT volumes. **Table 2-5** and **Table 2-6** show the survey results in terms of AADT estimates.

Northbound, almost 60 percent of all vehicles recorded entering the study area were surveyed travelling past the Waterfall Way interchange ie as through traffic. Almost 25 percent of northbound light vehicles (Class 1 and 2 – see **Appendix A**) entering the study area had their destination in the Macksville area, at the southern end of the study area. In contrast, southbound light vehicles entering the study area from the north were focused on Urunga and areas to the west on the Waterfall Way, as well as the through movement.

Through traffic accounted for 75 percent of northbound heavy vehicles entering the study area from the south, and for close to 58 percent of southbound heavy vehicles entering the study area from the north.

The origin-destination survey indicates an imbalance in northbound and southbound traffic. Despite the northbound / southbound split at most individual survey sites being approximately even, there was a higher through traffic component northbound than southbound, while southbound regional traffic was greater than through traffic. Two factors affect this: the dominance of major centres to the north of the study area, such as Coffs Harbour and Bellingen, and an imbalance between northbound and southbound traffic that was observed at several survey sites.

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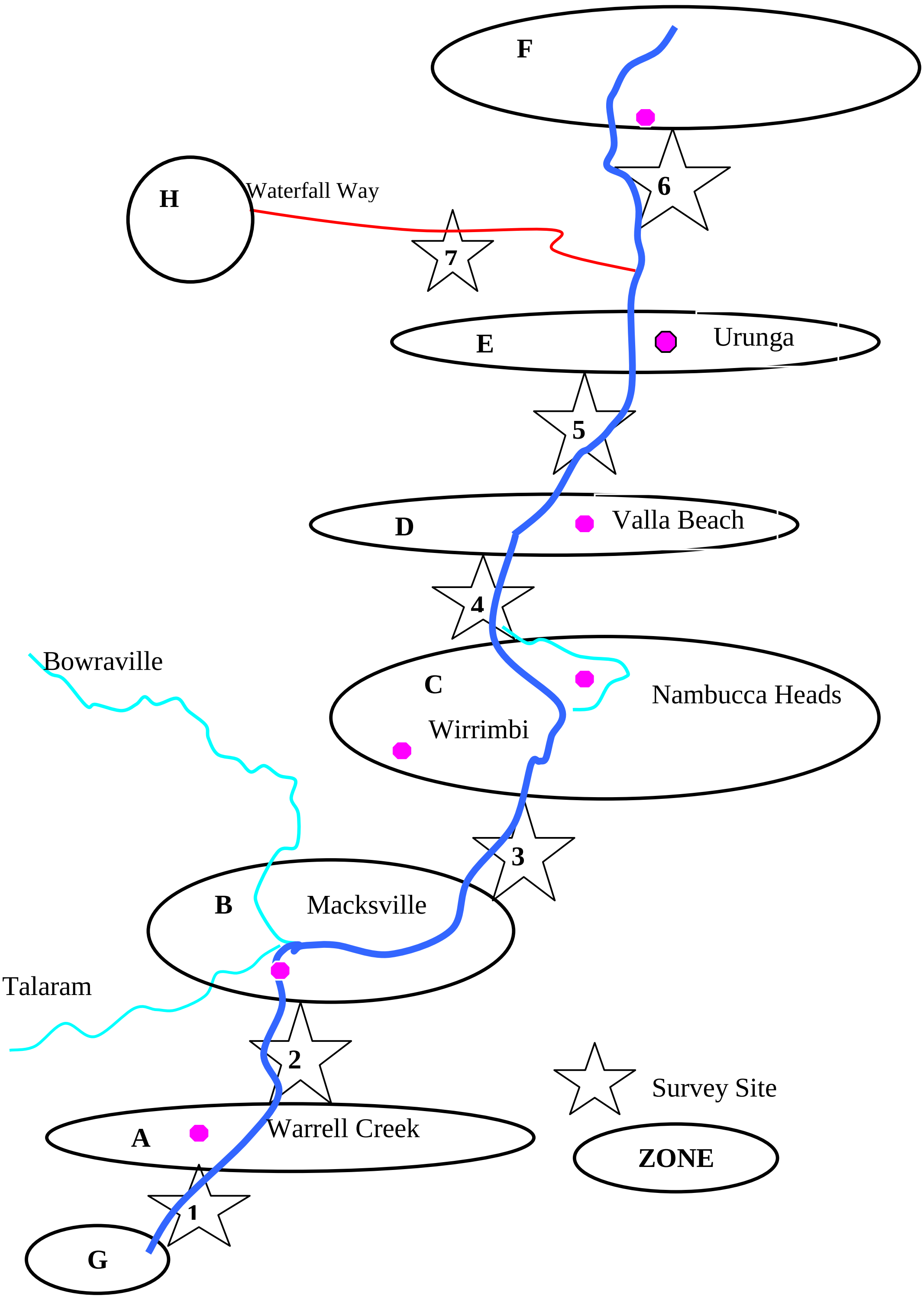
[2] A roadway with Level of Service D is operating close to its limit of stable flow, with all drivers being severely restricted in their freedom to select their desired speed and to manoeuvre in the traffic stream. At Level of Service E traffic volumes are close to or at capacity and there is virtually no freedom to select desired speeds or manoeuvre in the traffic stream.

- **Figure 2-5 Origin-destination survey locations and zones**



The volume of regional traffic to and from the northern end of the study area is similar, but are distorted by heavy flows to and from Bellingen, Raleigh and Urunga.

At each survey site, the majority of traffic was recorded as local traffic, particularly between adjacent zones. This is not an unexpected result, with local activity one of the main generators of traffic in the study area. However, the results are likely to over-estimate trips between adjacent-zones, as any errors in matching number plates at subsequent sites would be recorded as a local trip through each site. In terms of the total volume on the highway at any particular location, this issue would not affect the results. There may be an over-estimate of traffic using each interchange, however this would ensure that the interchanges are designed to a sufficient capacity. About 50 percent of all recorded trips can be classified as internal or local trips, with both trip ends (origin and destination) within the study area.

A summary of trips between zones is provided in **Table 2-5** and **Table 2-6**.

2.4.1. Through-traffic

Through-traffic is traffic which was recorded in both the Pacific Highway North and South zones (zones G and F in **Figure 2-5**), that is traffic that travels through the study area along the Pacific Highway. On the survey day, northbound through traffic comprised over 50% of all vehicles entering the study area from the south. Southbound, the percentage of through traffic entering the study area was smaller, due to the larger volume at the northern end of the study area.

2.4.2. Local traffic

Local traffic has been defined as having both its origin and destination between the northern and southern extents of the study area (ie including Bellingen and the Waterfall Way). The term “local traffic” is used for this assessment to distinguish trip categories for the purpose of applying different growth rates into the future. It includes visitors, trips related to business within the area, as well as to those trips made by local people living and working in the study area. There were a significant number of movements between the internal zones, particularly between Macksville, Nambucca Heads, Urunga and Bellingen. Local traffic movements comprise approximately 50 percent of the total trips on the Pacific Highway in the study area.

2.4.3. Regional traffic

For the purpose of this investigation, regional traffic has been defined as traffic recorded in any of the external zones (zones G and F in **Figure 2-5**) with either an origin or destination in the study area. For northbound regional traffic entering the study area from the south, the major destination was Macksville, while for southbound regional traffic the major destination was Urunga.

▪ **Table 2-5 Northbound trips between zone groups, 2007 AADT estimate**

Light Vehicles	To (northbound)								
From	**G**	**A**	**B**	**C**	**D**	**E**	**F**	**H**	**Total**
G	-	378	881	55	18	292	1912	126	**3662**
A		-	636	47	37	28	191	18	**958**
B			-	2314	100	36	53	44	**2547**
C				-	869	54	459	83	**1465**
D					-	634	221	10	**865**
E						-	2430	2094	**4523**
F							-	-	**-**
H							1297	-	**1297**
Total	**-**	**378**	**1517**	**2415**	**1023**	**1044**	**6564**	**2375**	**15317**
Heavy Vehicles	**To (northbound)**								
From	**G**	**A**	**B**	**C**	**D**	**E**	**F**	**H**	**Total**
G	-	132	5	17	20	24	637	19	**854**
A		-	95	9	4	3	63	0	**173**
B			-	72	9	13	10	1	**105**
C				-	69	0	9	4	**82**
D					-	50	6	0	**56**
E						-	138	50	**188**
F							-	-	**-**
H							37	-	**37**
Total	**-**	**132**	**99**	**98**	**102**	**90**	**901**	**74**	**1496**
All Vehicles	**To (northbound)**								
From	**G**	**A**	**B**	**C**	**D**	**E**	**F**	**H**	**Total**
G	-	510	886	72	38	316	2550	145	**4516**
A		-	731	55	41	31	254	18	**1131**
B			-	2386	109	49	63	45	**2653**
C				-	937	54	468	87	**1546**
D					-	684	227	10	**921**
E						-	2568	2144	**4712**
F							-	-	**-**
H							1334	-	**1334**
Total	**-**	**510**	**1617**	**2513**	**1125**	**1134**	**7465**	**2449**	**16813**

- **Table 2-6 Southbound trips between zone groups, 2007 AADT estimate**

Light Vehicles	To (southbound)								
From	G	A	B	C	D	E	F	H	Total
G	-								-
A	901	-							901
B	785	695	-						1480
C	82	628	2194	-					2904
D	21	191	123	1092	-				1427
E	511	69	74	551	914	-			2120
F	1107	118	92	651	216	2114	-	964	5262
H	114	19	19	119	59	1447	-	-	1778
Total	3521	1720	2503	2413	1189	3561	-	964	15872
Heavy Vehicles	To (southbound)								
From	G	A	B	C	D	E	F	H	Total
G	-								-
A	346	-							346
B	77	250	-						328
C	10	19	140	-					169
D	32	20	41	59	-				152
E	10	25	39	123	86	-			283
F	466	9	9	30	68	62	-	156	799
H	8	0	4	12	3	28	-	-	56
Total	950	322	233	224	157	91	-	156	2133
All Vehicles	To (southbound)								
From	G	A	B	C	D	E	F	H	Total
G	-								-
A	1247	-							1247
B	862	945	-						1807
C	93	646	2335	-					3074
D	53	211	164	1152	-				1580
E	521	94	113	674	1000	-			2402
F	1573	126	101	681	284	2177	-	1120	6061
H	123	20	23	131	63	1475	-	-	1834
Total	4472	2042	2737	2637	1346	3652	-	1120	18005

For regional traffic commencing from within the study area, the major origins were Urunga for northbound traffic and Warrell Creek for southbound traffic.

Approximately 40 percent of traffic recorded was classified as regional traffic.

2.4.4. Heavy vehicle movements

At each of the Pacific Highway survey sites, there were about 2,000 heavy vehicles recorded across the day, comprising between 15 and 24 percent of the total traffic. On the Waterfall Way, heavy vehicles make up around 4 percent of traffic.

Through traffic makes up 75 percent (northbound) and 58 percent (southbound) of all heavy vehicles entering the study area. Local heavy vehicle traffic movements comprise approximately 25 percent (northbound) and 40 percent (southbound) of the total heavy vehicle trips on the Pacific Highway. Approximately 36 percent of heavy vehicle traffic was regional traffic.

2.5. Public transport

Public transport operates in the study area in the form of CountryLink rail services and local and long-distance bus and coach services**.**

2.5.1. CountryLink services

CountryLink operates three daily rail services in each direction within the study area**.** They run between Sydney and Macksville, Casino and Brisbane respectively**.** Travel time via CountyLink between Nambucca Heads and Sydney is approximately eight hours, and between Nambucca Heads and Brisbane it is about six hours**.**

2.5.2. Long distance coach services

Two companies provide long-distance coach services through the study area, both operating Sydney to Brisbane and Brisbane to Sydney services.

Greyhound / McCafferty’s run four Sydney to Brisbane services each day via the Pacific Highway (there is also a service via the New England Highway). Each service stops at Macksville (Caltex service station, Pacific Highway), Nambucca Heads tourist information centre (Riverside Drive) and Urunga tourist information centre. There are an additional four services each day in the return direction, from Brisbane to Sydney. Each of these services also stops at Urunga, Nambucca Heads and Macksville. Travel time from Sydney to Macksville is 9-10 hours, depending on stopping patterns. Travel time between Macksville and Brisbane is about seven hours.

Premier Motor Service runs three services daily in each direction between Sydney and Brisbane, with a similar stopping pattern to the Greyhound / McCafferty’s services.

2.5.3. Local buses

One bus company provides regular and school bus services through the study area, in addition to those which provide coach services along the highway.

Busways has a number of routes that service Macksville, Nambucca Heads, Urunga and their immediate surrounds. Busways North Coast Services include:

- 360 Bowraville, Macksville, Nambucca Heads, Urunga and Coffs Harbour.
- 361 Bellingen, Urunga and Coffs Harbour.
- 359 Nambucca Heads, Urunga and Bellingen.
- 358 Macksville, Nambucca Heads and Valla Beach.
- 353 Macksville and Scotts Head.

2.6. Cyclists

The NSW Coastline Cycleway project is a joint project between the Department of Planning, RTA and local councils. The route of the cycleway aims to link the communities along the NSW coast, following the coastline and avoiding main roads wherever possible. The Coastline Cycleway would comprise a combination of shared off-road walking/cycling paths, back roads and fire trails.

The proposed cycleway route was outlined in the NSW Coastline Cycleway – Mid North Coast Study, prepared for the RTA in 1997. Subsequent planning work, including a Bicycle Plan by Bellingen Council, incorporates the Coastline Cycleway Proposal.

The Coastal Cycleway route runs north from Warrell Creek, along the south bank of the Nambucca River, towards Macksville. At Macksville, the route uses the highway bridge to cross the Nambucca River, and then turns back towards the coast, following the north and the west bank of the river to the main settlement of Nambucca Heads. In Nambucca Heads, the route stays close to the river shoreline all the way eastwards to the sea, before turning north, following the coastline towards Valla Beach.

From Valla Beach, the route turns slightly inland to join the existing Pacific Highway, which at this point runs very near the coast, and then proceeds along the east side of the highway, and continues northwards alongside the existing highway. It then turns off towards the coast at Hungry Head, from where it proceeds north to Urunga.

The route passes through Urunga, crossing the Kalang River on the highway bridge, shortly after which it rejoins the existing Pacific Highway, just north of Urunga. The route then continues north alongside the existing Pacific Highway, to Raleigh, where it crosses the Bellinger River on the existing highway bridge.

The parts of the route using the existing Pacific Highway to north of Valla Beach are all in the form of a shared pedestrian/cycle path running alongside the highway, including some attractive riverside stretches. In the northern section of the corridor, all parts along the existing Pacific Highway are proposed as "off-road" in the form of a separate, 2.5m wide, shared cycle/pedestrian path running alongside the road.

The creation of the bypassing route from Warrell Creek to Urunga would leave the existing highway available for incorporation into the Coastline Cycleway.

3. Accident analysis

3.1. Introduction

This section reviews the crash history of the existing highway in the study area over the five-year period 2003 to 2007, based on crash data from the RTA Traffic Accident Database.

A total of 229 accidents were recorded in this period along the Pacific Highway between Warrell Creek and Urunga, which equates to a crash rate of 25 crashes / 100 million vehicle kilometres traveled (MVKT). While the RTA and councils in the area have not designated any specific "blackspots"; the RTA and Police have located four fixed speed cameras in the corridor as crash counter-measures. The accident history at these locations is described in **Table 3-1**.

- **Table 3-1 Speed camera location accident history**

Site	Accident History (2002 to 2006)	Speed Problem
Macksville	5 killed, 10 injured, 10 accidents on 1.3 km	85th % - 100 km/h (Speed limit 100 km/h)
Valla Beach	3 injured, 5 accidents on 1.3 km	85th % - 109 km/h (Speed limit 100 km/h)
Hungry Head	1 killed, 15 injured, 24 accidents on 3.3 km	85th % - 104 km/h (Speed limit 100 km/h)
Urunga	3 injured, 7 accidents on 1.4 km	85th % - 68 km/h (Speed limit 60 km/h)

Source:http://www.rta.nsw.gov.au/roadsafety/speedandspeedcameras/fixeddigitalspeedcameras/fixedspeedcameralocations/fixedspeedoutsyd.html

3.2. Crash locations

Crashes occur consistently through the study area, although with notable concentrations in two specific areas where there is significant curved alignment:

- Between Moyles Road and after Tower Road (north of Wenonah Head and south of South Urunga); and
- In Macksville, just before Cooper Street until after the curve at the junction of Pacific Highway / Ferry Street.

Other concentrations can be identified:

- From Gumma to Nambucca Heads turnoff;
- North of Nambucca Heads, Valla Beach to Wenonah Heads; and
- South of Urunga to south of Raleigh.

Table 3-2 lists the locations of the fatal crashes that have occurred in the study area.

Table 3-2 Fatal crashes in the study area – 5 years to December 2007

Date	Crash Location	No. of Fatalities
28/08/2003	At VALLA RD	1
15/10/2003	1600m South of LUMSDENS LA	2
09/12/2003	150m North of HUNGRY HEAD RD	1
08/02/2005	At WILLUNGA AV	2
27/08/2005	55m East of NEWEE CREEK BR	1
29/08/2005	120m South of BURKES LA	1
27/06/2006	760m South of LUMSDENS LA	2
18/02/2007	550m North of HUNGRY HEAD RD	1
25/02/2007	150m West of NURSERY RD	1
25/11/2007	250m South of BELLWOOD RD	1

3.2.1. Around Moyles Road - Tower Road

24 non-fatal crashes have occurred in this area. The majority of the non-fatal crashes occurred between dawn and late evening, with a large proportion during the morning and the evening peak hours. Most were caused by a vehicle veering off-path or by losing control on the carriageway. A small number of vehicles hit a vehicle coming from the opposite direction.

3.2.2. Macksville

Over the five-year period to 2007, some 67 crashes occurred in and around Macksville. They were mainly *Injury*[3] and *Towaway* crashes, with four fatal crashes recorded:

- Crashes involving vehicles travelling in the same direction occurred on the southern approach to the town, and may have been associated with merging.
- Crashes of vehicles veering off-path occurred when approaching the town, and beyond the intersection with Ferry Street, where there is a very sharp bend.

3.2.3. Gumma to Nambucca Heads

These crashes were spread along the road near the river's edge. Vehicles veering off-path, hitting a vehicle travelling in the same direction and hitting a vehicle travelling in the opposite direction were the main cause of these crashes. Two fatal accidents were recorded along this section.

While crashes were spread throughout the day, there was a predominance of crashes during daylight, with only a few overnight on the bend approaching Gumma.

[3] Italicised crash descriptions accord with RTA standard definitions

3.2.4. North of Nambucca Heads, Valla Beach to Wenonah Heads.

Over the five year period to 2007, 15 accidents occurred on the two-way undivided section of highway in the vicinity of Valla Beach. Although they were mostly *Injury* and *Towaway* accidents, there was one fatal crash. Crashes were mostly caused by vehicles veering off-path, or vehicles coming from the same direction, with a few crashes occurring at T-Junction locations.

Further north from Valla Beach, around Wenonah Head, there were 21 accidents. They occurred on a straight or slightly curved alignment, most during daylight, with four during darkness. Most crashes were caused by vehicles veering off-path either on a straight or while turning on a curve, with four accidents occurring due to vehicles hitting another vehicle coming from the opposite direction.

Accidents between south of Urunga and south of Raleigh involved mainly *Injury* and *Towaway*, with two fatal crashes recorded. The majority of these crashes were as a result of vehicles colliding on the two-way undivided section of highway or at an intersection. Vehicles coming from the same direction or vehicles veering off-path while turning on a curve were the main causes of crashes in this section of the highway.

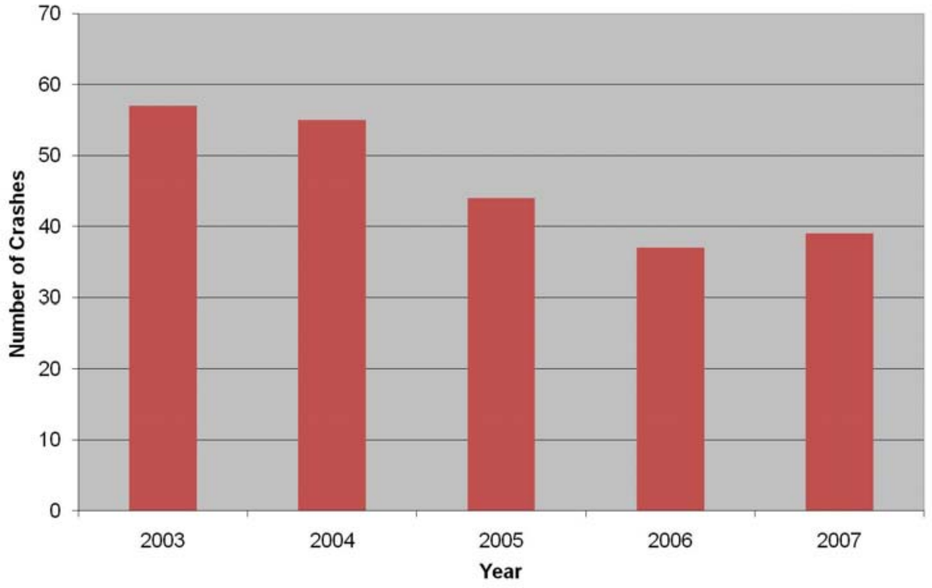
3.3. Yearly and monthly trends

Over the last five years, trends can be observed in terms of years, months, public holidays and school holiday periods.

3.3.1. Five years profile

Over the five years, the number of crashes has averaged 48 per year, varying within ±25 percent. **Figure 3-1** shows that the trend over the last five years in the study area has been for the number of crashes each year to reduce. It is not clear whether this is a long-term trend that will continue into the future.

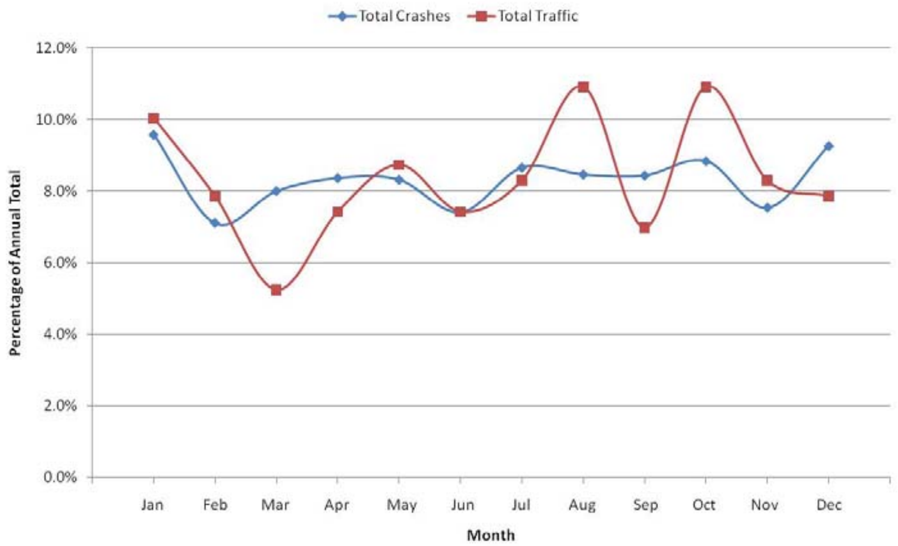
- **Figure 3-1: Number of crashes 2003-2007**



3.3.2. Monthly profile

A comparison of monthly traffic flows and crashes is shown **Figure 3-2**. If crash occurrence was directly attributable to traffic volume, it would be expected that the two lines would coincide.

- **Figure 3-2: Crashes and traffic flow per month**



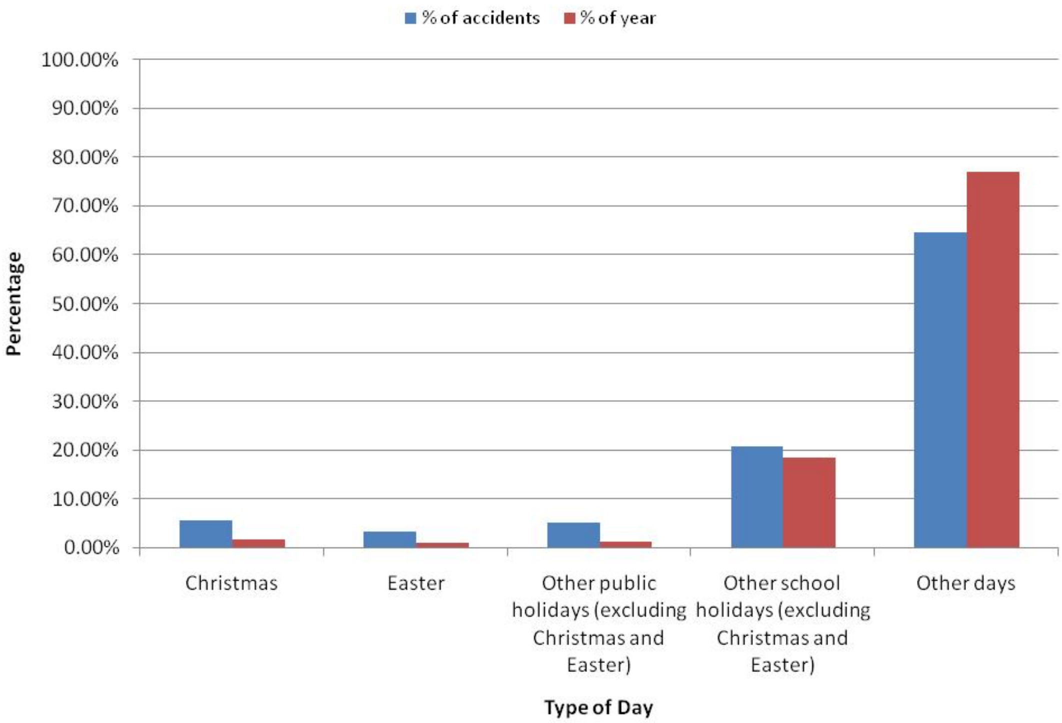
Note: Crash data is for the period 2003-2007. Traffic Flow Data is for 2004 at RTA Count Station 09.212 (Pacific Highway 3.8 km North of Scotts Head Rd).

From **Figure 3-2** it can be noted that at particular times of the year, including January / February, May, August and October / November, there are more crashes than would be expected if crash frequency and traffic volume were correlated. These months coincide with various school and public holidays. This seasonal effect is further explored in **Section 3.3.3**.

3.3.3. Holiday crashes

Figure 3-3 shows the percentage of accidents that occur on particular types of day, compared with the percentage of the year represented by those types of day.

- **Figure 3-3 Type of day**



Generally, the proportion of accidents is in line with the proportion of the year represented. However, the proportion of accidents occurring in the Christmas period, on public holidays and in school holidays is higher than would be expected if accidents occurred at an even rate across the year. This may be indicative of an increase in drivers unfamiliar with the road conditions or an increase in traffic volume at these times of the year.

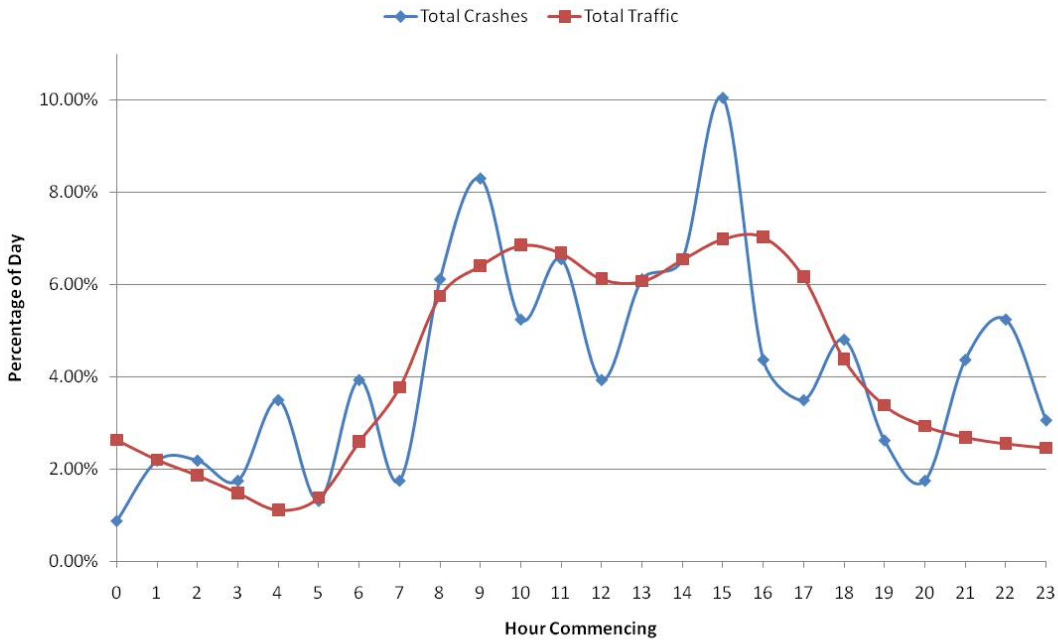
3.4. Weekly and daily trends

This section presents crash trends during the day and analyses peak hour traffic flows to demonstrate any relationship between Traffic Flows and Number of Crashes.

3.4.1. Throughout the day

Figure 3-4 shows the profile of crashes and traffic volumes across the day. While the broad trend is for crash frequency to follow traffic volumes, the late-night and early morning (pre-dawn) period is over-represented.

- **Figure 3-4: Crashes and traffic flows by time of day**

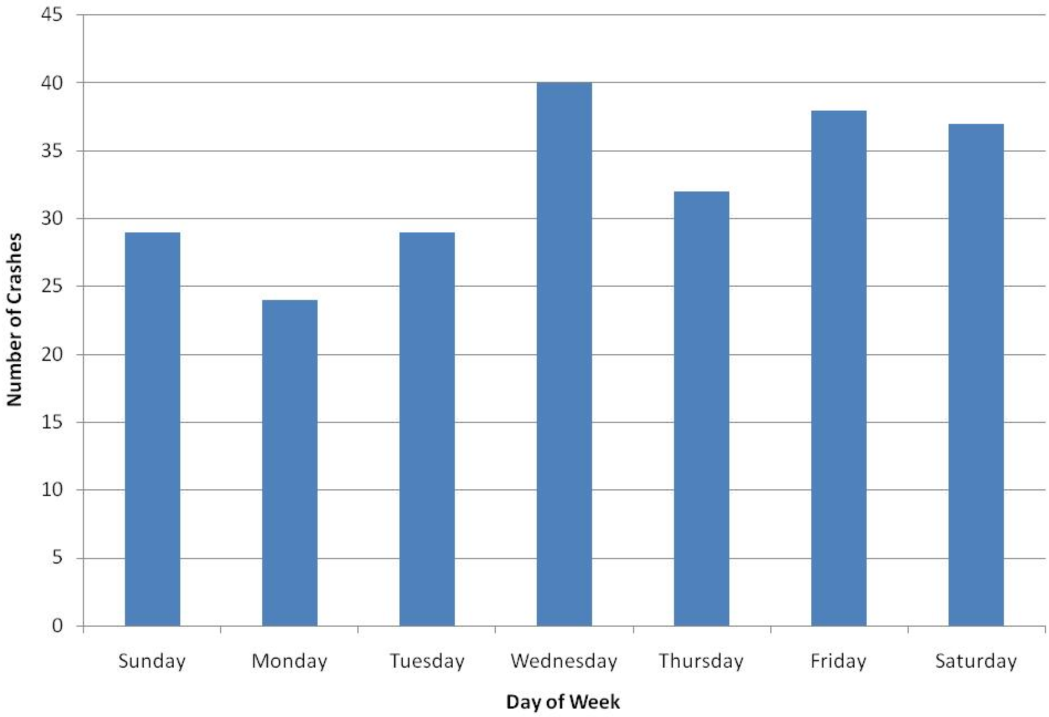


Note: Traffic flows are taken from published hourly flows during a week in August 2004 from RTA Count Station 09.212 (Pacific Highway 3.8 km North of Scotts Head Rd). Crash data is for the period 2003-2007.

3.4.2. Day of the week

Figure 3-5 shows that more crashes occur between Wednesdays and Saturdays, while fewer occur between Sundays and Tuesdays.

- **Figure 3-5: Number of crashes by day of week**



3.5. Crash severity

3.5.1. Five year period

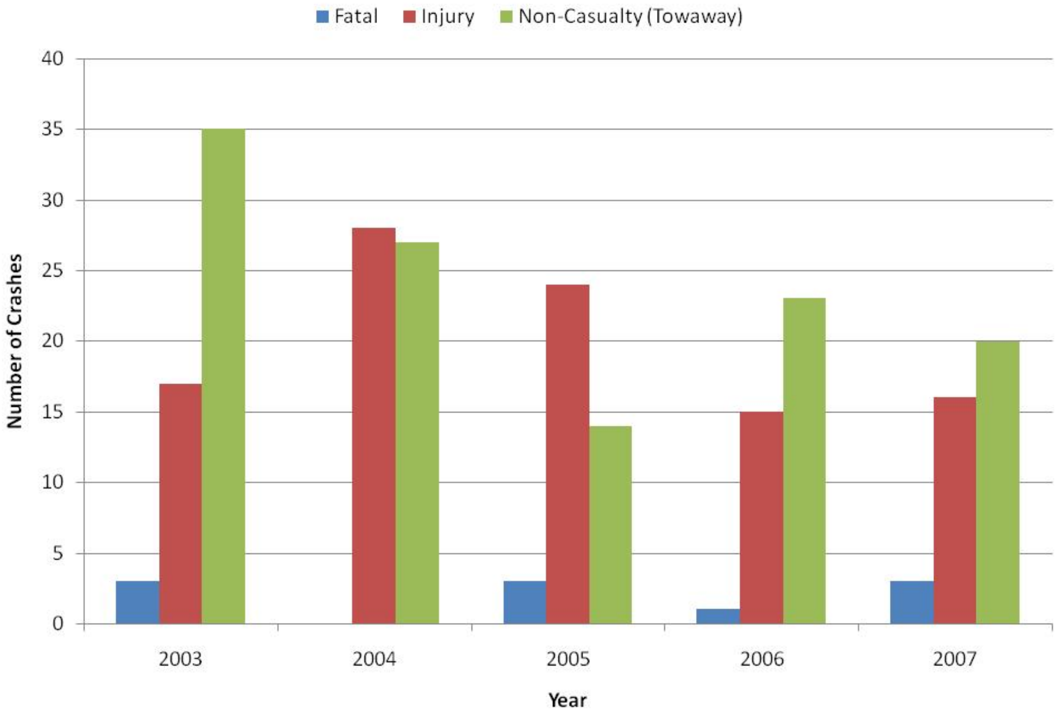
Crashes have been analysed over a five year period (2003-2007) to study potential trends related to crash severity.

Crashes have been classified into three categories:

- *Fatal Crashes*, which cause one or more deaths.
- *Injury Crashes*, which cause light or severe injuries of one or more persons involved in the crash.
- *Towaway Crashes*, where nobody is injured but a vehicle has been towed away.

Figure 3-6 and **Table 3-3** shows the crash trend per category over the last five years.

- **Figure 3-6: Five year trend by severity of crash**



- **Table 3-3: Five years period percentage of crashes by severity 2003-2007**

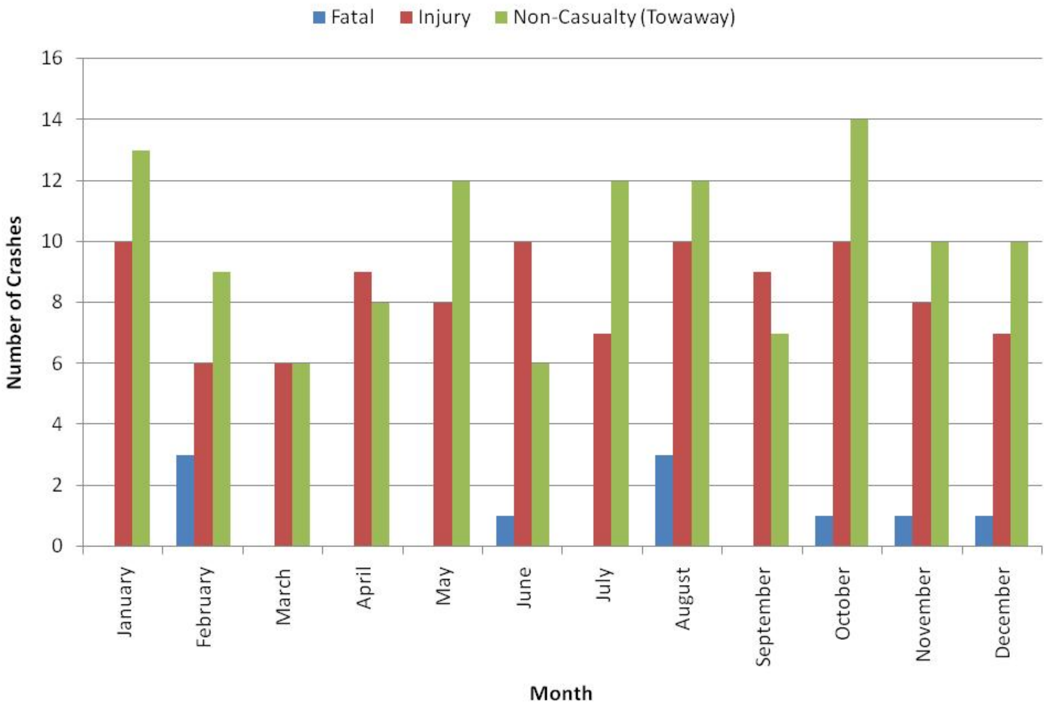
% of crash category	2003	2004	2005	2006	2007	Five Year Average
Fatal	5%	0%	7%	3%	8%	5%
Injury	32%	51%	59%	35%	41%	44%
Towaway	63%	49%	34%	62%	51%	52%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

From **Figure 3-6** and **Table 3-3**, it can be seen that over the five year period, *Fatal Crashes* represent 5 percent of all crashes, *Injury Crashes* 44 percent and *Towaway* 52 percent. It should be noted that no fatalities were recorded in 2004.

3.5.2. Monthly

The number and severity of crashes vary through the year. **Figure 3-7** shows the number of crashes per month by severity.

- **Figure 3-7: Number of crashes per month by severity**

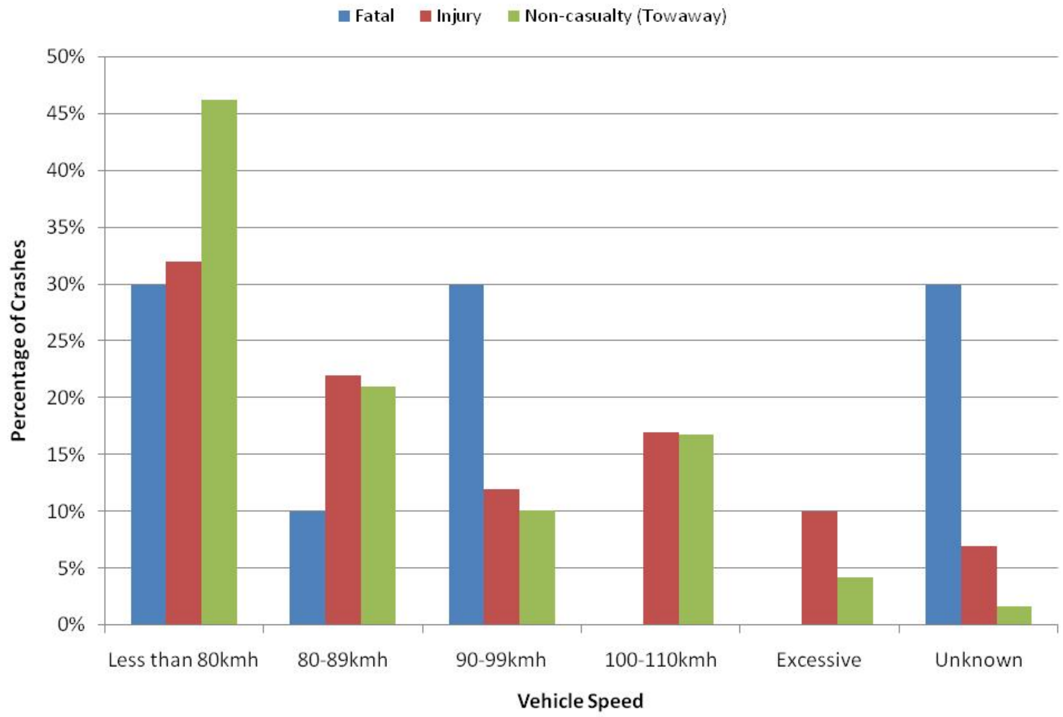


The highest number of accidents (total) occurs in January, August and October when crashes represent 10, 11 and 11 percent of the annual crash total, respectively. April and July had similar numbers of *Towaway* crashes, but fewer *Injury* and *Fatal* crashes.

3.5.3. Vehicle speed

Figure 3-8 presents the relationship between accident severity and vehicle speed. The data indicates that almost half of *Towaway crashes* occurred where the speed of the vehicle was less than 80 km/h, while one-third of *Fatal crashes* occurred at this speed. No *Fatal crashes* occurred when the vehicle speed was over 100 km/h and therefore exceeding the speed limit. Over one-quarter of *Injury crashes* occurred when the vehicle speed was over 100 km/h and therefore exceeding the speed limit. However, there is no clear correlation between vehicle speed and accident severity.

▪ **Figure 3-8: Accident severity and speed**



▪ **Table 3-4 Severity of accidents at various speeds**

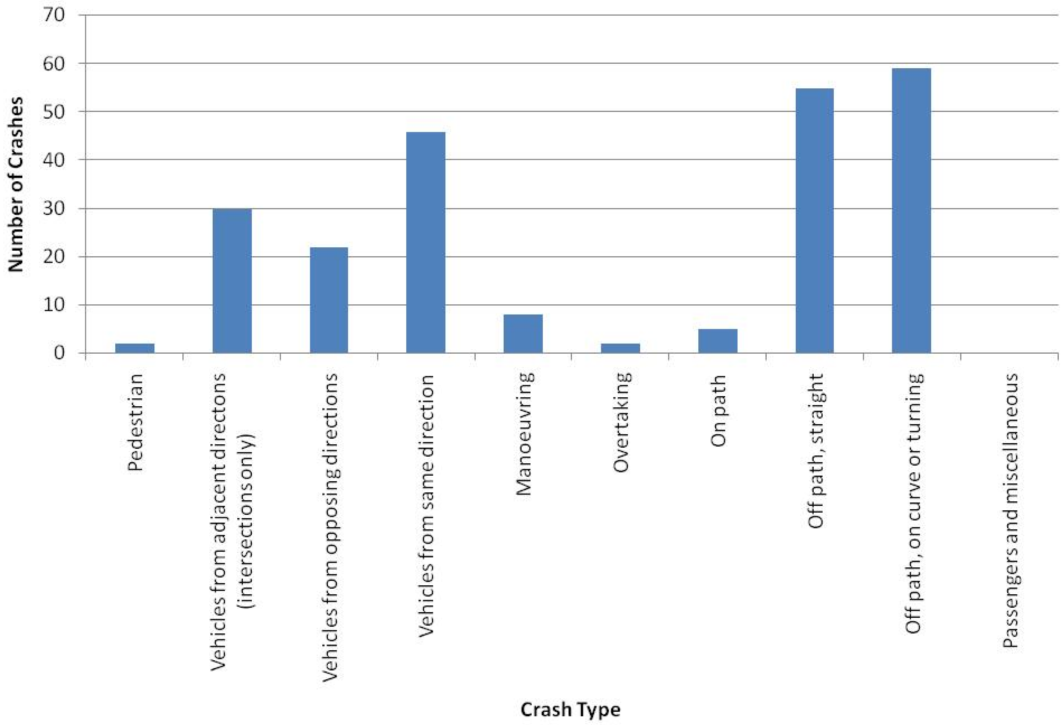
Stated Speed	Fatal	Injury	Towaway	Total
Less than 80 km/h	3%	36%	61%	100%
80-89 km/h	2%	46%	52%	100%
90-99 km/h	11%	44%	44%	100%
100-110 km/h	0%	46%	54%	100%
Excessive	0%	67%	33%	100%
Unknown	25%	58%	17%	100%

3.6. Type of crashes

The causes of accidents vary, with **Figure 3-9** presenting the number of crashes in relation to type of crash. To facilitate the analysis, types of crashes have been grouped into categories to demonstrate potential trends.

Figure 3-9 shows that the dominant type of crash in the study area involves a vehicle veering *off-path*, representing 50 percent of all crashes. Of the 114 *off-path* accidents recorded, 52 percent of these occurred on a curved section of road. *Off-path on curve* accidents account for 26 percent of all accidents, and 10 percent of fatal accidents. Vehicles *coming from the same direction* (while merging, making a U-turn or vehicles collided from rear) are the second main cause of accidents, representing 20 percent of all crashes. *Vehicles coming from the opposite direction* account for only 10 percent of all crashes, but represent half of the number of fatal accidents.

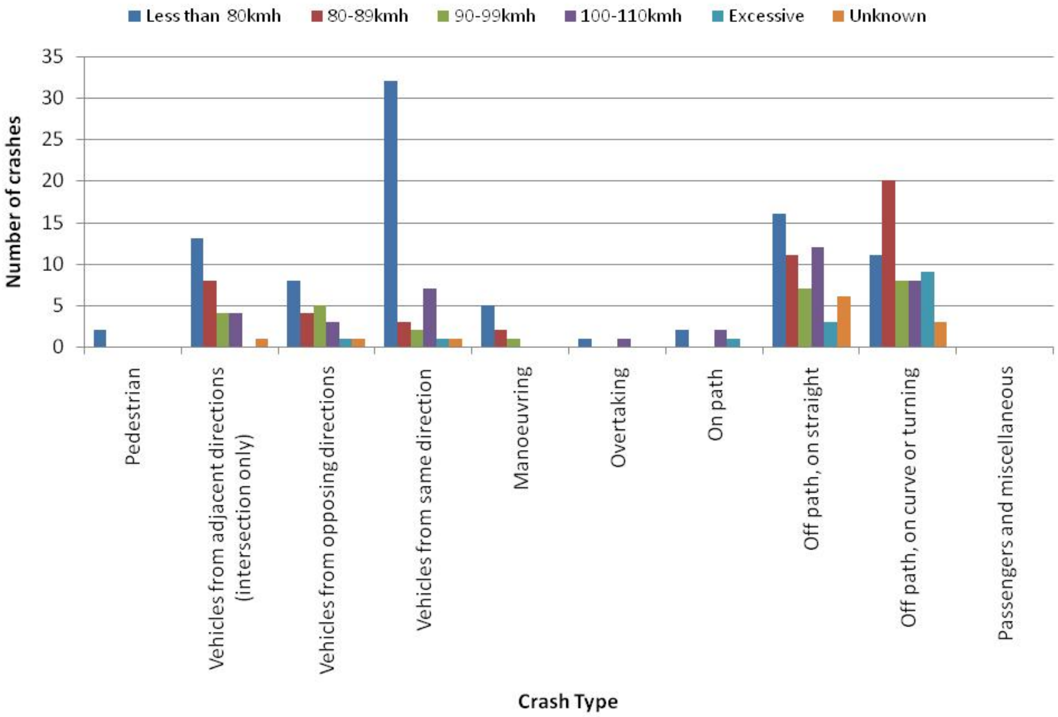
- **Figure 3-9: Five years trend crashes by type of crashes (2003-2007)**



3.6.1. Type of crash and speed

The relationship between speed and crash type is presented in **Figure 3-10**. At less than 80 km/h, the most frequent accident type involves *vehicles from the same direction*. *Off-path* type accidents (on straight) occur in roughly equal numbers in the various speed categories. *Off-path* type accidents (on curve) represent a significant proportion of the accidents that occur at 80 to 89 km/h and less than 80 km/h.

- **Figure 3-10: Crash type and vehicle speed**



3.7. Conclusion

While crashes are spread along the study area, there are some areas of concentration, including:

- Macksville; and
- Between Valla Beach and Wenonah Heads.

Although the number of crashes varies from year to year, there has been a decreasing trend observed in the five years to 2007. The over-representation of crashes in school holidays is consistent with recognised holiday traffic effects. Early mornings and Wednesdays also show an over representative contribution to the crash profile.

The data shows no clear relationship between the severity of an accident and the speed of the vehicle, with no fatal accidents occurring at excessive vehicle speeds. One-quarter of the accidents in the five year period involving excessive speed resulted in an injury.

With a crash rate of 25 crashes / 100 MVKT, this section of Pacific Highway has almost twice the target rate for the upgraded dual carriageway highway.

4. Freight transport

The movement of heavy freight vehicles on the Pacific Highway, the safety risks posed to local communities from this movement, and the adverse effects on the amenity of towns along the route are key issues within the study area.

The improvements to the Pacific Highway and changes in road network accessibility since 2002 have allowed freight to be transported in B-Doubles along the full length of the Pacific Highway from Hexham to Queensland. The final approval to the B-Double route was granted with the opening of the Yelgun to Chinderah section of the Pacific Highway in August 2002. This approval made the highway available for use by all B-Double vehicles.

The number of heavy vehicles on the highway has been growing at between 3 to 5 percent per annum in the preceding ten years until up to 2004[4]. The existing number of trucks travelling on the highway through the study area averages about 2,000 per day (2007), which is equivalent to 15 percent of all vehicles using the highway.

4.1. Existing freight movements

The latest available information on freight movements and tonnes carried in the corridor relates to 2004 and is provided in three reports:[5]

- Bureau of Transport and Regional Economics (BTRE) Working Paper 66, *Demand Projections for AusLink Non-Urban Corridors: Methodology and Projections* (February 2006)
- *North-South Rail Corridor Study*, prepared for Department of Transport and Regional Services (June 2006)
- AusLink, Sydney-Brisbane Corridor Strategy (April 2007)

Also, the Australian Bureau of Statistics provides estimates of inter and intra-regional freight movements (with regions defined as statistical divisions/subdivisions), although the latest available data is for the year ending March 2001.[6]

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[4] Working Paper, Macksville to Urunga Pacific Highway Upgrade, 2004

[5] BTRE, *Demand Projections for AusLink Non-Urban Corridors: Methodology and Projections*, Working Paper 66, February 2006; Ernst & Young, *North-South Rail Corridor Study*, prepared for Department of Transport and Regional Services, June 2006; Auslink, *Sydney-Brisbane Corridor Strategy*, Draft, April 2007.

[6] Australian Bureau of Statistics, *Freight Movements, Australia, Summary*, Cat. No. 9220.0

About 8.35 million tonnes of inter-capital freight moved between Sydney and Brisbane in 2004, including 1.35 million tonnes of rail freight between Melbourne and Brisbane which transits via Sydney. Of the Sydney-Brisbane inter-capital freight (7.0 million tonnes), road has an estimated 76 percent of the market, rail had 11 percent, coastal shipping had 12 percent and air one percent.[7]

Using data in BTRE Working Paper 66, the inter-capital volume moving on the Pacific Highway in the study area in 2004 is estimated to be about 2.9 million tonnes, while about 2.4 million tonnes moved on the New England Highway.

The corridor also has a large regional and intra-regional freight task. Population centres on the corridor are some of the fastest growing areas of Australia, especially the Central Coast, Hunter Valley and North Coast in NSW and South East Queensland. Although estimates of total tonnages for these freight trips are not considered by the ABS as statistically reliable for general use, the data indicates that regional and intra-regional freight tonnes on the Pacific Highway in the study area could be of the same order of magnitude as inter-capital freight tonnes.[8]

4.2. Future freight demand

4.2.1. Rail freight mode share

Rail has significant opportunities to increase its current mode share of 11 percent of the inter-capital freight movements in the Sydney-Brisbane corridor, given the relatively long haul distances in the corridor. However, the expansion of the rail freight mode share is restricted by existing infrastructure constraints and limited travel times resulting from the long single track sections and low average speeds. For this option to effectively compete with road freight in the future, it would require significant rail investment to track and signalling to reduce travel times and offset the double handling of containers to final destinations.

ARTC is responsible for implementing planned rail track and signalling improvements under AusLink and its own current investment program. This program aims to improve reliability and reduce transit times between Sydney and Brisbane from 19 to 20 hours to 15.5 hours.[9] However, it is likely that the existing route would again become capacity constrained at some point around

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[7] Ernst & Young, *North-South Rail Corridor Study - Executive Report*, 30 June 2006, pp.39-40.

[8] In 2001, using freight movement estimates for Clarence subdivision, inter-regional freight tonnes moved by road was about 1.8 million tonnes and intra-regional was about 0.9 million tonnes.

[9] This compares to a road transit time of about 11.25 hours – refer AusLink, *Sydney-Brisbane Corridor Strategy*, p.14.

2019.[10] The consequences would either be more capital work to further increase capacity, or a deterioration in reliability as the capacity constraint starts to affect operations. The analysis assumes that the increasing rail freight volumes in the Sydney-Brisbane corridor can be accommodated. However, constraints to this growth could include:

- access to the Sydney metropolitan network, which is restricted currently to operations and freight train paths mostly outside Cityrail's operating peak timetables, i.e. between 8pm to 6am – this could be eased by upgrades in the current and future investment programs.
- intermodal terminal capacity in Sydney and Brisbane.

The North-South Rail Corridor Study forecasts changes in mode share on the Sydney-Brisbane route, with rail forecast to double its existing 11 percent mode share by 2029, while road freight mode share would decline from 76 to 68 percent. This change is expected to result from the current AusLink/ ARTC investment program improving rail transit times and reliability, and from the declining future rail prices relative to road.[11]

4.2.2. Growth rate forecasts

The AusLink Sydney-Brisbane Corridor Strategy and North-South Rail Corridor Study forecast significant levels of freight growth for the Sydney-Brisbane corridor. This growth reflects general economic growth in the Australian economy, growth across the broad and diverse economic sectors present on the corridor, and population growth in the coastal towns within the corridor and at either end of the corridor (Central Coast/Hunter Valley and Gold Coast/South East Queensland).

The studies forecast freight on the Sydney-Brisbane corridor to almost triple over the period to 2029, rising from approximately 7 million tonnes to over 18 million tonnes, at an average annual growth rate of around 4 percent. This compares to an expected doubling of freight on most other AusLink corridors (average annual growth rate of around 2.8 percent).[12]

4.2.3. Freight movement forecasts

Freight movement forecasts based on a doubling of rail mode share as outlined above are given in **Table 4-1**. It has been assumed that the average annual growth rate for inter-capital freight along

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[10] Refer *North-South Rail Corridor Study - Detailed Study Report*, pp.4-98 to 4-100.

[11] Refer *North-South Rail Corridor Study - Detailed Study Report*, pp.4-6 & 4-99.

[12] Auslink, *Sydney-Brisbane Corridor Strategy*, p.22. Note that the tonnages quoted in the preceding sentence include sea and air freight – refer *North-South Rail Corridor Study - Detailed Study Report*, pp.4-88 & 4-100.

the Pacific Highway of 3.7 percent (road) and 6.6 percent (rail) also applies to inter-regional (road and rail) and intra-regional (road only) freight traffic.[13]

- **Table 4-1 Sydney – Brisbane corridor freight movements, road and rail with increasing rail mode share (million tonnes)**

(a) Inter-capital Freight (Sydney/Brisbane)		
	2004	2029
Road	5.3 (87%)	12.4 (75%)
Pacific Highway [a/]	*2.9*	*7.2*
New England Highway [a/]	*2.4*	*5.2*
Rail [b/]	0.8 (13%)	4.0 (25%)
(b) Inter-regional and Intra-regional Freight, to/from and within Clarence SSD		
	2004 [c/]	2029
Road (Pacific Highway)	3.0 (70%)	7.4 (61%)
Rail [d/]	1.3 (30%)	4.8 (39%)

Notes:
a/ Route shares based on relative number of heavy vehicles per day at lowest traffic sections on each route (Macksville-Ballina on Pacific Highway and Tamworth-Armidale on New England). From BTRE Working Paper 66, Tables 3.3 & 3.4.
b/ Excludes Melbourne-Brisbane inter-capital freight transited through Sydney.
c/ 2001 estimates (refer footnote 4) increased to 2004 by 3.1 percent per year (road) and 0.5 percent per year (rail). Growth rates based on data in BTRE Working Paper 66, Tables 2.15 & 3.4.
d/ Clarence SSD assumed to account for 60 percent of Mid-North Coast inter-regional rail tonnages (same as for road freight tonnages). In projecting to 2029, current AusLink/ARTC rail upgrades assumed effective from 2010.

However, for rail to double its mode share, two main conditions must be met:

- The freight transport industry responds to the improvements in rail transit times and reliability brought about by the upgraded rail infrastructure and diverts freight from road to rail.
- The Government is willing and able to fund the substantial investment required in rail track and signalling, including the northern access into Sydney from Newcastle and access to Sydney terminal and port facilities.

It is considered that these conditions are unlikely to be met and that the forecast freight movements in **Table 4-1** represent the most optimistic scenario for Sydney-Brisbane corridor freight movements.

An alternative scenario is where sufficient infrastructure investment is available to provide for almost three times the current number of freight trains to operate reliably on the Sydney-Brisbane corridor by 2029. This scenario allows rail to maintain its current mode share of 11 percent of inter-capital freight tonnages. This also assumes that the average annual growth rate for inter-capital

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[13] Truck trips (vehicles of Class 3 to 12 inclusive – see Appendix A) having both origins and destinations in

freight on the Pacific Highway of 4.2 percent (road) and 4.0 percent (rail) also applies to inter-regional (road and rail) and intra-regional (road only) freight traffic.

Freight movement forecasts based on a constant rail mode share between 2004 and 2029 are given in **Table 4-2**.

- **Table 4-2 Sydney-Brisbane corridor freight movements, road and rail, with constant rail mode share (million tonnes)**

(a) Inter-capital Freight (Sydney/Brisbane)		
	2004	**2029**
Road	5.3 (87%)	14.1 (87%)
Pacific Highway [a/]	*2.9*	*8.2*
New England Highway [a/]	*2.4*	*5.9*
Rail [b/]	0.8 (13%)	2.1 (13%)
(b) Inter-regional and Intra-regional Freight, to/from and within Clarence SSD		
	2004 [c/]	**2029**
Road (Pacific Highway)	3.0 (70%)	8.4 (70%)
Rail [d/]	1.3 (30%)	3.5 (30%)

Notes:
a/ Route shares based on relative number of heavy vehicles per day at lowest traffic sections on each route (Macksville-Ballina on Pacific Highway and Tamworth-Armidale on New England). From BTRE Working Paper 66, Tables 3.3 & 3.4.
b/ Excludes Melbourne-Brisbane inter-capital freight transited through Sydney.
c/ 2001 estimates (refer footnote 4) increased to 2004 by 3.1percent per year (road) and 0.5 percent per year (rail). Growth rates based on data in BTRE Working Paper 66, Tables 2.15 & 3.4.
d/ Clarence SSD assumed to account for 60 percent of Mid-North Coast inter-regional rail tonnages (same as for road freight tonnages).

4.3. Conclusion

The freight forecasts for the Sydney-Brisbane corridor in **Table 4-1** and **Table 4-2** indicate that road freight tonnages along the Pacific Highway would increase at an average annual rate of between 3.7 and 4.2 percent per annum to 2029. In both rail mode share scenarios analysed, road would continue to be the dominant mode with the percentage of freight tonnes expected to be carried along the Pacific Highway in 2029 to range between 62 and 75 percent.

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the study area.

5. The Proposal

5.1. Description of Route

The Proposal is shown in **Figure 5-1.** The upgraded highway would provide 2 lanes of travel each direction on a divided carriageway, with a speed limit of 110 km/h. Provision would be made in the median for an additional lane per direction if required in the future.

The upgraded highway would ultimately be developed to Class M (Motorway) standard. Class M refers to a dual carriageway high standard road constructed to 110 km/h horizontal and 100 km/h vertical speed, and with opportunities for access at interchanges only. Other local roads would pass under or over a Class M standard road. However, initial development of some sections of the route may be to Class A (Arterial Highway) standard. Class A standard is similar to Class M in terms of the road standard and the provision of interchanges at major roads. However, it also has limited at-grade access at some intersecting roads, and left-in and left-out access to properties.

5.2. Benefits of Proposal

Quantifiable monetary benefits of the Proposal, such as savings in vehicle operating costs, travel time and avoided crashes, are estimated to be approximately $15,749,318 per annum on opening and would rise over time, assuming the first year of operation is 2013. The savings are presented in **Table 5-1**.

- **Table 5-1 Savings in vehicle operating costs, travel time and avoided crashes**

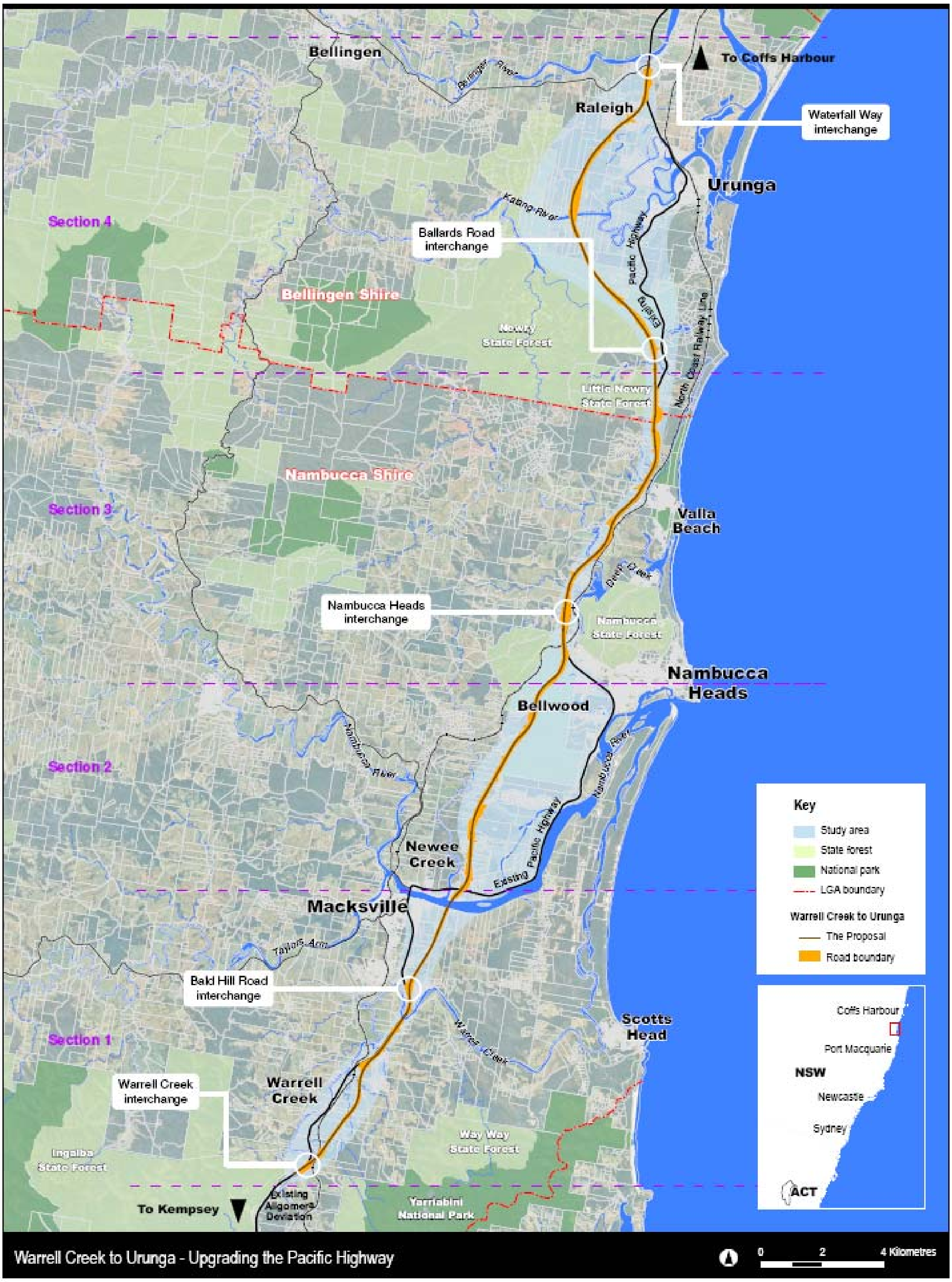
Cost Type	Cost Value
Vehicle operation and travel time	$10,547,770
Avoided crashes (fatalities)	$2,521,484
Avoided crashes (injuries)	$2,680,064
Total	**$15,749,318**

The reduction in accident rates as a result of the Proposal, assuming the first year of operation is 2013, are presented in **Table 5-2**.

- **Table 5-2 Reduction in accident rates**

Items	Existing Highway	Proposal
Injuries (per 100 million vehicle kilometres travelled)	18.5	13.07
Fatalities (per 100 million vehicle kilometres travelled)	2.03	0.94

- **Figure 5-1 The Proposal**



5.3. Interchange locations

Interchanges would be constructed at key locations to provide access to local communities and the local road network from the highway. Interchanges would be constructed at Warrell Creek, South Macksville, Nambucca Heads, Ballards Road and modifications Waterfall Way.

5.3.1. Warrell Creek

Northbound traffic using the Allgomera deviation would be able to use the northbound off-ramp to connect with the existing highway to access the Warrell Creek village and Donnellyville. Traffic from those villages heading south could use the new access road under the upgrade and connect to Browns Crossing Road where a southbound on-ramp would be provided to facilitate safer access to the southbound dual carriageway.

Southbound vehicles on the Proposal wanting to access Warrell Creek village would either exit at the Bald Hill Road interchange or at the existing Pacific Highway at Allgomera at the southbound off-ramp at Browns Crossing Road, which would connect with the new two-way access road under the upgrade. Traffic would then reconnect with the existing highway to travel into Warrell Creek village. Northbound traffic from Warrell Creek village and Donnellyville would access the Proposal at the Bald Hill Road interchange.

5.3.2. South Macksville (Bald Hill Road Interchange)

Access to Macksville from the north and south is at the Bald Hill Road interchange. Northbound and southbound on and off ramps are provided at the interchange. This provides access to Scotts Head and Macksville as well as Donnellyville and Warrell Creek from the north and access onto the Proposal from Warrell Creek for northbound traffic.

The interchange would provide for all traffic movements, with intersections such as roundabouts proposed to the west and east of the main highway carriageways to connect to Bald Hill Road and the existing highway. The western intersection would provide access from the northbound off-ramp, access to and from Macksville, Donnellyville and Warrell Creek, the northbound on-ramp and the interchange bridge. The eastern intersection would provide access from the southbound off-ramp, the southbound on-ramp and the interchange bridge and Bald Hill Road.

5.3.3. Nambucca Heads

The interchange would provide for all traffic movements to and from the dual carriageway. The interchange to the north-west of Nambucca Heads provides access to Nambucca Heads, Bowraville, Valla, Valla Beach and adjacent areas.

The interchange has been located and designed in consultation with Nambucca Shire Council to support future land use plans and provide efficient access to and from the proposed Boggy Creek industrial/commercial area. It allows for full access onto and from the upgrade as well as providing a connection between the existing highway and the proposed industrial subdivision to the west. The area between the existing Pacific Highway and the upgrade has also been identified as a rest area and future heavy vehicle trailer exchange facility.

5.3.4. Ballards Road

Following consultation with the Urunga Chamber of Commerce, members of the Valla Beach community and emergency services in Urunga, an interchange was added to the concept design for the Proposal in June 2008 at Ballards Road, where the upgrade heads north-east away from the existing highway. The interchange would provide for all traffic movements, with access from the existing highway being at Ballards Road. The interchange would provide access for southbound traffic from Urunga onto the upgrade and also for northbound traffic from the growing area of Valla Beach and Waterfall Way.

5.4. The Waterfall Way

The Waterfall Way interchange provides access to the township of Urunga from the north as well as Raleigh and Bellingen. The layout of the interchange would be reconfigured to ensure sufficient acceleration and deceleration is provided on all ramps. A service road east of the upgrade would provide a connection between Waterfall Way and the existing Pacific Highway. The Waterfall Way interchange would improve road safety by providing greater vehicle storage capacity on off-ramps and avoid queuing back into high speed traffic.

5.5. Role of existing highway

The existing Pacific Highway would be retained as part of the Proposal and would serve as a local access road. Operational and maintenance responsibilities would be determined in consultation with the relevant roads authority.

6. Traffic forecasts and impact assessment

6.1. Growth in total traffic

Historical AADT data are available for several locations in the study area. Nine locations were chosen as being representative of the study area:

- RTA Station 09.149 (6.5 km south of Nambucca Shire Council boundary).
- RTA Station 09.241 (south of Scotts Head Road).
- RTA Station 09.212 (3.8 km north of Scotts Head Road).
- RTA Station 09.244 (at Nambucca River Bridge).
- RTA Station 09.213 (north of Ferry Street).
- RTA Station 09.245 (6.5 km North of Nambucca River Bridge).
- RTA Station 09.214 (at Bellwood Creek Bridge).
- RTA Station 09.247 (at Bellingen Shire Council Boundary).
- RTA Station 04.141 (1.5 km north of Bellingen River bridge).

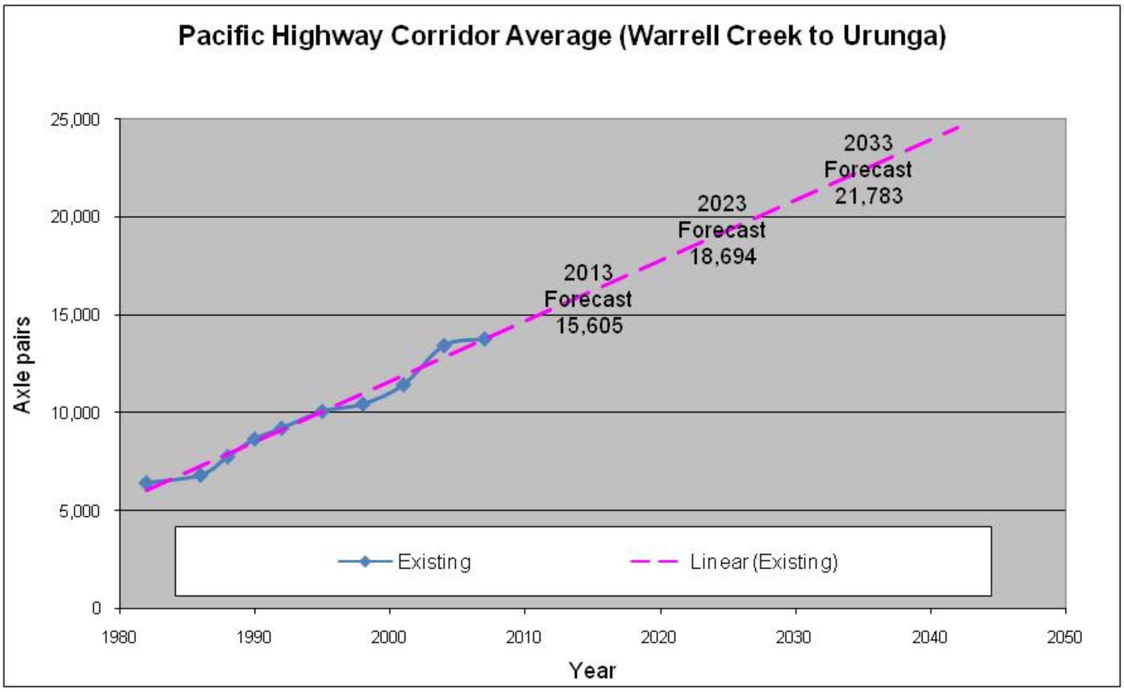
Using the distance-weighted average of the AADT for these locations, a line of best fit was derived, based on the 1982 – 2007 data. This line showed growth in 2007 terms of 2.1 percent each year between 1982 and 2007.

The process is summarised in **Table 6-1** and the resulting volumes in axle pairs illustrated in **Figure 6-1**.

- **Table 6-1 Basis for traffic forecasts (axle pairs)**

Location	Observed										Forecast (overall corridor average)			
	1982	1986	1988	1990	1992	1995	1998	2001	2004	2007	2013	2023	2033	2043
6.5KM S OF NAMBUCCA SHIRE BDY	5,570	5,707	6,792	7,877	8,141	8,536	8,931	9,464	12,025	12,905				
S OF SCOTTS HEAD RD-RR7736	5,560	6,048	6,674	7,299	7,575	8,180	8,784	9,389	9,993	10,598				
MACKSVILLE-3.8KM N OF SCOTTS HEAD RD	6,336	7,381	8,371	8,760	9,309	10,066	11,656	11,984	14,078	15,122				
MACKSVILLE-AT NAMBUCCA RIVER BR TOWN	8,110	9,197	10,557	11,917	12,466	13,290	14,114	14,881	17,140	17,508				
MACKSVILLE-N OF MR118,FERRY ST	7,460	8,511	9,037	9,562	10,088	10,876	11,664	12,452	13,241	14,029				
6.5KM N OF NAMBUCCA RIVER BR	6,890	7,285	8,092	8,899	9,810	11,177	12,544	12,931	15,492	11,946				
NAMBUCCA HEADS-AT BELLWOOD CREEK BR	7,450	7,994	8,628	9,261	10,039	11,207	14,517	13,603	14,600	19,484				
AT BELLINGEN SHIRE BDY	5,540	5,583	6,733	7,883	8,390	9,150	10,933	11,113	14,135	10,891				
RALEIGH-1.5KM N OF BELLINGER RV BR	8,333	9,017	10,000	10,895	11,965	13,571	10,101	13,770	16,179	17,249				
Study area Distance Weighted Average AADT (axle pairs)	6,446	6,843	7,780	8,684	9,241	10,101	10,471	11,463	13,461	13,799				
Forecast AADT using uniform growth rate derived from existing trend											15,605	18,694	21,783	24,872

- **Figure 6-1 Traffic forecasting (axle pairs)**



These forecast volumes are for the distance weighted average of the RTA count stations identified above. They do not represent an actual location but give an indication of the overall future traffic growth throughout the study area.

6.2. Growth in town access

Expected population growth in the study area has been utilised in forecasting local and regional light vehicle traffic. The proportion of the new industrial land which would be released relative to the existing industrial land in each of the three main towns has been used in forecasting local heavy vehicle traffic. Base year estimates of town access volumes are derived from the origin-destination survey conducted in 2007.

According to Census data, between 1996 and 2006, the populations of both the Nambucca and Bellingen local government areas remained fairly steady, with Nambucca increasing by 0.6 percent per annum and Bellingen increasing by 0.4 percent per annum. NSW Department of Planning population forecasts (2005 State and Regional Population Projections) for these local government areas show this trend continuing for the foreseeable future.

Looking at the main towns within the study area, the populations of Macksville and Urunga decreased from 2001 to 2006 by 3.7 percent and 5.8 percent per annum respectively, while the population of Nambucca Heads did not change. In preference to underestimating population growth and not allowing for any future turnaround in population, a positive growth rate of 1 percent per annum has been assumed for the population of the study area. This takes into account potential growth in areas such as Boggy Creek and South Macksville.

The potential industrial land growth of the three main towns is presented in **Table 6-2**. For the purpose of calculating annual growth rates, this land release has been assumed to occur over the next 10 years.

- **Table 6-2 Existing and new released industrial land in Macksville, Nambucca Heads and Urunga**

Township	Existing Industrial Land (ha)	New Industrial Land Released (ha)	% of New Land Released
Macksville	71.9	7 [1]	10%
Nambucca Heads	23.4	25 [2]	102%
Urunga	37.8	6 [3]	16%

[1] South of Macksville

[2] Includes portion of ultimate 100ha industrial development at Boggy Creek and Cow Creek

[3] North of Urunga

6.3. Growth in through traffic

Overall corridor average growth between 1982 and 2007 has been around 2.1 percent per annum (base year 2007) as discussed in **Section 6.1**. The effect of further upgrades of the highway is likely to see this rate and linear trend continue. This forms the basis of forecasting through-light vehicle traffic.

6.4. Growth in through heavy traffic

There is a degree of uncertainty associated with predicting heavy vehicle through-traffic growth in the corridor, due to a number of contributory factors.

Heavy vehicle activity, particularly on a major freight corridor such as the Pacific Highway, is related to general economic growth, and indicators such as Gross Domestic Product. Over the last 30 years, heavy vehicle travel on Australian roads has increased at an annual rate slightly higher than GDP growth.[14]. This would suggest that heavy vehicle growth in the short term could be in the order of 4% per annum.

However, recent years have seen the proportion of larger vehicles, such as B-Doubles, in the heavy vehicle fleet increase, resulting in the same amount of freight being carried by fewer vehicles. This

[14] Bureau of Transport Economics, “Trends in Trucks and Traffic”, Information Sheet No. 15, 1999

has the effect of dampening heavy vehicle growth slightly. The opening of the Pacific Highway to B-Double traffic in 2002 resulted in a significant short-term increase in heavy vehicle traffic, although this is not expected to continue.

For the purpose of this study, a heavy vehicle growth rate of 3% per annum has been adopted.

6.4.1. Growth in local and regional traffic

For the purpose of this investigation both local and regional traffic are forecast to grow in line with the population of the study area (see **Section 6.2**).

6.5. Year of opening traffic forecasts

For the purposes of this analysis, it has been assumed that the whole of the Proposal would be opened to traffic in 2013. The actual year of opening would be dependent upon a number of factors including opportunities to stage construction and the availability of funding.

Forecast AADT volumes for 2013 are shown in **Table 6-3**.

- **Table 6-3 2013 Forecast traffic volumes on the upgraded highway**

Section	AADT		
	Light Traffic	Heavy Traffic	Total
Warrell Creek Interchange to Bald Hill Road Interchange	6,500	1,600	8,100
Bald Hill Road Interchange to Nambucca Interchange	6,500	1,800	8,300
Nambucca Interchange to Ballards Road Interchange	7,900	1,950	9,850
Ballards Road Interchange to Waterfall Way Interchange	7,400	1,800	9,200

6.5.1. Traffic on the existing Pacific Highway

Forecast traffic remaining on the existing Pacific Highway is presented in **Table 6-4**. This is mainly local traffic travelling to and from the nearest interchange, but includes local travel between adjacent zones.

- **Table 6-4 2013 Forecast traffic remaining on the existing Pacific Highway**

Section	AADT		
	Light Traffic	Heavy Traffic	Total
South of Bald Hill Road	2,850	550	3,400
Bald Hill Road to Macksville	3,750	600	4,350

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Section	AADT		
	Light Traffic	Heavy Traffic	Total
Macksville to Nambucca Heads	4,800	250	5,000
Nambucca Heads to Nambucca Interchange	4,950	550	5,500
Nambucca Interchange to Valla Beach	2,600	300	2,900
Valla Beach to Ballards Road	2,200	250	2,450
Ballards Road to Urunga	3,350	450	3,800

6.6. Traffic forecasts 10 years after opening

The 2023 forecast 30th HHV traffic volumes and AADT are shown in **Table 6-5.**

- **Table 6-5 2023 Forecast traffic volumes on the upgraded highway**

Section	30th HHV			AADT		
	Light Traffic	Heavy Traffic	Total	Light Traffic	Heavy Traffic	Total
Warrell Creek Interchange to Bald Hill Road Interchange	800	230	1,030	7,550	2,100	9,650
Bald Hill Road Interchange to Nambucca Interchange	795	245	1,040	7,500	2,300	9,800
Nambucca Interchange to Ballards Road Interchange	960	270	1,230	9,050	2,500	11,550
Ballards Road Interchange to Waterfall Way Interchange	900	250	1,150	8,500	2,350	10,850

6.6.1. Traffic on the existing Pacific Highway

Forecast traffic remaining on the existing Pacific Highway is presented in **Table 6-6.**

- **Table 6-6 2023 Forecast traffic on the existing Pacific Highway**

Section	AADT		
	Light Traffic	Heavy Traffic	Total
South of Bald Hill Road	3,100	600	3,700
Bald Hill Road to Macksville	4,100	650	4,750
Macksville to Nambucca Heads	5,250	300	5,500
Nambucca Heads to Nambucca Interchange	5,450	650	6,100
Nambucca Interchange to Valla Beach	2,850	350	3,200

Section	AADT		
	Light Traffic	Heavy Traffic	Total
Valla Beach to Ballards Road	2,400	300	2,650
Ballards Road to Urunga	3,650	450	4,150

6.7. Traffic forecasts 20 years after opening

The forecast 2033 30th HHV traffic volumes and the AADT are shown in **Table 6-7.**

- **Table 6-7 2033 Forecast traffic volumes on the upgraded highway**

Section	30th HHV			AADT		
	Light Traffic	Heavy Traffic	Total	Light Traffic	Heavy Traffic	Total
Warrell Creek Interchange to Bald Hill Road Interchange	900	250	1150	8,550	2,300	10,850
Bald Hill Road Interchange to Nambucca Interchange	910	270	1180	8,550	2,550	11,100
Nambucca Interchange to Ballards Road Interchange	1100	300	1400	10,200	2,750	12,950
Ballards Road Interchange to Waterfall Way Interchange	1050	300	1350	9,600	2,550	12,150

6.7.1. Traffic on the existing Pacific Highway

The 2033 forecast traffic volumes (AADT) on the existing Pacific Highway are shown in **Table 6-8**.

- **Table 6-8 2033 Forecast traffic volume on the existing Pacific Highway**

Section	AADT		
	Light Traffic	Heavy Traffic	Total
South of Bald Hill Road	3,350	700	4,050
Bald Hill Road to Macksville	4,450	700	5,200
Macksville to Nambucca Heads	5,700	350	6,000
Nambucca Heads to Nambucca Interchange	5,900	850	6,800
Nambucca Interchange to Valla Beach	3,100	400	3,500
Valla Beach to Ballards Road	2,600	350	2,900
Ballards Road to Urunga	4,000	550	4,500

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6.8. Summary of forecast volumes on the Proposal

The summary of the forecast volumes within the study area are presented in **Table 6-9**.

- **Table 6-9 Summary, forecast AADT volumes on the Proposal**

Location	2013	2023	2033
Warrell Creek Interchange to Bald Hill Road Interchange			
Light	6,500	7,550	8,550
Heavy	1,600	2,100	2,300
Total	8,100	9,650	10,850
% Heavy	20%	21%	21%
Bald Hill Road Interchange to Nambucca Interchange			
Light	6,500	7,500	8,550
Heavy	1,800	2,300	2,550
Total	8,300	9,800	11,100
% Heavy	22%	23%	23%
Nambucca Interchange to Ballards Road Interchange			
Light	7,900	9,050	10,200
Heavy	1,950	2,500	2,750
Total	9,850	11,550	12,950
% Heavy	20%	21%	21%
Ballards Road Interchange to Waterfall Way Interchange			
Light	7,400	8,500	9,600
Heavy	1,800	2,350	2,550
Total	9,200	10,850	12,150
% Heavy	20%	21%	21%

Note that the proportion of heavy vehicles is forecast to increase over time**.** This is due to the growth rate applied to heavy vehicles being higher than the rate applied to other vehicles**.**

6.9. Public Transport

For all public transport services, individual operators may decide to modify services in light of the changed traffic conditions arising from the Proposal. This may include changes in routes, or additional services, to use the upgraded highway. However, it is likely that bus routes would be routed as close to the existing highway alignment as possible, as this would in most cases provide access to the greatest number of potential passengers. Some long distance coach services may use the upgraded highway to improve travel times through the study area, although this would be at the expense of additional patronage from Macksville, Nambucca Heads, Urunga and other stops in the study area.

Some minor changes would be required where routes are blocked or diverted due to crossing the upgraded highway alignment. However, no significant impact on public transport services is expected from the Proposal.

6.10. Pedestrians and Cyclists

Construction

Cyclists and pedestrian may experience short term impacts where the Proposal impacts local access roads private accesses (e.g. driveways).

Operation

The existing highway and local roads, with their associated pedestrian and cycle facilities where provided, would continue to be available once the Proposal is constructed. The significant difference would be the reduction in the number of heavy vehicles using the existing highway. This has the potential to create a more attractive, and safe, cycle route through the study area than is currently available. Where existing pedestrian and cycle links are severed by the Proposal, new facilities have been incorporated into the design of overbridges, as appropriate. Cyclists wishing to ride on the Proposal would be accommodated in the 2.5 metre shoulder to be provided.

6.11. Freight efficiency

The inter-capital freight volume on the existing Pacific Highway in the study area was estimated to be approximately 2.9 million tonnes in the study area in 2004 (BRTE 2006). Road-based freight transport represents 76 per cent of the Sydney-Brisbane inter-capital freight, rail represents 11 per cent, coastal shipping 12 per cent and air 1 per cent (Ernst & Young 2006).

Any increase in the freight task is most likely to be absorbed predominantly by road. For the rail mode share to increase, significant investment in rail track and signalling infrastructure to improve travel times and access to the Sydney ports is required, and the freight industry needs to respond to such improvements by diverting freight from road to rail. This is considered an unlikely scenario in the short-medium term.

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The continued upgrade of the Pacific Highway would improve travel times relative to the New England Highway, and provide a high-quality and safer route for road freight between Sydney and Brisbane.

The freight forecasts for the Sydney-Brisbane corridor indicate that road freight tonnages along the Pacific Highway would increase at an average annual rate of between 3.7 and 4.2 per cent per annum to 2029. From the freight movement forecasts, road will continue to be the dominant mode with the freight tonnes expected to be carried along the Pacific Highway in 2029 to range between 62 and 75 per cent. It is considered that the higher end of this range is the more likely outcome. Without the Proposal this growth would be constrained with the current and predicted LoS experienced on the existing highway throughout the study area.

The Proposal would improve road travel times, reliability, safety and fuel efficiency for heavy vehicles. Travel time through the study area would improve at signposted speeds by approximately nine minutes. Further benefits for heavy vehicle transport would also be experienced through similar upgrades in the region such as Kempsey to Eungai to the south and the proposed Sapphire to Woolgoolga upgrade to the north. The Proposal is unlikely to have any significant negative impacts on the movement of freight to or from the study area, but would contribute to a general improvement in conditions on the Pacific Highway between Sydney and Brisbane.

6.12. Local access and impact on local roads

Local access onto and off the Proposal would be provided through five grade-separated interchanges listed below. Further details are provided in Chapter 6 – *Description of the Proposal*.

- Warrell Creek interchange, south of Warrell Creek village.
- Bald Hill Road interchange, south of Macksville.
- Nambucca Heads interchange near Boggy Creek.
- Ballards Road interchange, south of Urunga.
- Waterfall Way interchange at Raleigh.

These proposed interchanges would provide access to the local road network and community destinations. Local road crossings of the Proposal have been consolidated through the provision of adjacent local access roads that feed local traffic to the crossing points incorporated into the design. These local access roads are shown in figures Figure 6-5 to Figure 6-9 of the Environmental Assessment. The existing Pacific Highway would be retained for local access purposes. The location of the interchanges has been designed with consideration for the proposed future urban development in the study area. As such these intersections would cater for both the existing and planned development. Details of the interchange options investigated are provided in Chapter 4 – *Route development*.

The local road network strategy aims to maintain a continuous alternative route (the existing highway) to the upgrade, as a local connector road, with rationalised, safer connections across the upgrade. It is expected that local road connections with the existing highway would be safer and more efficient with the separation of local and through-traffic and the resultant reductions in vehicle numbers on the existing highway. The local road network strategy is included in Chapter 6 – *Description of the Proposal*.

Some minor rerouting of existing roads would be required to enable access to particular local roads such as Old Coast Road north of Mattick Road and Deep Creek Road. Access would be maintained to all properties along the local roads, which may require modification to the driveways of individual properties.

There is not expected to be any significant change in local travel times or distances as a result of the Proposal.

6.13. Impacts on fire trail network

Construction

The Proposal severs numerous fire trails as indicated below, however access to the fire trail network during construction would be maintained in consultation with NSW Forests branch of the Department of Industry & Investment (DII).

Operation

Numerous fire trails are present throughout the Nambucca State Forest, the Newry State Forest and the Little Newry State Forest. The Proposal would bisect several existing fire trails in Nambucca State Forest and Newry State Forest in particular. The fire trails impacted by the Proposal include:

- Poplar Trail
- Gossips Road
- CPT 319/2
- CPT 296/8
- CPT 296/1
- CPT 294/2
- Tower Road
- Jacksons Road
- Mines Road
- Allans Trail
- Jacks Ridge Road
- Plantation Trail
- CPT 298/1
- CPT 319/3
- CPT 284/1
- CPT 318/3
- Fairbrothers Road
- CPT 293/1
- CPT 296/6
- CPT 298/4
- CPT 294/4

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- CPT 284/5
- CPT 296/2
- CPT 284/3

The Proposal had the potential to hinder access to areas of the forest during construction and operation. Consultation has been undertaken with NSW Forests branch of the Department of Primary Industries to relocate a number of fire trails which would be impacted by the Proposal. Some fire trails have been relocated or diverted to avoid the proposal. Full access has been maintained to the fire trail network through new connections alongside the Proposal. Further consultation would be required during detailed design to ensure the needs of fire trails are further considered in the detailed design. The construction traffic management plan to be implemented during construction would include measures to ensure access to the firetrails within the state forests is maintained through the construction period. Therefore, no significant long term impacts on fire trails are envisaged.

6.14. Interaction with rail infrastructure

The Proposal crosses the North Coast Railway Line at two locations: approximately 700 metres east of Browns Crossing Road, Warrell Creek, and approximately 200 metres south of Gordons Knob Road, Nambucca Heads. There would be no obstruction to the functioning of the railway during the construction or operation of the Proposal at these two locations. Consultation has and would take place between the RTA and the Australian Rail Track Corporation (ARTC) regarding the construction method at these crossing points.

The North Coast Railway Line runs north south through the study area in close proximity to the existing Pacific Highway in some locations. To reduce land use issues and to maximise the use of this existing transport corridor, the opportunity to insert the Proposal within or alongside the railway corridor was reviewed during the early route selection stages. Discussions with ARTC, and the geology and the potential alignment geometry for a highway in this location was investigated. It was found that a suitable alignment that would meet RTA design guidelines could not be achieved by sharing the rail corridor. Furthermore, significant fill or piling would be required to render the soft soils suitable for road construction. More suitable alignments which would meet the RTA's design guidelines could be achieved in the vicinity, therefore the option for sharing the rail corridor was not progressed.

6.15. Travel time

At prescribed speed limits, travel time for the study area is approximately 28 minutes for the 40 km length of the existing Highway. On the upgraded highway, travel time for through traffic would be 21 minutes at the design speed of 110 km/h, providing a saving in travel time for through traffic of approximately 7 minutes.

6.16. Road safety

The Proposal would be a high standard of road, with 2 lanes of traffic per direction, wide shoulders on a divided carriageway. The designed speed limit for the Proposal is 110 km/h. Exit and entry to the Proposal would be via grade-separated interchanges. The alignment chosen for the Proposal would result in only small volumes of traffic using the existing highway, with the removal of through traffic from the existing highway.

A target of 15 crashes per 100 Million Vehicle Kilometres Travelled was set at the commencement of the Pacific Highway upgrade program. This is approximately one-third of the existing rate on the sections of highway between Warrell creek and Urunga. Evidence from sections of the Pacific Highway that have been upgraded since the Pacific Highway Upgrade Program commenced suggest that this target for all crashes is not being met, but that there has been a reduction in injury and fatal crashes.

The Yelgun- Chinderah section of the Pacific Highway was opened in 2002. Crash data for 2003 – 2005 indicates a crash rate of approximately 25.8 per 100MVKT. This is not dissimilar to the existing crash rate in the study area, of 28 crashes per 100MVKT (see **Section 3**). However, the difference in injury and fatality crash rates is much more marked: on the upgraded Yelgun to Chinderah section injury crashes occur at a rate of just under 2 per 100MVKT, with 0.5 fatal crashes occurring per 100MVKT. Within the limit of the Warrell Creek to Urunga study area, there are currently 12.1 injury crashes and 1.5 fatal crashes per 100MVKT.

Without the Proposal, it is estimated that between 2013 and 2033, there would be nearly 1,400 crashes on the highway in the study area. Some 590 of these crashes would result in an injury, and 75 would result in a fatality. Adopting the observed crash rates for the upgraded Yelgun – Chinderah section of highway, the Proposal between Warrell Creek and Urunga is expected to reduce the number of injury crashes by 67 percent and the number of fatal crashes by 60 percent. This represents a saving of 45 lives over a 20 year period after the construction of the Proposal. Similarly, almost 400 fewer people would be injured in crashes in the study area.

6.17. Future corridor capacity and Level of Service

The design standard for the Proposal is specified as dual carriageway with two 3.5m-wide lanes, a 2.5m left-hand shoulder and a 0.5m right-hand shoulder. A design speed of 110 km/h has been adopted. On the basis of forecast traffic volumes, the proposed design would provide a Level of Service A at opening and in 2033 in the 100th Highest Hourly Volume design hour.

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6.18. Future interchange Level of Service

The Level of Service criteria set out for the Pacific Highway Upgrade Program requires that interchanges must operate at Level of Service 'C' or better for the 100th Highest Hourly Volume 20 years after the Proposal opening. Each of the proposed intersections within each interchange has been modelled in the SIDRA intersection modelling software for the 100th Highest Hourly Volume forecast for 2033. Each of the intersections is expected to operate at Level of Service C or better, with most forecast to operate at Level of Service A or B.

6.19. Construction impacts

The majority of the Proposal includes a bypass through rural or state forest land and would be constructed away from the existing Pacific Highway and therefore minimal traffic would be affected on the existing highway. In locations where the Proposal crosses the existing Highway, local and arterial roads, there are likely to be short-term, temporary traffic delays. Potential traffic impacts during construction would also be due to increases in traffic volumes from construction work vehicles and haulage of materials to and from the construction site(s). Haulage of materials between areas of cut and fill would take place off-road where possible, either along the carriageway under construction or in bypass areas within the proposed corridor, where feasible. Appropriate traffic management measures would be implemented to minimise any traffic related impacts and incorporated as part of the traffic management sub-plan to be developed as part of the construction environmental management plan.

The construction traffic management sub-plan would address the management of traffic around worksites at the following locations where the Proposal intersects with existing roads.

For properties where access would be temporarily affected by the construction of the Proposal, alternative access would be provided, where feasible and reasonable, in consultation with property owner.

Spoil haulage within construction corridor

The key routes for spoil haulage would depend on exact nature of the cut and fill produced by the Proposal and the quarries used by the construction contractor. It has been anticipated that the Proposal would result in a surplus of spoil. Where possible, excess spoil generated by the Proposal would be used to construct visual screening and noise mounds. Spoil haulage would generally be limited to within the construction corridor. Some haulage of spoil material may also be required along the existing local road network. It would be expected that vehicle movements along existing roads, if required, would be difficult to detect above normal daily fluctuations in traffic.

The impact of spoil haulage would be minimised through a number of measures, including:

- Timing of construction activities to avoid spoil haulage at peak traffic times such as holidays and long weekends.
- Provision of turn bays for access to work areas, to avoid traffic being delayed behind turning trucks; and use of access tracks within the work site to avoid haulage of spoil along trafficked roads.
- The use of the Proposal route for spoil haulage, where appropriate.

Quarry material haulage

It may be necessary to source some material from nearby quarries. Haulage of quarry material has the potential to damage local roads, disrupt traffic, and create adverse noise and amenity impacts for those living alongside haulage routes. Quarries used to supply material for the construction of the Proposal would be selected by the construction contractor. As for spoil haulage, it has been expected that vehicle movements along existing roads would be difficult to detect above normal daily fluctuations in traffic. Additionally, any impacts associated with the haulage of quarry material would be managed in accordance with mitigation measures outlined in the following section.

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7. Management of impacts

The construction of the Proposal would be managed to minimise disruption to traffic using the existing Pacific Highway as well as traffic using the existing local access road network.

A traffic management sub-plan would be prepared as part of the construction environmental management plan detailed in Chapter 8 – *Environmental management*. This would facilitate the safe and efficient management of local and highway traffic during construction, minimising impacts on the local community.

The sub-plan would include the following mitigation measures:

7.1. Regional and local roads (including property access)

7.1.1. Construction

- Identification of local roads to be utilised by construction traffic and implement measures to ensure that construction traffic utilise the identified roads.
- Identification of local roads that may be partially or completely closed during the construction phase and provide affected stakeholders information regarding expected timings and duration of closures.
- Implement temporary traffic diversions (including property access) in accordance with RTA requirements. Property access to be maintained during construction in consultation with affected landowners.
- Identification of access arrangements to construction sites and compounds and measures to prevent construction traffic from obstructing traffic flow inadvertently.
- A response plan for any construction traffic incidents.
- Monitoring, review and amendment mechanisms.

The following measures have also been included in the *Draft Statement of Commitments* (Appendix D, Volume 1 of the Environmental Assessment).

- Pre-construction road condition reports will be prepared for all non-arterial (local) roads likely to be used by construction traffic.
- Post-construction road condition reports will be prepared for the roads assessed prior to construction. Copies of the reports will be provided to the relevant roads authority. Any damage resulting from construction (not normal wear and tear) will be repaired at the RTA's cost, unless an alternative arrangement for road damage is agreed with the relevant roads authority.

- Construction vehicle movement arrangements will be developed to limit impacts on other road users (including pedestrians, vehicles and cyclists) and with specific regard to other road works in the area, local traffic movement requirements and peak traffic volumes, including long weekends and holiday periods.

7.1.2. Operation

- Confirm feasible property access with affected landowner at detailed design stage.
- Safe access to the upgraded highway would be provided at strategically located grade separated interchanges.
- Local roads would pass over or under the upgraded highway.

7.2. Fire trail networks

7.2.1. Construction

- Access to the fire trail network would be maintained during construction in consultation with NSW Forests (now a branch of the Department of Industry & Investment (DII)).

7.2.2. Operation

- Suitability of proposed access into State Forests included in the Proposal would be re-confirmed with the NSW Forests (now a branch of the Department of Industry & Investment (DII)) at the detail design stage.

7.3. Cyclists, pedestrians and public transport (including bus services)

7.3.1. Construction

- Access to local roads (including for pedestrians, cyclists and bus services) would be maintained during construction. Any temporary access changes during construction would be undertaken in accordance with RTA requirements.

7.3.2. Operation

- Provision for cyclist and pedestrian movement over the upgrade has been made at the local road bridges identified in Chapter 6 – *Description of the proposal*, Environmental Assessment, Volume 1. It is expected that cyclists would use the existing Pacific highway for cycling activities as a result of lower traffic volumes and reduced number of heavy vehicles.

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7.4. Spoil haulage and quarry material haulage

7.4.1. Construction

- Noise and amenity impacts for quarry material haulage would be managed by the quarry operational license.
- Spoil haulage would generally be confined to access tracks within the worksite. Should local roads be required for spoil haulage, RTA would comply with the Statement of Commitment outlined in Appendix D of the Environmental Assessment, Volume 1.
- Timing of construction activities to avoid spoil and quarry material haulage along local roads at peak traffic times, such as holidays and long weekends.

Appendix A Definition of Vehicle Classes

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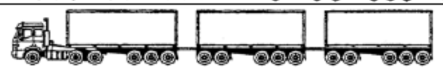
AUSTROADS Vehicle Classification System

Level 1 Length (indicative) Type	Level 2 Axles and Axle Groups Axles	 Groups	Level 3 Vehicle Type Typical Description	AUSTROADS Classification Class	 Parameters	 Typical Configuration
			LIGHT VEHICLES			
Short up to 5.5m		1 or 2	**Short** Sedan, Wagon, 4WD, Utility, Light Van, Bicycle, Motorcycle, etc	1	d(1) ≤ 3.2m and axles = 2	
Medium 5.5m to 14.5m	3, 4 or 5	3	**Short - Towing** Trailer, Caravan, Boat, etc	2	groups = 3 d(1) ≥ 2.1m, d(1) ≤ 3.2m, d(2) ≥ 2.1m and axles = 3, 4 or 5	
			HEAVY VEHICLES			
	2	2	**Two Axle Truck or Bus**	3	d(1) > 3.2m and axles = 2	
	3	2	**Three Axle Truck or Bus**	4	axles = 3 and groups = 2	
	> 3	2	**Four Axle Truck**	5	axles > 3 and groups = 2	
Long 11.5m to 19.0m	3	3	**Three Axle Articulated** Three axle articulated vehicle, or Rigid vehicle and trailer	6	d(1) > 3.2m, axles = 3 and groups = 3	
	4	> 2	**Four Axle Articulated** Four axle articulated vehicle, or Rigid vehicle and trailer	7	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 4 and groups > 2	
	5	> 2	**Five Axle Articulated** Five axle articulated vehicle, or Rigid vehicle and trailer	8	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 5 and groups > 2	
	≥ 6	> 2	**Six Axle Articulated** Six axle articulated vehicle, or Rigid vehicle and trailer	9	axles = 6 and groups > 2 or axles > 6 and groups = 3	
Medium Combination 17.5m to 36.5m	> 6	4	**B Double** B Double, or Heavy truck and trailer	10	groups = 4 and axles > 6	
	> 6	5 or 6	**Double Road Train** Double road train, or Medium articulated vehicle and one dog trailer (M.A.D.)	11	groups = 5 or 6 and axles > 6	
Large Combination Over 33.0m	> 6	> 6	**Triple Road Train** Triple road train, or Heavy truck and three trailers	12	groups > 6 and axles > 6	

Definitions:
Group: Axle group, where adjacent axles are less than 2.1m apart
Groups: Number of axle groups
Axles: Number of axles (maximum axle spacing of 10.0m)

d(1): Distance between first and second axle
d(2): Distance between second and third axle

Source: Austroads (2006) *AP-T60/06 Automatic Vehicle Classification by Vehicle Length*, Austroads, Sydney

Appendix B Level of Service criteria

Level of Service	Average Delay (sec/ vehicle)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays	At capacity, requires other control mode
F	More than 70	Poor - Require another control mode	