Moorland to Herons Creek EIS

Working Paper No. 1
Traffic Assessment

Roads and Traffic Authority NSW

Pacific Highway Upgrade - Moorland to Herons Creek

Preferred Option - Working Paper - Traffic and Transport

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1. INTRODUCTION

Arup Transport Planning was commissioned to carry out a detailed traffic assessment for the proposed upgrade of the Pacific Highway between Moorland and Herons Creek. This report forms part of the Concept Design and EIS process.

This report addresses the following issues:

- Existing traffic volumes and Level of Service;
- Traffic volume projections for up to 30 years after opening;
- Assessment of the Level of Service of the Highway upgrade upon opening and after 10, 20 and 30 years of operation;
- Description and assessment of proposed intersections/ interchanges for the Preferred Option;
- Provisions for pedestrians, cyclists, equestrians, bus passengers and other forms of transport;
- Locations for car stopping bays and truck stopping bays;
- Need and location for any other special facilities such as service roads, median crossovers, auxiliary climbing lanes, rest areas, service centres, bus stops and heavy vehicle facilities;
- Analysis of impacts on area-wide traffic/transportation patterns on the adjacent road network; and
- Accident records for the most recent five-year period and an assessment of the accident rate that might arise if no upgrade is provided.

This report discusses the Preferred route and intersection options in accordance with Section 8.16 of the study brief. The Preferred Option is shown in **Figure 8**.

1.1 Standards and Guidelines

A number of guidelines and reports provide guidance on road design standards for the upgrading of the Pacific Highway between Moorland and Herons Creek. These standards and guidelines are subsequently referred to as references throughout this report, using the numbering below, and include:

1. Austroads (1999). Guide to Traffic Engineering Practice, Part 14, Bicycles.
2. RTA (1999). Road Design Guide.
3. RTA (1997). Upgrading the Pacific Highway. Ten Year Pacific Highway Reconstruction Program. Discussion Paper.
4. RTA (2004) Road Environment Safety Update 22 - Rural Road Crash Rates by Road Stereotypes.
5. Sinclair Knight Merz (2000). Pacific Highway Upgrade Strategic Assessment Final Draft. Technical Working Paper 14: Transport Analysis. Prepared for the RTA.
6. Sinclair Knight Merz (2000). Pacific Highway Upgrade Strategic Assessment Final Draft. Technical Working Paper 16: Stopping Area Strategic Plan. Prepared for the RTA.
7. RTA (1992). Road Environment Safety Guidelines.
8. Austroads (1988) Guide to Traffic Engineering Practice, Part 3, Traffic Studies.

9. Austroads (1988) Guide to Traffic Engineering Practice, Part 2, Roadway Capacity.
10. RTA (1999) Economic Analysis Manual, Version 2 (Incl. Rev 1-6, 2000-2002)
11. RTA (2000) Highway Rest Area Strategy Background Report.
12. ERM for Boral Timber (February 2000) Herons Creek Bypass Road; Traffic Impact Study.
13. RTA (1993) Rural Crash Rates-Road Stereotypes Summary Report.
14. Arup-Geoplan for Hastings Council (November 1997) Hastings Regional Bike Plan
15. Roadnet Pty Ltd, Traffic Counts and Intersection Modelling: Intersection of Pacific Highway, Kew Road and Ocean Drive, Kew, report for the RTA Northern Region, April 2000.
16. (RTA 1999, 2000, 2001) Road Traffic Accidents in NSW – Statistical Statement.

2. LOCAL, INTER-REGIONAL AND INTRA REGIONAL TRAFFIC AND TRANSPORTATION ISSUES

Figure 8 illustrates the Pacific Highway between Moorland and Herons Creek and the region, which it passes through. Local townships exist along the route at Johns River, Rossglen, Kew and Herons Creek. In addition Kendall is located approximately 2 km west of Kew and the Highway. The 2001 Census recorded that Kendall supports a population of 732, whilst Kew has a population of 144. Recent residential development has taken place both to the north and south of Ocean Drive, east of the main Highway. Consultation with Hastings Council has taken place but no specific data on the population of these developments is available. The township of Johns River supports a population of 140 (Greater Taree Council estimate for 2001). Rossglen and Herons Creek support very small populations in comparison.

In national terms, the Pacific Highway links Australia's largest city, Sydney, with Brisbane, which is located at the northern end of Australia's fastest growing urban corridor. The Highway passes through the North Coast region which has, and is forecast to continue to have, the highest population growth rate in New South Wales.

Within the Hastings Council and Greater Taree Council areas, no other roads provide equivalent north-south access. Only the route via Ocean Drive and Houston Mitchell Drive provides additional north south access through the region. However, this route is significantly longer than the Pacific Highway and serves only a local and tourist function.

2.1 Traffic and transportation objectives

Based on the above discussion of traffic and transportation issues, key traffic and transportation objectives for the project can be defined as:

Relevant Pacific Highway Upgrade Program Objective	Relevant Evaluation Criteria
Significantly reduced road accidents and injuries	Increased length of dual carriageway
	Increased safe overtaking opportunities
	Improved alignment and elimination of narrow bridges
Reduced travel times	Acceptable/appropriate Levels of Service relative to forecast traffic volumes
Reduced freight transport costs	Travel time savings
	Vehicle operating cost savings
Project Specific Objectives	
Develop a dual carriageway road with potential to reduce crash rates to 15 crashes per 100MVK over the project length	Comparison with crash rates of other sections of highway built to a similar standard as the proposed upgrade.
Develop a Preliminary Engineering Design that meets or exceeds B-Double requirements, including at intersections where required	Reference B-Double design standards for horizontal and vertical alignments, in addition to relevant intersections.
Provide transport developments which are complimentary with landuse	Type of local vehicular movements catered for by the Highway upgrade and intersection upgrades
Allow for all connections, modifications and improvements necessary to upgrade the existing highway where it is retained as part of the project	Consistency of design with connections required to existing highway
Consider delay management strategies to minimise disruption to local and through traffic and maintain access to affected properties and land during construction	Consideration of strategic and local travel patterns and access requirements
Develop a solution for the intersection of the Pacific Highway with Ocean Drive/Kendall Road at Kew that meets community expectations	Surrogate criteria for the broader community will be in the form of safety and traffic performance criteria
	Criteria will depend in part on input from local community
Retain or replace existing rest areas within the study area	Alignment option retains or replaces existing rest areas
	Alignment option replaces existing rest areas with new rest areas that meet needs of the travelling public
Develop a Preliminary Engineering Design generally meeting the criteria for a 100km/h-design speed for the vertical alignment and a 110km/h-design speed for the horizontal alignment. Adoption of a lower design speed of 80km/h may be acceptable in specific urban locations, depending on the alignment of the Preferred Route	Length of option providing 100km/h design speed for vertical alignment (kilometres)
	Length of option providing 110km/h design speed for horizontal alignment (kilometres)
	Length of option providing 80km/h design speed for horizontal alignment (kilometres)
Provide intersections designed to provide at least Level of Service C thirty (30) years after opening for the 100th Highest Hourly Volume	Type of local vehicular and pedestrian movements catered for by each intersection (Level of Service)

3. EXISTING TRAFFIC

3.1 Data

3.1.1 RTA Traffic Counts

The most recent Annual Average Daily Traffic (AADT) figures and historical counts on the Pacific Highway are presented in **Figure 9** and in **Table 1** below. Current AADT (2001) between Moorland and Herons Creek is approximately 11,900 at Kew.

Table 2 details traffic volumes on other roads in the region, with significant counts on roads MR 538/ MR 600 (Kendall Road/Ocean Drive) either side of the Pacific Highway. Current data from these sites is also presented in **Figure 9**.

3.1.2 Traffic Counts at Kew

RoadNet was commissioned by the Northern Region of the RTA to conduct traffic counts and monitor delays during various traffic periods at the intersection of Ocean Drive and Kendall Road with the Pacific Highway at Kew. Intersection counts were conducted on the following days:

- Good Friday 2000 – 10:00 to 12:00
- Typical Weekday outside school holidays – Tuesday 11th April 2000 between 08:30 and 09:30 and 15:00 and 17:00
- A weekday during school holidays – Tuesday 18th April 2000 between 08:30 and 09:30 and 15:00 and 17:00

The RoadNet survey results are included as **APPENDIX F** to this report. Under normal traffic conditions, AM peak hour (08:30 to 09:30) movements through the intersection total almost 1,000 vehicles. This figure rises to 1,110 during the PM peak hour (15:30 to 16:30).

On Good Friday movements through the intersection during the AM peak hour (10:15 to 11:15) total almost 1,900 vehicles.

3.1.3 Counts at Other Junctions

As part of this study, additional traffic counts were undertaken on key side roads intersecting with the Highway between Moorland and Herons Creek. Twelve hour turning movements counts were conducted between 07:00 and 19:00 during November 2000. **Table 3** indicates that vehicle movements on these side roads were low, with total movements through the intersection at Stewarts River Road, Johns River, being the highest at 309 vehicles. The survey results are presented as **APPENDIX G** to this report.

An Origin and Destination survey was also undertaken at Johns River during June 2002. The aim of the survey was to gain an understanding of the existing movements between Stewarts River Road, the Pacific Highway and other local traffic generators within the Johns River Township. This involved monitoring traffic at seven locations within the area. Twelve hour counts were conducted between 07:00 and 19:00 on a representative weekday (Wednesday 5 June 2002) and a representative weekend day (Saturday 8 June 2002). The results of this survey are also presented in **APPENDIX G** of this report.

3.1.4 Journey Time Surveys

Journey time surveys were conducted in November/December 2000. Six trips were made throughout the day in each direction between Moorland and Herons Creek, with times taken at key points en route. **Table 4** details the journey times between Moorland and Herons Creek. Average end-to-end speeds are between 89 and 93km/h in both directions, indicating that congestion was not an issue when journey time surveys were undertaken.

Table 1 - AADTs on the Pacific Highway

Station	Location	Year									
		1982	1986	1990	1995	1998	1999	2000	2001	2002	2003
09.212*	Macksville – 3.8km N of Scotts Head Rd	6,336	7,381	8,760	10,066	11,655	12,051	11,670	11,984	14,043	13,902
09.004*	Blackmans Point – at Hastings River Br	6,454	7,136	8,198	10,237	11455	11,883	12,356	12,696	13,716	16,883[1]
09.043*	S of SH11, Oxley Hwy to Wauchope	5,540	6,013	8061	9,008	9,862	10,552	11,706	12,535	14,070	15,071
9122	Kew, 0.5km N of MR538 Laurieton Road	6,110	6,242	8,086	9,720	11,570			11,898		
9120	2.3km S of MR538 Laurieton Road	6,480	7,027	8,465	9,749	11,042			10,607		
9115	At Ghinni Ghinni	7,700		8304	10,987	12,903			13,747		
09.109*	Purfleet – 1.3km S of Old Bar Road	8701	9376	12506	13,833	16,149	16,384	17,445	17,157	18,574	20,938[1]
05.006*	Karuah – at Karuah River Bridge		8024	8950	10336	12169	12,289	13,086	13,075	14,479	15,021

Source: RTA Traffic volumes Northern Data Region 2001, Traffic Volume Data Hunter Region 2001, and RTA Traffic Information Group

* *Permanent Count Site*

[1] *Overcounting reported at this site. Actual AADT is likely to be lower than these figures.*

Table 2 – AADTs on Other Roads

Station	Location	Year							
		1982	1986	1990	1995	1998	1999	2000	2001
09.662	Kendall, 1.6km W of Camden Haven Br (MR 538)	280	622	619		598			643
09.663	Kew – W of SH 10, Pacific Hwy (MR 538)	1740	2726						
09.664	Kew - E of SH 10, Pacific Hwy (MR 600)	2520	2805	4374	4208	4298			6321
09.832	Herons Creek Road, W of SH 10 Pacific Hwy	890	845	710					
09.851	Laurieton – N of North Haven Road	3260	3488	5787					

Source: RTA Traffic volume Data Northern Region 2001 and Traffic Volume Data Hunter Region 2001

Table 3 - Side Roads Intersecting with the Pacific Highway: Traffic Counts (0700-1900)

Location of Survey – Intersection with the Pacific Highway	Survey Date	Twelve-hour (0700-1900) two-way vehicle count
Station Street; Johns River	Wednesday 1 November 2000	120
Stewarts River Road; Johns River	Wednesday 1 November 2000	309
Thomas Street; Johns River	Wednesday 1 November 2000	122
Algona Road	Tuesday 21 November 2000	67
Rossglen access road	Tuesday 7 November 2000	99
Sunnyvale Road (south)	Wednesday 8 November 2000	24
Sunnyvale Road (north)	Thursday 23 November 2000	38
Herons Creek Road (south)	Thursday 9 November 2000	28
Cluleys Lane	Tuesday 14 November 2000	48
Herons Creek Road (north)	Tuesday 14 November 2000	248

Table 4 - Highway Journey Times between Moorland and Herons Creek

Road	Elapsed Time in Minutes and Seconds											
	7am		9am		11am		1pm		3pm		5pm	
Camp Obadiah	0.00	14.47	0.00	14.22	0.00	14.43	0.00	14.30	0.00	15.00	0.00	14.45
Stewarts River Rd	1.36	13.10	1.39	12.42	1.33	12.50	1.27	13.10	1.40	13.24	1.42	13.00
Algona Road	4.08	10.56	4.04	10.18	3.58	10.43	3.47	10.25	4.00	11.00	4.09	10.45
Rossglen Road	7.32	7.20	7.42	6.50	7.24	7.05	7.11	6.55	7.07	7.10	7.47	7.00
Kew Intersection	10.10	4.20	10.30	4.10	10.22	4.18	10.24	4.30	10.20	4.25	10.50	4.15
Bobs Creek Road (start of existing dual carriageway)	14.05	0.00	14.20	0.00	15.00	0.00	14.20	0.00	14.15	0.00	14.50	0.00
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
Average End to End Speed (km/h)	93.3	88.9	91.7	91.5	87.6	89.3	91.7	90.6	92.2	87.6	88.6	89.1

3.2 Traffic Pattern and Growth Rates

The permanent counter (RTA site 09043) on the Pacific Highway south of the intersection with the Oxley Highway (SH11) east of Wauchope provides information on the traffic fluctuations throughout the day, the week and year. In addition, classified count data is available at RTA Sites 09.120 and 09.122 (Kew) for February 2004.

3.2.1 Traffic Growth Rates

The Pacific Highway Upgrading Program – Strategic Assessment (Ref 5) contains detailed traffic projections along the Pacific Highway. Volumes were predicted through the use of the CARTS model. Traffic volumes have been projected for numerous locations between Hexham and Tweed Heads. All traffic projections considered:

- Baseline traffic;
- Diverted traffic (mainly from the New England Highway); and
- Induced traffic.

The RTA temporary Count Station 09.122 at Kew is listed in the Strategic Assessment. Traffic projections were given at this location for the years 2007, 2016 and 2022. A subsequent study update by Scott Wilson Nairn in early 2001 provides updated traffic forecasts of Pacific Highway traffic at the Kempsey Shire boundary for the years 1999, 2006 and 2021. These indicate an initial annual traffic growth rate of 4.3% between 1999-2006 and 2.7% between 2007 and 2021, predicting an increase of approximately 99% between the years 1999 and 2021.

Traffic counts at RTA Station 09.122 have been used to assess existing traffic flow over the Moorland to Herons Creek section of the Highway. Counts at this location have also been used as a base from which to develop future traffic flows given the above forecasts for this section of the Highway. Since traffic volumes for 1999 are not available for RTA count site 09122, the 4.3% growth rate has been assumed to apply from the actual 1998 counts. It has also been assumed that the projected 2.7% growth rate can be extrapolated beyond the 2007-2021 period.

The RTA has indicated that the predicted opening year for the upgraded highway is 2011. Forecasts at Kew for 2011 and all other future years, have been based on the updated traffic growth rates forecast at the Kempsey Shire boundary for 1999, 2006 and 2021.

APPENDIX A contains the graphs of weekly traffic volume data from 1998 to 2002 for all the 5 permanent stations. The annual growth rates are summarised in **Table 5**.

Table 5 - AADT and Calculated Traffic Growth for Selected Sites

	RTA Station No	Location	AADT at 1998	AADT at 2002	Annual growth(1) (Jan 1998-Dec 2002)
North	09.212	Macksville – 3.8k N of Scotts Head Rd	11,655	14,043	2.4%
↕	09.004	Blackmans Point – at Hastings River Br	11,455	13,716	4.7%
↕	09.043	S of SH11, Oxley Hwy to Wauchope	9,862	14,070	9.2%
↕	09.109	Purfleet – 1.3k S of Old Bar Rd	16,149	18,574	3.2%
South	05.006(2)	Karuah – at Karuah Bridge	12,169(2)	14,479(2)	3.9%(2)

(1) Annual growth rate is calculated from daily count data from the five year period (Jan 1998 to Dec 2002) using regression analysis. It should not be compared directly with the growth rate calculated from just the 1998 and 2001 AADTs.
(2) Karuah counts are presented in vehicles

The closest permanent station to the proposed upgrade, Station 09043, experienced an annual growth rate of around 9% for the previous 5 years. This is significantly higher than the 4.3%pa traffic growth assumed from 1998 to 2006 on the basis of the Strategic Assessment (Ref 5). A detailed study of the traffic growth at other stations north and south also revealed that:

- The traffic growth at Station 09043 is significantly higher than other stations, which all showed around 3 to 5% growth pa,
- The 1998 AADT at Station 09043 was significantly lower than the surrounding sites. Therefore, despite the high growth rates, the AADT at 2003 is in line with the surrounding sites.
- The baseline traffic volume for highway design was based on Station 09122 rather than Station 09043, so in terms of current volume, forecast are still in line with adopted design values.

- Recent AADT values (2001-2003 and preliminary 2004) indicate potential increased growth in axle pairs.

The analysis shows that it is reasonable to adopt a 4.3% annual growth rate from 1998 to 2006 for the Moorland to Herons Creek section of the highway. The high growth rate at Station 09043 appears to be a local pattern that is not reflected in the other sites. A possible reason could be growth in local traffic movements associated with the growth of the Port Macquarie area. The 9.2% growth rate is not expected to continue over the longer period.

The opening of the Yelgun to Chinderah Freeway in August 2002, discussed further in **Section 3.4.2**, has resulted in increased heavy vehicle volumes on the Pacific Highway. The RTA has suggested that this increase should be viewed as a discontinuity rather than an increase in growth rates. However, the heavy vehicle percentages have not altered significantly, suggesting that there may have been a similar increase in private vehicle/ car volumes. Analysis and advice from the RTA has resulted in an instantaneous increase of 250 heavy vehicles per day being adopted, over and above the adopted growth rates, consisting of 80 semi-trailers and 170 B-Doubles. This corresponds to a total increase of 902 axle pairs, assuming six axles per semi-trailer and eight axles per B-Double. The additional vehicles have been added to the projected traffic volumes at the beginning of 2003.

3.2.2 Traffic Variation during the Year

Traffic flows on the highway peak during the major public holiday periods such as Easter, Christmas and school holiday times, with peak travel 50% to 100% greater than the average weekday level, as illustrated by the variation shown in **Figure 10**.

The highest daily volume recorded (to date) was during the 2001/ 2002 Christmas period, on 27 December 2001, when in total 29887 axle pairs were recorded for the two directions. This represents in excess of double the AADT (Average Annual Daily Traffic) and is consistent with other parts of the Pacific Highway affected by holiday traffic.

3.2.3 Traffic Variation during the Day

In terms of vehicles per hour, weekday volumes are relatively consistent throughout the 8am to 6pm period whilst at weekends, traffic volumes are consistent for the period (10am to 4pm). During the February 2004 RTA classified counts on the Pacific Highway, north of Kew (Station 9122), the average peak hour traffic volume (measured in vehicles) was 8.8% of the daily total for the weekend and 7.8% during the week. The data shows that, for non-holiday weekdays, traffic is relatively evenly spread throughout the day, without a major ‘commuter peak' that is evident in metropolitan regions.

3.3 Directional Split of Traffic on Highway

On peak days, the directional split of traffic is skewed from 50/50. This is characteristic of routes with a high degree of holiday traffic. On the peak day of 27 December 2001, the traffic stream comprised of 76% northbound and 24% southbound. During this time of the holiday period, the peak directional flow is away from Sydney as people are heading north for their Christmas holidays.

3.4 Heavy Vehicles

3.4.1 Number and Proportion of Heavy Vehicles

In February 2004, the RTA conducted vehicle classification counts on the Pacific Highway to the north and south of highway MR538, at Kew (sites 9120 and 9122). **Table 6** summarises this data, in the form of average number of heavy vehicles as a percentage of total vehicles (measured in vehicles).

Table 6 shows that the level of heavy vehicle traffic on the Pacific Highway in this region is considerable. Detailed analysis of heavy vehicle data shows that:

- Heavy vehicle traffic is evenly distributed in terms of north and south bound directions;
- The percentage of heavy vehicles in relation to the total number of vehicles is significantly higher at night, ie 10pm-6am; and
- the average percentage of heavy vehicles, calculated over the whole week (17%), is almost twice the number of heavy vehicles on a weekend day (9-10%); source: RTA Classified Vehicle Counts (9120 and 9122), February 2004.

Table 6 - Heavy Vehicle Volumes (measured as vehicles): RTA Station 09.122 (2004)

Time Period	Heavy Vehicle Measure	Direction		Total
		Northbound	Southbound	
Average	Heavy vehicles as % of daily vehicles	17%	17%	17%
Night only	Night HV's as % of total night vehicles	50%	55%	54%
(10pm – 6am)	Night HV's as % of total daily HV's	31%	31%	31%
Weekend	Weekend HV's as % of weekend total vehicles	9%	10%	10%
	% HV's during weekend peak hour (11am)	4%	5%	5%

Notes: 1. "Average" data represents an average of both weekend and weekday traffic patterns.

2. Survey period represents a typical non-holiday period. It should be noted that the total number of heavy vehicles per day is relatively uniform throughout the year.

3. Heavy vehicles are defined by Austroads in the *Guide to Traffic Engineering Practice, Part 3, Traffic Studies, 1994*. Heavy vehicles include trucks with two or more axles, buses, semi-trailers, B Doubles and road trains (classification categories 3-12).

While the proportion of heavy vehicles is high during the weekday non-holiday period, **Table 6** shows that the proportion of heavy vehicles is much less during weekend days. As also shown in **Table 6**, heavy vehicles contribute about 5% of the total traffic volume during peak periods on a weekend day.

The percentage of heavy vehicles using the Pacific Highway between Moorland and Herons Creek is relatively high, even when compared with the Hume Highway (18% Heavy Vehicles), one of Australia's busiest freight routes (see **Table 7**).

Table 7 - Heavy Vehicle Proportions on NSW Highways

Highway	Location	% Heavy Vehicles	Approximate AADT
Pacific	East of Bucketts Way	17%	14,000
Hume	Holbrook	18%	8,000
Princes	Ulladulla	10%	7,500
New England	Bendemeer	15%	4,150

Source: RTA 1996

The average level of Heavy Vehicle traffic using the Pacific Highway between Moorland and Herons Creek (indicated as 17% in **Table 6**) compares closely with 16% stated in the Pacific Highway Upgrade Strategic Assessment (Ref 5).

As the highway is being progressively upgraded, it has been suggested that heavy vehicle traffic may be diverting from other routes to the highway and thus the proportion of heavy vehicles on the Pacific Highway may be rising.

One week of classified count from August in 1998, 2001 and 2002 from RTA Stations 09.122 and 09.043 was analysed to update the heavy vehicle proportion. A summary of the analysis is included in **APPENDIX B**. It shows that the proportion of HV to total vehicles has remained around 16%-17%.

Since the 1998 classification counts were for Station 09122, while the available 2001 and 2002 counts were for Station 09.043, it is difficult to compare the number of heavy vehicles in 1998 with the later years. However, between 2001 and October 2002 the number of northbound heavy vehicles increased from 5250 per week to 7000 per week. The numbers suggest a 33% increase in heavy vehicles compared to a 44% increase in total vehicles. In other words, as a proportion, heavy vehicle volumes at Station 09.043 in fact fell slightly from about 17% in 2001 to 16% in 2002. February 2004 heavy vehicle volumes at Station 09.043 were again 17% of the total daily vehicles.

The February 2004 data at RTA Station 09.122 (shown in **Table 6**), when compared with 1998 values, shows that the pattern of heavy vehicle movements in 2004 is similar to that observed in 1998. There does however appear to have been a slight increase in the percentage of daily heavy vehicles that travel at night (rising from 28% to 31%) and slight increase in the percentage of heavy vehicles making up the traffic stream in the weekend peak hour (rising from 4% to just under 5%).

For the purpose of converting AADT to Annual Average Daily Vehicles (AADV), the Pacific Highway Upgrade Strategic Assessment (Ref 5) uses an average of 2.4 axle pairs per heavy vehicle. Analysis of the February 2004 RTA classified count data at Station 09.122 suggests that this figure is a reasonable approximation, if not slightly conservative. Based on the February 2004 observed heavy vehicle percentage of 17%, this results in a multiplier of 1.24 for conversion of AADT to AADV. However, it should be noted that the proportion of heavy vehicles is significantly lower during the holiday peak periods. Northbound classified counts at Station 09043 during the first weekend of the 2001 Easter holiday recorded around 3-5% heavy vehicles. Therefore this study has adopted a heavy vehicle proportion of 5% during peak holiday periods. Using an average 2.4 axle pairs for heavy vehicles, this study assumes:

- For general period: AADV (vehicles) = AADT (axle pairs) / 1.24
- For peak holiday period: AADV (vehicles) = AADT (axle pairs) / 1.07

3.4.2 Number and Proportion of B-Doubles

The opening of the Yelgun to Chinderah Freeway in August 2002 coincided with the removal of the previous restriction on B-doubles north of Ballina. As shown in **APPENDIX B**, **Table B1**, there has been a noticeable increase in B-Double vehicles since the opening of the Yelgun to Chinderah Freeway. From 2001 to 2002, the proportion of northbound vehicles which are B-Doubles increased from 0.36% to around 1.6%, or from 110 northbound per week in 2001 to 700 northbound per week in 2002. The increase in B-Doubles was most marked in midweek, with a pattern emerging in 2002 of higher flows on Tuesday, Wednesday, Thursday and Friday and low flows on Saturday and Sunday.

APPENDIX B, **Table B1** also shows that the number of semi-trailers at Station 09.043 increased from about 3,200 during a week in June 2001 to 4,000 during a week in October 2002. The increase of about 800 semi-trailers per week was similar to the increase in the number of B-Doubles, but as a percentage of all vehicles semi-trailers fell slightly from 10% to 9%. Most of the increase in heavy vehicles during this period can be attributed to semi-trailers and B-Doubles.

Table 8 shows a summary of that pattern of B-Double movements along the highway as observed from the recent February 2004 data at RTA Station 09.122. A more detailed presentation of the B-Double pattern discussed above can be found in **APPENDIX B**, **Tables B1 and B2**.

Table 8 - B-Double Volumes (measured as vehicles): RTA Station 09.122 (2004)

Time Period	Heavy Vehicle Measure	Direction		Total
		Northbound	Southbound	
Average	B-Doubles as % of daily vehicles	2.0%	2.2%	2.1%
Night only	Night B-Doubles as % of total night vehicles	8.9%	11.3%	10.1%
(10pm – 6am)	Night B-Doubles as % of total daily B-Doubles	46%	49%	48%
Weekend	Weekend B-Doubles as % of weekend total vehicles	1.0%	1.3%	1.1%
	% B-Doubles during weekend peak hour (11am)	0.4%	0.2%	0.3%

The analysis shows that B-Double movements are more concentrated during the night-time hours (defined as 10pm to 6am in this study). For example, in terms of total movement during night hours compared with daily total movement, around 31% of heavy vehicles travel during the night hours, while around 48% of B-Doubles travels during the night hours. The result is that while B-Doubles make up only 2.1% of the daily traffic overall, the lower flows at night mean that B-Doubles increase to around 10% of the traffic stream at night. In terms of proportion of B-Doubles, 10% of heavy vehicles through the day are B-Doubles while the proportion increases to 19% during the night-time hours.

3.4.3 Adjusted Heavy Vehicle Volumes

To account for the sustained instantaneous increase in heavy vehicles as a result of the Yelgun to Chinderah Freeway opening, as discussed in **Section 3.4.2**, an additional 250 vehicles or 902 axle pairs (as discussed in **Section 3.2.1**) have been included in the traffic volume projections, affecting the heavy vehicle percentages used for design purposes, including pavement design. On this basis, the February 2004 classified count data has been adjusted to reflect the aforementioned increase. The revised values are shown in **Table 9**.

Table 9 - Adjusted Heavy Vehicle Volumes

Time Period	Heavy Vehicle Measure	Direction		Total
		Northbound	Southbound	
Average	Heavy vehicles as % of daily vehicles	19%	19%	19%
	B-Doubles as % of daily vehicles	3.5%	3.7%	3.5%

3.4.4 Hourly Distribution of Heavy Vehicles

Classified hourly counts at Station 09.122 during a week in February 2004, adjusted as discussed in **Section 3.4.3** above, were analysed to assess the distribution of heavy vehicles through the day. The average distribution of total traffic and corresponding proportion of heavy vehicles for 24 hours, based on the 2004 data is shown in **Table 10**. The forecast hourly distribution of heavy vehicles on an average day in 2011 is also shown in **Table 10**. **APPENDIX B**, **Table B2** shows the more detailed calculations including the total and heavy vehicle traffic volumes for the opening, +10, +20 and +30 years.

Although there have been slight changes in hourly HV proportion between 1998 data and the 2004 data, the pattern of HV proportion per hour is quite similar, with the highest proportion (peaking at just under 75%) around midnight to 4am in the early morning.

Table 10 - Hourly Distribution and Heavy Vehicle Pattern based on February 2004 Data

Hour Commencing	Hourly flow as a proportion of Daily Traffic flow	Percentage of Heavy vehicles	2011 opening year forecast	
			Heavy vehicles	Total vehicles
0	1.4%	67%	140	210
1	1.1%	71%	124	173
2	1.2%	74%	133	178
3	0.9%	69%	97	141
4	1.0%	57%	85	148
5	1.6%	34%	82	240
6	2.9%	21%	95	446
7	4.4%	16%	111	674
8	6.1%	12%	110	936
9	6.8%	11%	112	1038
10	7.2%	11%	116	1105
11	7.3%	10%	107	1120
12	6.8%	10%	108	1038
13	6.8%	11%	115	1034
14	7.1%	11%	115	1082
15	7.7%	11%	133	1169
16	7.3%	13%	140	1106
17	6.2%	13%	121	941
18	4.7%	19%	138	714
19	3.2%	28%	135	487
20	2.6%	33%	131	391
21	2.2%	39%	130	330
22	1.8%	44%	125	282
23	1.7%	54%	143	266
AADV	100%	19%	2844	15,253
AADT				19,705

3.5 Existing Highway Level of Service

For a given number of traffic lanes, Level of Service (LoS) analysis provides a means of determining the traffic-carrying performance of a road or any element of it under the prevailing roadway and traffic control conditions. This form of analysis is fundamental to the planning, design and operation of roads, and provides the basis for determining the number of traffic lanes to be provided in the Road Network. It takes into account the volume and composition of traffic as well as the prevailing roadway, traffic and traffic control conditions.

Part 2 of the *Guide to Traffic Engineering Practice* (Austroads 1988), entitled *Roadway Capacity* (Ref 9) documents procedures for calculating LoS for all prevailing roadway and traffic conditions.

The RTA count station north of the intersection of the Pacific Highway and Ocean Drive (09.122) provides a representative record of vehicle flows for the main Highway between Moorland and Herons Creek. This count site is one of only two for the Moorland to Herons Creek section of the Highway, and of the two records the highest AADT. It is also the site used in the Pacific Highway Strategic Assessment (Ref 5). It has therefore been used to calculate the existing Level of Service for the Highway.

Figure 11 shows that the current general LoS for the existing Pacific Highway (two lane rural highway) is LoS E; near capacity and where any incidents may cause excessive delays. **APPENDIX D** details the LoS calculations for the existing Highway, calculated using the 1998 recorded AADT at the adopted count site.

4. FUTURE TRAFFIC

4.1 Annual Traffic Volume at Kew

As discussed in **Section 3.2.1**, the strategic traffic growth rate adopted for this study was developed for the period 1998 to 2021, with an intermediate simulation year at 2006. It is understood that while the year-to-year growth rate is expected to vary, the strategic forecasts indicate that traffic growth from 1998 to 2006 will be around 40% (at 4.3%pa over 8 years) and traffic growth from 2006 to 2021will be around 49% (at 2.7%pa over 15 years).

Applying the above growth pattern to the Kew Station (No. 09122), forecast AADT at 2001, 2004, 2006, 2011 and 2021 are shown in **Table 11** for comparison with the actual AADT as published by RTA.

Table 11 - Forecast AADT at Station 09.122 compared with Actual Count AADT

Year	Forecast AADT	Actual AADT
1998	*11,570*	11,570
2001	13,128	11,898
2004	15,855[2]	15,909[(1)]
2006	17,243[2]	
2011	19,705[2]	
2021	25,720[2]	

(1) Approximate AADT based on February 2004 RTA count data at Station 09.122 and 2001 annual traffic pattern at Station 09.043.
(2) Including additional heavy vehicles as discussed in **Section 3.2.1**.

Table 11 shows that the actual AADT in 2001 is below the forecast AADT, while preliminary 2004 data indicates that the actual AADT in 2004 is above the forecast AADT. However, this does not necessarily imply that the actual growth rate differs from the predicted 1998-2006 growth rate. Traffic growth can vary between peak and trough from year to year. That is, the 2001 AADT may be lower than forecast because it corresponds to a trough in the growth pattern rather than an overall decrease in traffic growth between 1998 to 2006. Likewise the 2004 AADT may correspond to a peak in the growth pattern. In support of these fluctuations, actual traffic growth rates between 1995 and 1998 were 6% per year, somewhat higher than the traffic forecast of 4.3% between 1999 and 2006.

On the basis of the discussion above as well as that in **Section 3.2.1**, this study continues to adopt the forecast AADT as generated using the 1998 AADT with an average annual growth rate of 4.3% up to 2006 and 2.7% from 2006 onwards for highway design.

APPENDIX B details the total two-way traffic volume and number of heavy vehicles for each hour of the day (given as a proportion of AADV) at Kew.

4.2 Design Hour Volume (DHV)

4.2.1 Highway Capacity Calculations

Three stations from the five permanent stations listed in **Table 1** have hourly data by direction. These were analysed to determine hourly one-way traffic as a proportion of AADT. The values for selected highest hourly volumes (HHV) are presented in **Table 12** below.

Table 12 - Northbound Hourly Traffic As Proportion of 2001 AADT

	Station 05006 -	Karuah[(1)]	Station 09109 -	S of Taree	Station 09043 -	S of Port Macquarie
	Axle Pairs	% of AADT	Axle Pairs	% of AADT	Axle Pairs	% of AADT
Actual 2001 AADT	16,224[(1)]		17,157		12,535	
30th HHV	1,239	7.64%	1101	6.42%	1201	9.58%
50th HHV	1,190	7.33%	1020	5.95%	1003	8.00%
100th HHV	1,005	6.19%	902	5.26%	851	6.79%

(1) RTA published data for Karuah in vehicles. Data is converted to axle pairs for analysis. The conversion assumes AADV x 1.24 = AADT and hourly vehicle volumes x 1.07 = hourly axle pairs during peak hours.

Graphs of the top 250 hours for the three stations are included in **APPENDIX C**. They show that:

- The pronounced peak as a percentage of AADT (see **Figure C2** in **APPENDIX C**) observed in Station 09043 is not as evident in the other two stations. Hourly volume as a percentage of AADT falls rapidly for the first 50 hours or so for Station 09.043.
- Peak hour flows in axle pairs at Station 09043 appear to have increased by 50% between 1998 and 2001. The extent of the apparent increase greatly exceeds the 27% increase in AADT. This suggests that traffic flows at the site have become much "peakier" than before, as shown by the apparent change in the 30th HHV from 6.9% of the AADT in 1998 to 9.6% of the AADT in 2001.
- Traffic volumes during the 2001 Christmas period were dramatically higher than general traffic volume at Station 09.043. It is further noted that nearly all of the peak 50 northbound hours in 2001 occurred during a 4-5 day period around Christmas. The measured hourly volumes during this period are very high, but the 2002 Christmas data was unavailable for checking the validity of the 2001 pattern, at the time of analysis.
- The Station 09043 graph levels off significantly at around the 50th HHV with 1,000 axle pairs/hour (in 2001). A similar traffic volume of above 1,000 axle pairs/hour is observed in the 09109 (Taree) line at the "elbow' of the graph.
- The Station 05006 (Karuah) line shows higher hourly values (around 1,190 axle pairs/hour at 50th HHV and 1,240 axle pair/hour at 30th HHV) but the shape of the graph is much flatter. This may reflect that fact that Karuah is significantly closer to Sydney and is more affected by the peak flow from the city.

Based on the above, a design hourly volume at Kew of 1000 axle pairs for 2001 has been adopted, corresponding to about 8% of the forecast 2001 AADT at Kew (ie. Station 09122). The basis for this is as follows:

- While the 30th HHV is commonly adopted for the design of rural roads (Austroad Guide Part 2), the 30th HHV at the nearest permanent site (Station 09043) where hourly counts are available represents 9.6% of the AADT. In comparison to the counts at Karuah and Taree, 9.6% would correspond to the highest measured hourly one way volumes in 2001 at those stations and is considered excessive as a design hour percentage of AADT.
- The 1000 axle pairs per hour proposed corresponds to 7.6% of the forecast 2001 AADT at Station 09122. While this corresponds to the 50th HHV based on Station 09043 the 7.6% still compares well with the 30th HHV at Karuah (7.6%) and Taree (6.4%).
- In 2001 at Station 09043, hourly volumes higher than 1,000 axle pairs/hour were mostly limited to the Christmas period. Therefore designing for higher HHV (eg. 30th HHV) would required a significant increase in design capacity for a limited number of days with limited potential benefit in return.

Based on the above discussion, the Level of Service (LoS) Highway capacity calculations are based on 1,000 axle pairs/hour (935 veh/hr) in 2001. The adopted growth rates for the DHV are consistent with the AADT growth rates of 4.3% from 2001 to 2006 and 2.7% from 2007 onwards. The additional heavy vehicles included in the AADV and AADT values at the end of 2002, as discussed in **Section 3.2.1**, have also been taken into account in the DHV by maintaining DHV values at the same percentage of the AADV values. Therefore the instantaneous daily increase of 250 heavy vehicles corresponds to an instantaneous increase of 22 vehicles in the 2003 Design Hour.

4.2.2 Intersection Capacity Design Hour

The 100th HHV for the three permanent stations analysed are listed in **Table 12**. As with the 30th HHV, the proportion of the 100th HHV is the highest for Station 09043. As discussed in **Section 3.2.1** and **Section 4.2.1**, the traffic growth pattern and high peak volumes (as a percentage of AADT) at Station 09043 are considered to be a local pattern could be a result of factors specific to that site. The AADT multiplier for the design hour for intersection capacity analysis should represent the traffic pattern of the length of highway and Station 09043 appears to be out of character compared to other permanent stations in the vicinity. Therefore, the multiplier adopted for the 100th HHV, for intersection capacity analysis, has estimated from the pattern observed in Station 05006, being 6.2% of AADT. The basis for is as follows:

- The multiplier recommended for highway capacity evaluation at Kew (i.e. 7.6% of forecast AADT) has the same value as the 30th HHV in Station 05006.
- Compared to other Stations, adoption of 6.79% of forecast AADT as suggested by the Station 09043 counts as the multiplier for the 100th HHV at Kew is considered to be excessive.
- It is expected that the peak intensity of through traffic along this section of the highway would decrease as one travels further from Sydney, particularly for the key holiday periods such as Christmas/New Year and Easter periods which made up the vast majority of the top 100 hours at all three stations. Since the Moorland to Herons Creek section of the highway is north of Taree (Station 09109), which is north of Karuah (Station 05006), adopting the multiplier from Station 05006 would still be conservative.

Based on the above discussion, the Level of Service (LoS) for intersection capacity calculations is based on 814 axle pairs/hour (760 veh/hr) in 2001. The additional heavy vehicles included in the AADV and AADT values at the end of 2002, as discussed in **Section 3.2.1**, have also been taken into account in the DHV by maintaining DHV values at the same percentage of the AADV values. Therefore the instantaneous daily increase of 250 heavy vehicles corresponds to an instantaneous increase of 18 vehicles in the 2003 Design Hour.

4.3 Additional Overtaking Lanes

Additional overtaking lanes are provided along the existing highway between Moorland and Herons Creek for both northbound and southbound carriageways. **Table 13** details the existing overtaking lanes between Moorland and Herons Creek. Overtaking lanes are present for three sections of the northbound carriageway and total 4.9 km in length (including tapers). They are present for four sections of the southbound carriageway and total 5.6 km in length (including tapers).

The specific Level of Service for each of these sections where overtaking lanes have been provided, has not been calculated as they constitute only 25% of the total route length, in either direction, between Moorland and Herons Creek.

Table 13 - Existing Overtaking Lanes (km) (Distances from Taree)

No.	Roadloc Link	Start Taper	End Taper	Start Taper	End Taper	Length Excl Taper	Length Incl Taper
SB 1	2120	37.0	37.1	38.2	38.3	1.05	1.3
NB 1	2130	40.5	40.5	41.9	42.0	1.35	1.3
SB 2	2130	43	43.26	44.6	44.7	1.34	1.7
NB 2	2130	45.95	46.06	47.7	47.8	1.64	1.85
SB 3	2145	50.87	51.63	51.92	52.01	0.89	1.14
NB 3	2150	53.56	53.69	55.18	55.3	1.49	1.74
SB 4	2150	56.29	56.48	57.52	57.64	1.04	1.35
					SB	**4.3**	**5.6**
					NB	**4.5**	**4.9**
					Total	**8.8**	**10.5**

4.4 Future LoS for Existing Highway

Table 14 indicates the forecast traffic flows along the Pacific Highway between Moorland and Herons Creek (based on the 1998 RTA counts at Site 09122 with forecast growth rates and additional heavy vehicles), and details the LoS in 2001, 2004, 2011 and 2021 for the existing two-lane highway. Sensitivity test percentages of ±10% have also been applied, to allow for possible variations in traffic volumes, and the respective levels of Service are also given in **Table 14**. **Figure 11** also shows the increase in traffic flow and the worsening Level of Service in future years for the existing Pacific Highway.

Table 14 - Levels of Service 2001 – 2021 for Existing Highway

Year	One way peak hour volume	LoS	Sensitivity Tests			
			+10%	LoS	-10%	LoS
2001	935	E	1028	E	841	E
2004	1,084	F	1192	F	975	E
2011	1,347	F	1482	F	1212	F
2021	1,758	F	1934	F	1582	F

It has been calculated that the existing two-lane Pacific Highway currently operates at LoS E at peak times (projected year 2004) and will reach LoS F by the end of 2004. LoS E occurs when traffic flows are at or close to capacity. Queuing and delays occur when LoS F is achieved. A comparison of the projected year 2004 traffic volume used for this analysis with the preliminary actual (measured) volume is available in **Section 4.1** and **Table 11**. **APPENDIX D** outlines the derivation of the above LoS calculations and also shows the growth in traffic to the year 2041.

4.5 Existing Intersections

All intersections with the Pacific Highway between Moorland and Herons Creek are shown in **Figure 13** and are listed as **APPENDIX E**. The existing layout is described and an estimate of traffic volumes given as AADV.

The intersection of Kendall Road/ Ocean Drive exhibits the highest traffic volumes interacting with the Pacific Highway. Around 1000 vehicles pass through this intersection in a typical morning peak hour (as presented in **Section 3.1.2**). Further details of surveys at this intersection can be found in **APPENDIX F**.

Many other roads that intersect with the main Highway are unsealed tracks leading to individual properties. However, more significant intersections are located at Johns River, Rossglen and Herons Creek. Highway turning counts were conducted in November 2000. **Table 15** details the location of these surveys and the traffic count of turning movements for the twelve-hour period 0700-1900 (as presented in **Section 3.1.3**). Further details of these surveys can be found in **APPENDIX G**.

Table 15 - Side Roads Intersecting with the Pacific Highway: Traffic Counts (0700-1900)

Location of Survey – Intersection with the Pacific Highway	Survey Date	Twelve-hour vehicle count (0700-1900)
Station Street; Johns River	Wednesday 1 November 2000	120
Stewarts River Road; Johns River	Wednesday 1 November 2000	309
Thomas Street; Johns River	Wednesday 1 November 2000	122
Algona Road	Tuesday 21 November 2000	67
Rossglen access road	Tuesday 7 November 2000	99
Sunnyvale Road (south)	Wednesday 8 November 2000	24
Sunnyvale Road (north)	Thursday 23 November 2000	38
Herons Creek Road (south)	Thursday 9 November 2000	28
Cluleys Lane	Tuesday 14 November 2000	48
Herons Creek Road (north)	Tuesday 14 November 2000	248

Further analysis of the side roads intersecting with the upgraded Highway is presented in **Section 5.4**.

5. HIGHWAY UPGRADE

5.1 Alignment Overview

An overview of the proposed alignment is shown in **Figure 8** and is as follows:

The Project would link with the proposed highway duplication between Coopernook and Moorland at the southern boundary of the property known as Camp Obadiah.

The existing highway would then be duplicated on the western side for a distance of about 1 km until the point where the proposed western bypass of Johns River diverges from the existing highway. The Johns River bypass would be about 2.5 km long and passing about 250 m west of the Johns River township.

A grade-separated half-diamond interchange is proposed at Stewarts River Road. Northbound off- and on-ramps would connect to a roundabout on Stewarts River Road which would pass above the bypass on a bridge. Southbound traffic would be catered for by southbound ramps formed by the existing highway at each end of the bypass. The existing highway would revert to a two-way local road between the southbound off-ramp and on-ramp.

The bypass would merge with the existing highway near Bulleys Road and Wharf Road, just to the south of the Stewarts River.

Between the Stewarts River bridge and the Camden Haven River bridge, duplicated immediately to the west of the existing carriageway with an 11 metre wide median except for two sections:

- Immediately north of the Stewarts River, the available width for the Project is restricted by a high rock cutting on the western side and the North Coast railway line on the eastern side. The median width would reduce from 11 m to 4.5 m over a length of about 1 km. Split-level carriageways with a median barrier and median retaining wall up to 3 m high are also proposed throughout this restricted section.
- In order to avoid any requirement for land acquisition from Middle Brother National Park and to reduce the impact on vegetation, a narrow median (3 m) containing a wire rope barrier would be adopted for a 1 km section adjacent to the boundary of the National Park. A retaining wall up to 6 m high is also proposed between the southbound carriageway and the railway over a 150 m long section within this constrained zone.

North of the Camden Haven River, the new carriageway would remain on the western side of the existing carriageway for a distance of about 500 m before crossing to the eastern side.

About 1.5 km north of the Camden Haven River (1.5 km south of Kew) the proposed bypass of Kew would diverge eastwards from the existing highway. The Kew bypass would be about 2.5 km long and would pass about 250 m east of the Kew township, at Ocean Drive.

A grade-separated half-diamond interchange is proposed at Ocean Drive. Southbound off- and on-ramps would connect to a roundabout on Ocean Drive which would pass above the bypass on a bridge. Northbound traffic to and from the bypass would be catered for by use of the existing highway at each end of the bypass. The existing highway would revert to a two-way local road between the northbound off-ramp and on-ramp.

The Kew bypass would rejoin the existing highway about 800 m north of Kew and the new carriageway would be located on the western side of the existing highway. The new carriageway would remain on the western side for the next 1 km through to the Kew/Kendall STP.

From the STP, the new carriageway would transition across to the eastern side of the existing carriageway and remain there through to just beyond the Boral Timber mill at Herons Creek.

5.2 Design Criteria and Provisions

The RTA brief has specified 110 km/h for horizontal alignments and 100km/h for vertical alignments as the design speed for the upgraded Highway. A four-lane dual carriageway cross-section has also been selected as the most appropriate design. The road will be configured as two 3.5m lanes and a 2.5m breakdown lane/bicycle lane in each direction with an additional 0.5m right hand shoulder.

This configuration is in keeping with the ten-year upgrading program for the Pacific Highway between Hexham and the Queensland border. The strategy proposes four lanes by duplication of the existing carriageway or by deviations, between Hexham and Port Macquarie.

LoS calculations have been undertaken to the applicable Austroads guidelines (Ref 9). Sensitivity test percentages of ± 10% have been applied, to allow for possible variations in traffic volumes, and the respective LoS given.

5.3 Upgraded Highway Level of Service

The design hour traffic is calculated based on the assumptions discussed in the previous sections. Level of Service (LoS) of the highway is calculated based on the Austroads *Guide to Traffic Engineering* Part 2 (Ref 9). The LoS Calculation for a two-lane each way divided upgraded highway is presented in **APPENDIX D**, the LoS of selected years are presented in **Table 16**.

It is predicted that the highway upgrade at Moorland to Herons Creek would operate at LoS B in 2011 and reach LoS D by the end 2027, 16 years after the proposed opening year 2011. LoS E is predicted to be reached in 2035. This is considered acceptable as LoS D continues through to 24 years after opening.

Table 16 - Level of Service 2001 – 2041 for Upgraded 110kph Highway

Year	One-way peak hr (veh)	LoS	Sensitivity Tests			
			+10%	LoS	-10%	LoS
2001	935	B	1028	B	841	B
2011	1,347	B	1482	B	1212	B
2021	1,758	C	1934	C	1582	B
2031	2,295	D	2524	D	2065	C
2041	2,995	F	3295	F	2696	E

The sensitivity analysis indicates that with a 10% increase in traffic above the projected in crease, LoS D continues through to 2031, 20 years after opening, and is therefore still acceptable. The provision for widening to three lanes in each direction in the future is therefore not considered necessary at this stage.

Figure 12 also shows the increase in traffic flow and the forecast Level of Service in relation to the upgraded Pacific Highway.

5.4 Existing Intersections

5.4.1 Kendall Road/ Ocean Drive

MR538 (Kendall Road and Ocean Drive) at Kew is the only major intersection between Moorland and Herons Creek. This intersection is currently controlled by traffic signals, installed in late 2001. The Pacific Highway has one through lane in each direction, right turn storage bays and left turn lanes.

5.4.1.1 Existing Traffic Conditions

RoadNet undertook traffic counts and monitored delays at this intersection for the RTA Northern Region during various traffic periods in April 2000 (prior to the installation of signals). They compared the existing sign control with traffic signal control using the INTANAL program to model the observed traffic flow.

Under normal traffic conditions almost 1,000 vehicles move through the intersection during the morning peak hour, 8.30am-9.30am. Through north-south movements along the main Highway total 453 vehicles. Vehicles turning into and out of Kendall Road and Ocean Drive total 413 and 309 respectively.

Delays of up to 180 seconds occur for vehicles turning out of Ocean Drive during the morning peak hour. Vehicles moving straight across to Kendall Road or turning right onto the Highway constitute over 70% of all movements out of Ocean Drive. Delays of up to 150 seconds are experienced for vehicles turning out of Kendall Road during the morning peak hour when over 65% of vehicles turning out of Kendall Road move straight across the intersection or turn right onto the Highway. Delays of up to 180 seconds are again experienced during the PM peak hour for vehicles moving out of Ocean Drive and Kendall Road.

Traffic movements through the intersection reach a peak during School holidays and over public holidays. The Good Friday survey shows that over the peak hour (10.15 – 11.15), almost 1900 vehicles move through the intersection. North and south through movements along the main Highway account for 1393 vehicles. Vehicles turning into and out of Kendall Road and Ocean Drive total 382 and 203 respectively.

The surveys conducted during the school holidays highlight delays of up to 210 seconds on both the Ocean Drive and Kendall Road arms of the intersection. On Good Friday delays of up to 15 minutes were recorded for vehicles turning out of Ocean Drive at 10.30 in the morning. Delays of up to 4 minutes were experienced by vehicles turning out of Kendall Road.

Observations by RoadNet survey staff highlight the fact that when intersection delays are at their worst, vehicles waiting to turn right out of the side roads, or proceed across the Highway, often give up and turn left onto the Highway before making a ‘U-turn’. Vehicles were also observed to enter the Highway from Ocean Drive only to find that they could not proceed due to the traffic flow and closing gaps, resulting in them propping half way thus blocking the main Highway flow.

The RoadNet survey results are presented in **APPENDIX F**. The RoadNet intersection modelling (Ref. 15), using INTANAL showed that under normal conditions, and on School holidays, the existing intersection reaches Level of Service C during the peak hour. However, at midday on Good Friday (21 April 2000), the intersection reached Level of Service F, indicating saturation.

5.4.1.2 Proposed Treatment

A grade-separated half-diamond interchange is proposed at Ocean Drive just to the east of Kew, as indicated in **Figure 15**. The proposed interchange would provide for all local traffic movements to and from the upgraded highway. Key features of the interchange are as follows:

- Ocean Drive would pass above the bypass on a bridge.
- Southbound local traffic is catered for by southbound ramps to and from the bypass. A southbound off-ramp and southbound on-ramp would connect to Ocean Drive at an elevated roundabout on Ocean Drive just to the east of the bypass.
  - Access to the local region for southbound traffic would be available using the southbound off-ramp connecting to the roundabout on Ocean Drive and areas to the east and west.
  - Southbound traffic from Kew and other local areas to the east and west would take the southbound on-ramp from the roundabout on Ocean Drive.
- Northbound local traffic is catered for by northbound ramps to and from the existing highway:
  - Access to the local region for northbound traffic is provided by a northbound off-ramp from the near Sunnyvale Road where the bypass diverges away from the existing highway. The single lane exit ramp would meet the existing highway, the Sunnyvale Road (north) diversion, and Bethesda Road at a roundabout about 300 m further north of the diverge.
  - A northbound on-ramp from the existing highway is proposed at the north end of the bypass to allow local traffic to rejoin the upgraded highway. At the northern end of the bypass, Herons Creek Road would be diverted along a frontage road to the south which would also connect to Weeroona Place. The frontage road would connect to the existing highway at a T-intersection at the start of the northbound on-ramp, about 500 m north of Kew.
- The existing highway would revert to a two-way local road between the northbound off-ramp at Sunnyvale Road and the northbound on-ramp south of Weeroona Place.

5.4.1.3 Future Traffic Conditions

Intersection traffic volumes at the intersection of the existing Highway and Kendall Road/ Ocean Drive were estimated based on turning movement counts collected during school holidays in 2000 and the estimated highway Design Hour traffic used for highway capacity calculation (based on 2002 highway traffic volumes). Traffic volume was projected to 2031 using growth rates of 4.3%pa from 2000 to 2006, and 2.7% pa from 2006 onwards.

For the highway capacity calculation, this study assumes that all through traffic would use the new bypass. This approach was adopted to reflect a conservatively high estimation on traffic volume along the new highway. A nominal allowance was made for the two through movements on the old highway to represent local traffic movements.

In studying the intersection operation at Kew, three scenarios have been tested. The low scenario is based on the traffic volumes calculated in previous work discussed above. It is based on holiday afternoon turning counts and no through traffic on the old highway. For the High A Scenario, through traffic at the Kew intersection on the old highway is assumed to be 10% of the Design Hour traffic previously fully allocated to the bypass for the highway capacity analysis. This could represent through traffic stopping at Kew and general local traffic movement. The High B Scenario includes the same extra through traffic on the old

highway and a higher traffic volume on Kendall Road based on morning peak hour during school holiday.

The turning volumes for the three scenarios are shown in **Figure 1**, **Figure 2**and **Figure 3**.

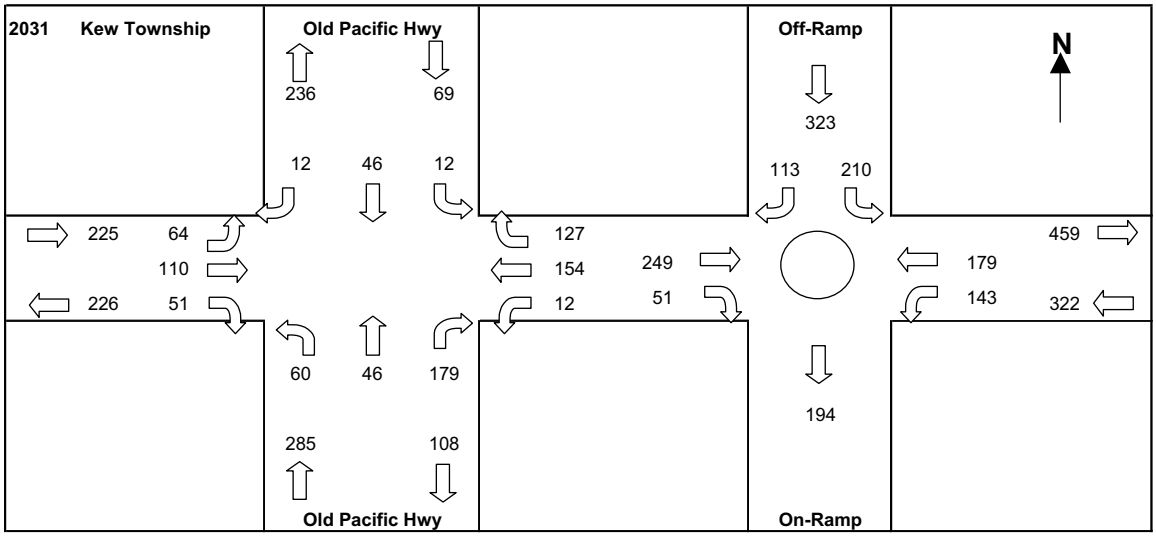

Figure 1 - Low Scenario Holiday Peak Hour Turning Volume at Kew (veh/ hr)

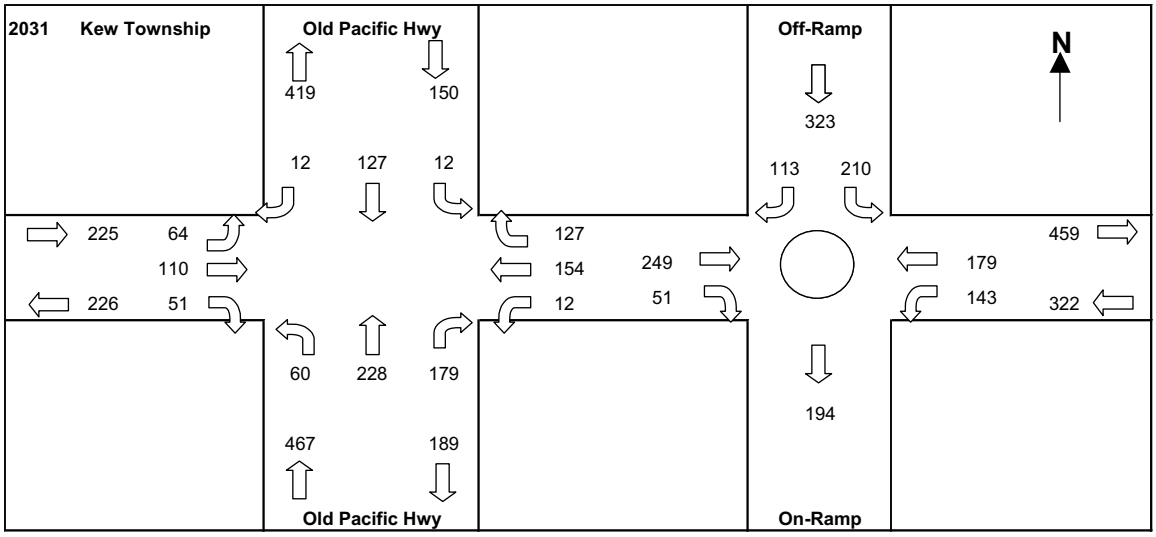

Figure 2 - High A Scenario Holiday PM Peak Hour Turning Volume at Kew (veh/ hr)

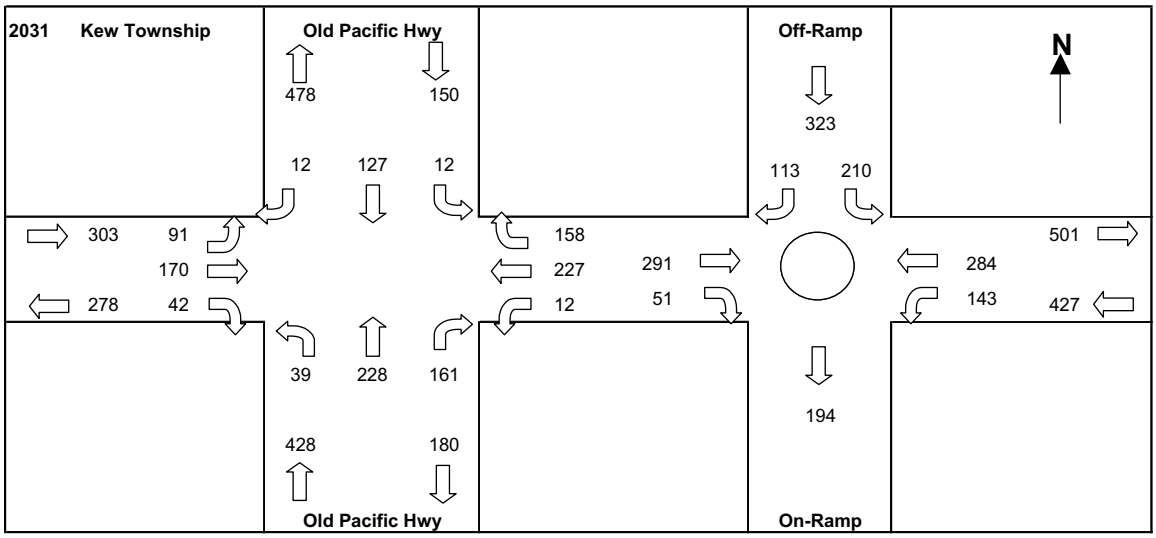

Figure 3 - High B Scenario Holiday AM Peak Hour Turning Volume at Kew (veh/ hr)

The turning volumes presented above were analysed using INTANAL. Kendall Road/ Ocean Drive would have priority over the old Pacific Highway for the Give-way priority control layout. The analysis included the conservative high estimates of traffic volume shown in **Figure 2** and **Figure 3**. Similarly, the analysis also adopted conservative assumptions with regards to intersection design. All approaches were modelled as 2-lane 2-way roads with no turning bays or slip lanes. The models also include marked pedestrian crossings on all approaches with nominal pedestrian crossing volumes.

Table 17 - Intersection Performance at Kew in 2031

Scenario	Give-Way			Roundabout			Signals		
	Max. Avg Delay	LoS	DoS	Max. Avg Delay	LoS	DoS	Average Delay	LoS	DoS
Old Pacific Highway/Kendall Road/Ocean Drive									
Low	14.1	B	0.35	9.3	A	0.15	11.6	A	0.4
High A (Holiday PM)	16.0	B	0.57	11.4	A	0.25	11.6	A	0.45
High B (Holiday AM)	19.9	B	0.60	11.7	A	0.25	11.5	A	0.52
Highway On/Off-Ramps/Ocean Drive									
Low				9.6	A	0.24			
High A (Holiday PM)				9.6	A	0.24			
High B (Holiday AM)				10.1	A	0.27			

The results from the INTANAL analysis is shown are **Table 17**. The results show that for the intersection of the Old Pacific Highway and Kendall Road/Ocean Drive, a give-way intersection would operate at LoS B (acceptable) for all three scenarios in 2031 (20 years after opening), while roundabout and signals would operate at LoS A for all three scenarios. The maximum delay in the give-way priority control intersection, would be experienced by vehicles turning right from the southern approach (old highway), towards the new highway interchange. The maximum delay in a roundabout controlled intersection would be experienced by vehicles approaching from the west. The intersection of the Highway on/off-ramps and Ocean Drive would operate at LoS A in 2031 for all three scenarios. The maximum

delay would be experienced by vehicles turning right from the Highway off-ramp, towards Kew.

The estimated future traffic volumes do not warrant a signalised intersection at the Old Pacific Highway. However, in general, signalised intersections with pedestrian signals provide for safer pedestrian movements at the intersection. Therefore, there might be advantages in retaining the existing signals although not warranted by the estimated future traffic volumes. In general, traffic signals are also safer for cyclists than roundabouts or priority intersections.

If the proposed roundabout is installed at the intersection in place of the existing signals, the design should include marked pedestrian crossings on at least the east, west and south approaches. The roundabout should be designed as a low speed roundabout that integrates cyclists into the traffic stream, and pedestrian crossings should be moved back from the roundabout. This would provide an acceptable arrangement which overcomes some of the disadvantages associated with pedestrian and cyclist safety at roundabouts, and would still be effective in slowing all vehicles as they pass through the town centre.

The analysis shows that roundabout and signal options would provide better Level of Service than give-way priority control. However all three types of intersection treatment are acceptable with respect to traffic capacity.

5.4.2 Stewarts River Road

5.4.2.1 Existing Traffic Conditions

As discussed in **Section 3.1.2**, traffic surveys were undertaken at Johns River to gain a better understanding of the existing movements between Stewarts River Road, the Pacific Highway and the other local traffic generators. These survey results are presented in The movement of vehicles between the following destinations was recorded:

- Pacific Highway north of Thomas Street
- Thomas Street
- General Store and adjacent frontage development
- Station Street
- Pacific Highway south of Station Street
- Tavern
- Stewarts River Road west of Tavern

The surveys were undertaken over the 7am to 7pm, 12 hour period. Two days were chosen being a typical weekday Wednesday 5 June 2002 and a busy Saturday when the monthly fair occurred on Saturday 8 June 2002.

In addition to vehicle movements, the number of people walking along Stewarts River Road to the west of the tavern was recorded. This represents the number of people likely to cross the new alignment of the highway to the west of the Tavern.

The traffic movements that will occur at the intersection of the New Highway alignment and Stewarts River Road can be assigned based of the observed origins and destinations from the survey. Trips with origins and destinations within the Johns River township have been excluded so that the remaining trips can be assigned to the new interchange. An allowance has been made for through traffic at the intersection of the old Pacific Highway and Stewarts River Road.

5.4.2.2 Proposed Treatment

An overpass for Stewarts River Road is proposed to enable traffic to travel over the highway. Northbound access to and from Johns River would be via on and off-ramps at Stewarts River Road, as indicated in **Figure 14**. Southbound traffic would enter and depart Johns River by using the existing highway.

The proposed grade-separated interchange incorporates a bridge on Stewarts River Road above the bypass. A northbound off-ramp and northbound on-ramp would connect to Stewarts River Road at an elevated roundabout and provide access to and from Johns River and areas to the west for northbound traffic.

Southbound traffic would be catered for by a southbound off-ramp from the existing highway just south of the Stewarts River where the bypass rejoins the existing highway alignment. A southbound on-ramp is proposed at the south end of the bypass to allow local traffic to rejoin the upgraded highway. The existing highway would revert to a two-way local road between Wharf Road and the southbound on-ramp, through the Johns River township.

5.4.2.3 Future Traffic Conditions

Figure 4 shows the resulting vehicle turning movements that would occur at the proposed Johns River Interchange with the upgraded Pacific Highway. This has been derived by selecting the peak turning movements observed on Wednesday 5 June 2002 (0800-0900) and Saturday 8 June 2002 (0900-1000). On the Wednesday the total number of turning movements, excluding Pacific Highway through traffic, ranged from 43 to 82 vehicles per hour. On Saturday, traffic volumes were higher in the morning with a peak of 126 between 9.00 and 10.00am.

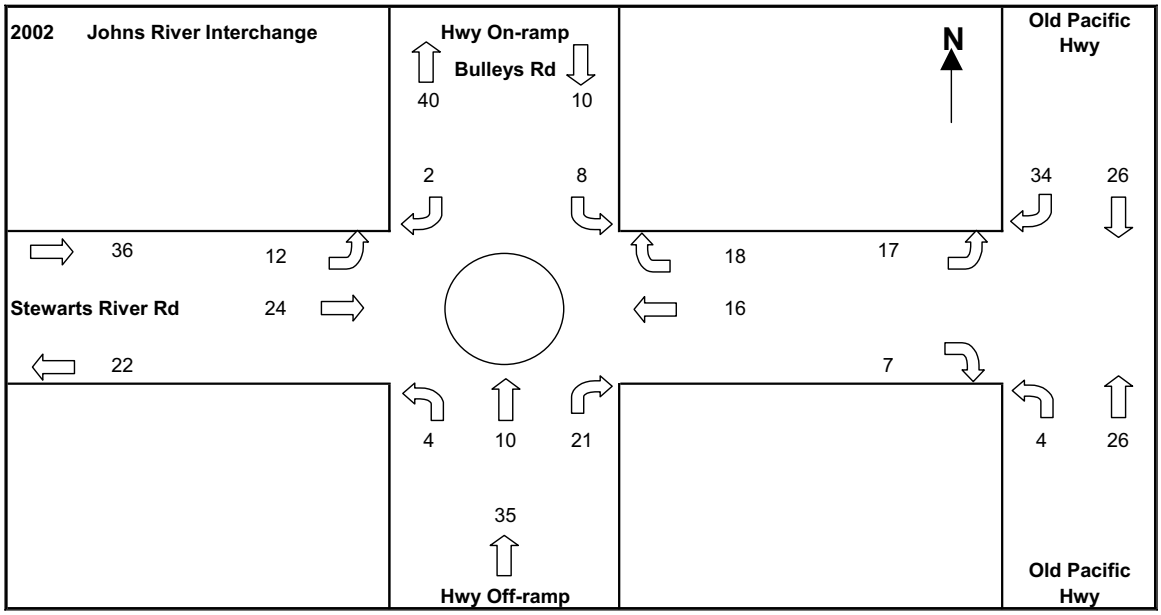

Figure 4 – Vehicle Movements at Johns River Interchange - 2002

The Hastings Urban Growth Strategy 2001, considers future population increases for different parts of the Hastings Council Area. The medium population projections for the 20 year period 2001 to 2021 average 3% per annum for the key growth areas, 2% per annum for the other urban areas and 0.9% for the rural areas. For Johns River and Stewarts River Road, an annual growth rate of 1.2% has been adopted. Projected intersection volumes are shown in **Figure 5**. To test the proposed intersections, the adopted Highway growth rates of 4.3% (2002-2006) and 2.7% (2007-2031) have also been modelled. These values are shown in **Figure 6**.

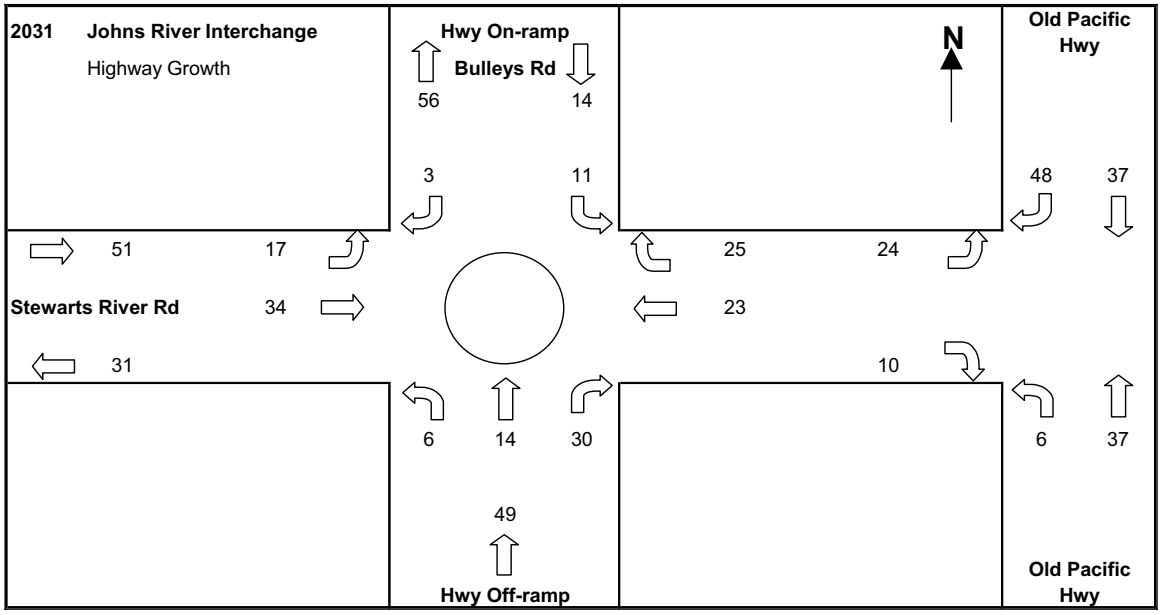

Figure 5 – Vehicle Movements at Johns River Interchange – 2031 (Projected Growth)

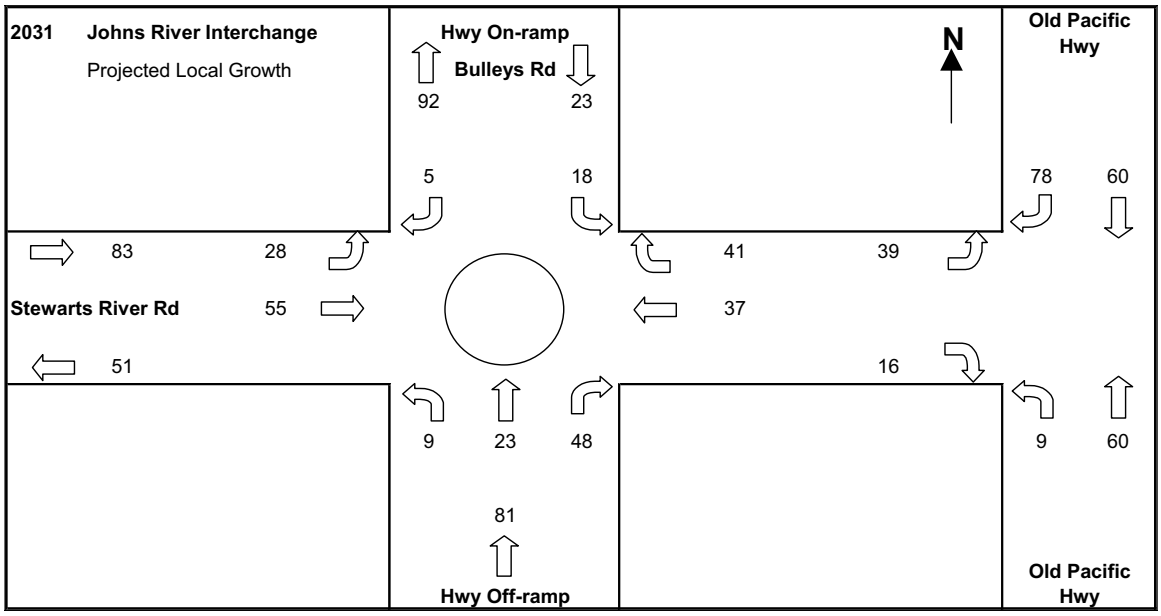

Figure 6 – Vehicle Movements at Johns River Interchange – 2031 (High Growth)

The existing 2002 and projected 2031 traffic volumes have been modelled with the intersection analysis program INTANAL. The results are presented in **Table 18**, and indicate operation at LoS A through to 2031 (20 years after predicted opening), even with a high estimate of growth in the area. Both intersections have considerable spare capacity to cater for any unusual traffic volume peaks throughout the year or additional induced tourist or local traffic on the existing Highway.

Table 18 – Johns River Interchange Level of Service

Scenario	Highway Connection (Roundabout)			Old Pacific Highway (Signs)		
	Max. Avg Delay	LoS	DoS	Max. Avg Delay	LoS	DoS
2002 Base	6.0	A	0.02	5.7	A	0.04
2031, 1.2% Local Growth	6.3	A	0.03	5.9	A	0.05
2031, Equivalent to Highway Growth (4.3%/2/7%)	6.8	A	0.05	6.3	A	0.09

5.4.3 Herons Creek Road

5.4.3.1 Existing Traffic Conditions

Herons Creek Road (north) provides access from the Highway to the Boral Timber Mill at Herons Creek. The mill currently accounts for a significant proportion of vehicles using the northern section of Herons Creek Road, with the site generating on average 86 vehicle trips per day, with this rising to 110 vehicles a day during peak production periods (Ref 12).

The volume of traffic to and from the timber mill is expected to increase as a result of some redevelopment/expansion and an increase in woodchip production. A 3% per annum growth rate has been assumed for Herons Creek Road north and south, which includes traffic generated by the timber mill (Ref 12).

In consultation with Herons Creek Timber Mill to establish the existing and likely future vehicle types that will access the mill, it has been confirmed that a number of B-Double trucks have accessed the mill to pick up sawn timber. Delivery of product from the mill is generally undertaken by contractor vehicles. Whilst the size of load is generally not large, often trucks are already half loaded or pick up additional load elsewhere and hence larger trucks are often used. The mill has little control on the size of truck that is used to do the delivery run.

The counts undertaken at Herons Creek Road (north) indicate that 29 heavy vehicles turned onto or off the main Highway at this intersection.

5.4.3.2 Proposed Treatment

A standard two-stage priority intersection, incorporating provision for U-turns, is proposed for the Herons Creek Road (north) intersection, as shown in **Figure 7**. A two-stage priority intersection is where the provision of median storage for vehicles, allows the intersection to be negotiated in two separate stages. In this case, these two stages are entering, leaving or crossing the northbound carriageway (stage one), and entering or leaving the southbound carriageway (stage two). Between these two stages, vehicles can safely wait within the median width provided until an appropriate gap is available. The selection of this type of intersection is discussed in the following **Section 5.4.4.3**.

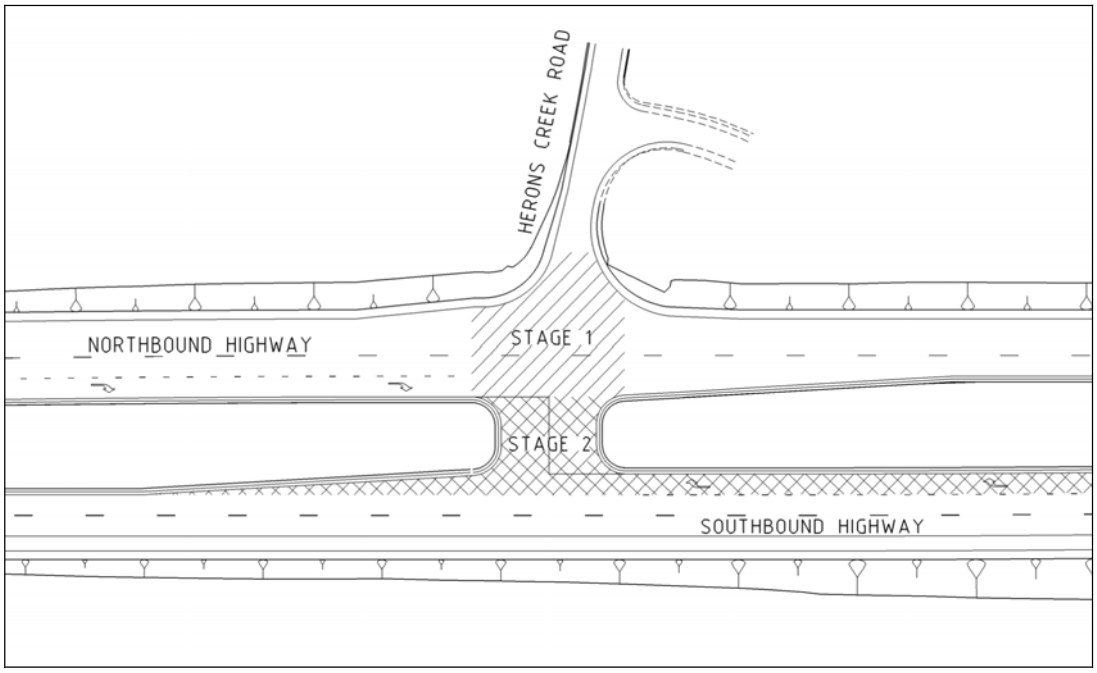

Figure 7 - Herons Creek Rd (north) Intersection Treatment

5.4.3.3 Future Traffic Conditions

The Brief calls for intersections to be designed to provide for LoS C or better for the 100th highest hourly volume (HHV), 20 years after opening. As discussed in **Section 4.2.2**, the one-way 100th HHV for movements along the Highway has been calculated as 6.2% of the projected AADT at Station 09.122.

The traffic counts (see **Section 3.1.3** and **APPENDIX G**) indicate that just over 20% of daily traffic at Herons Creek Road occurred within the peak hour, relatively evenly distributed between the available movements. On this basis, the existing 2000 survey base and projected 2011, 2021, 2031 and 2041 traffic volumes have been modelled with the intersection analysis program INTANAL, using the 3% growth discussed in **Section 5.4.3.1**.

Table 19 - Herons Creek Road Intersection Performance

Year	Northbound (1st Stage)			Southbound (2nd Stage)		
	Max. Avg Delay (sec)	LoS	DoS	Max. Avg Delay (sec)	LoS	DoS
2000 (survey base)	13.5	A	0.03	12.7	A	0.02
2011 (opening year)	15.5	B	0.06	12.9	A	0.02
2021	20.7	B	0.12	13.2	A	0.04
2031	39.1	C	0.26	13.5	A	0.06
2041	109.1	F	0.71	14.1	B	0.09

The results in **Table 19** indicate that that the first stage of the two-stage priority intersection controls the LoS, due to vehicles on Herons Creek Road crossing both lanes of the northbound carriageway. The intersection modelling indicates that the Herons Creek Road (north) intersection will operate at LoS B upon opening in 2011 and LoS C in 2031 (20 years after opening), complying with the design criteria stated above. Between 2031 and 2041 (20-30 years after opening) the intersection performance deteriorates, resulting in LoS F in 2041. This is due to the Highway traffic volumes approaching capacity. Based on the 100th HHV and under uninterrupted multi-lane road conditions (Ref 9), the Highway would operate at LoS C (restricted stable flow) in 2031 and LoS D (close to the limit of stable flow) in 2041. Hence, there are limited available gaps for vehicles crossing both lanes of the northbound carriageway.

5.4.4 Other Intersections

5.4.4.1 Existing Traffic Conditions

All other intersections on the Pacific Highway between Moorland and Herons Creek are shown in **Figure 13** and are listed in **APPENDIX E**. The existing layout is described and an estimate of traffic volumes given as AADV. Many roads that intersect with the main Highway are currently unsealed tracks leading to individual properties. However, more significant intersections are located at Johns River, Rossglen and Herons Creek. Highway turning counts of the more significant intersections were conducted in November 2000, as discussed in **Section 3.1.3**. **Table 15** details the location of these surveys and the traffic count for the twelve-hour period (0700-1900).

The counts confirm that existing traffic flows into and out of each of the side roads, with the exception of Kendall Road/ Ocean Drive, Stewarts River Road and Herons Creek Road (north), total no more than 122 vehicles per day.

Traffic on the minor side roads intersecting with the Highway is not expected to grow significantly over the next 10-20 years. Many of the side roads intersecting with the Highway serve only small communities, individual home/farmsteads or unpopulated areas of the National Park. There is little scope for new or expanded settlement and therefore traffic is expected to grow only marginally. For the purposes of analysis however, the traffic growth rate of 1.2%, consistent with the adopted rate for the Johns River Township, will be assumed.

Consultations with the operators of the Boral quarry north of Johns River show that it is accessed by on average 20 heavy goods vehicles per day, with this rising to up to 50 per day during peak periods of production. The majority of vehicles gain access to the main Highway via an intersection approximately 1km north of Johns River. However, some vehicles access the Highway north of the quarry at Yaralin.

5.4.4.2 Proposed Treatment

Standard two staged priority intersections incorporating provision for U-turns are proposed at the intersections with Algona Road, Watson Taylor Road and the Rossglen access road. At these locations total daily turning movements are very low, totalling no more than 100-150 vehicles per day, although peak direction volumes on the main Highway reach 760vph for the 100th HHV in 2001.

The type of intersection layout, is justified in terms of the Practical Absorption Capacity at Unsignalised Intersections (Ref 2) and vehicle sight lines.

With the increasing use of B-Double trucks for haulage jobs along the highway, it is appropriate to assess the extent to which B-Double trucks access industry along the route. To allow for B-Double truck access to intersecting side roads would require the storage length between carriageways for wide median treatments at intersections to be increased to allow for the 25m long B-Double vehicle (RTA Road Design Guide and Austroads).

5.4.4.3 Future Traffic Conditions

The Brief calls for intersections to be designed to provide for LoS C or better for the 100th highest hourly volume (HHV), 20 years after opening. As discussed in **Section 4.2.2**, the one-way 100th HHV for movements along the Highway has been calculated as 6.2% of the projected AADT at Station 09.122. The forecast growth rates outlined in **Section 3.2.1** have been used to predict traffic flows on both the main Highway and side roads to 2011 (predicted opening date) and 2031 (30 years after opening) at Kew. These growth rates have also been used to calculate a conservatively high estimate of traffic volumes on the smaller side roads.

The most difficult manoeuvre at the existing priority intersections at Algona Road, Watson Taylor Road and Rossglen access road, would be a right turn from the side road onto the Highway, crossing both major streams. The proposed intersection layout can be justified in terms of the Practical Absorption Capacity at Unsignalised Intersections (Ref 2) and vehicle sight lines. Analysis of the practical absorption capacity at these existing priority intersections shows that for the right turn movement, crossing both major traffic lanes with a two way major stream flow of 1520 vph (2001, 100th HHV), a practical absorption capacity of over 100 vph could be attained. Thus existing turning flows at Algona Road, Watson Taylor Road and the Rossglen access road are easily accommodated. By 2031 the right turn movement would be crossing both major lanes with a two way major stream flow of 3652 vph (2031, 100th HHV). Given the very low daily flows turning onto and off the Highway at these points, priority intersections are appropriate.

For all other movements, vehicles would have to cross only one of the major traffic streams. The practical absorption capacity for these other movements would therefore be greater than 100vph.

Two-stage priority intersection at these locations would accommodate forecast growth in traffic through these intersections, with the absorption capacity increased by the wide median and two-stage intersection layout provided.

The proposed intersection/median crossover locations meet the requirements of the Section 4 of the RTA's Road Design Guide which states that "Drivers using a cross-over should be able to recognise that the cross-over exists from at least 300m in either direction".

Traffic volumes total no more than fifty vehicles per day at all other existing access points and left-in/left-out only intersections are proposed elsewhere, including Bulleys Road (north), Middle Brother Road, Haydons Road, Charles Yard Road and the Camden Haven Airport access.

For capacity analysis, the highest existing 12-hour volume of 99 vehicles (at the Rossglen access road) has been modelled for a worst-case scenario. The peak volume has been conservatively taken as 20 percent of the 12-hour volume. A typical proposed intersection layout has been modelled using INTANAL for selected years. The years modelled and corresponding traffic volumes and LoS are shown in **Table 20**.

Table 20 - Typical Two-Stage Priority Intersection Performance

Year	Northbound (1st Stage)			Southbound (2nd Stage)		
	Max. Avg Delay (sec)	LoS	DoS	Max. Avg Delay (sec)	LoS	DoS
2011 (opening year)	14.6	B	0.02	12.9	A	0.01
2031	31.7	C	0.06	13.3	A	0.01
2041	63.8	E	0.14	13.7	A	0.02

Table 20 indicates that the Rossglen access road intersection will operate at LoS B upon opening in 2011 and LoS C in 2031 (20 years after opening). Between 2031 and 2041 (20-30 years after opening) the intersection performance deteriorates, resulting in LoS E in 2041. This meets the design criteria, as stated above. Further discussion relating to the performance of proposed two-stage priority intersections can be found in **Section 5.4.3.3**.

5.4.5 Summary of Upgraded Highway Access Provisions

Table 21 summarises the at-grade intersections, median openings and local access provisions included in the Preferred Option.

Table 21 - At-grade Intersections, Median Openings and Local Access Provisions

Station	Facility
600 m south of project limits	Median opening shown in Coopernook to Moorland EIS
2500	Johns River interchange
3600	Median opening/U-turn facility
6400	Median opening/U-turn facility combined with Algona Road intersection
8550	Median opening/U-turn facility combined with Watson Taylor Road intersection
11650	Median opening/U-turn facility combined with Ross Glen Road intersection
13650	Median opening/U-turn facility combined with local access connection near Glen Haven
15800	Kew interchange
17150	Median opening/U-turn facility
19000	Median opening/U-turn facility combined with local access connection at Eggbert property
20900/ 21100	Median opening/U-turn facility combined with Cluleys Rd/Herons Creek Road intersections. The Herons Creek Road intersection would allow B-Double vehicles to make turns to and from the upgraded highway.
22150	Median opening/U-turn facility combined with Bobs Creek Road intersection

While the proposed highway upgrade is not a controlled access road, it is also RTA policy to limit the number of left-in/left-out connections as well as the number of median openings. This can be achieved by the construction of frontage roads on one or both sides of the upgraded highway which direct traffic from several properties to one access point with the highway. Local access roads have been considered where:

- There are several properties close together and a short frontage road would allow their access to be combined to one point
- Direct access to the upgraded highway would be difficult as a result of changes in the level of the upgraded highway
- Sight distance is substandard and a frontage road is required to shift the access connection to a point where adequate sight distance is available
- A relatively short section of frontage road would allow property access or minor local access roads to be diverted through the proposed interchanges at Johns River and Kew, thus eliminating at-grade intersections and increasing the safety benefits of the interchanges.

Based on this approach, frontage roads have been proposed at the locations identified in **Table 22**. In addition, allowance has been made in the proposed land acquisition boundaries for frontage roads in the future at the locations shown in Table 22, however these frontage roads are not proposed as part of the EIS.

Table 22 - Frontage road locations

Station	Frontage road description
Proposed as part of this Project	
2500 – 3500	Frontage road on west side of bypass diverts Bulleys Road to Johns River interchange
4900 – 5200	Frontage road on west side of upgraded highway. Shifts access point to the cut/fill line where good sight distance is available
5700 – 6100	Frontage road on west side of upgraded highway provides access connection for 3 properties
13600 – 14600	Frontage road on east side of upgraded highway provides access connection for 3 properties
14400 – 14700	Sunnyvale Road diverted on west side away from exit ramp diverge and connected to roundabout approx 300 m north
16400 – 17200	Frontage road on west side of highway diverts Herons Creek Road south and Weeroona Place back to the Kew interchange.
21800 – 22150	Frontage road on west side of highway diverts school access to the Bobs Creek Road intersection
Provision for future frontage roads	
50 – 200	Frontage road on west side to combine access for 4 properties
400 – 1150	Frontage road on west side to combine access for 4 properties
19000 – 19450	Frontage road on west side to combine access for 3 properties
19700 – 20400	Frontage road on west side to combine access for 4 properties

5.5 Provision for Cyclists, Pedestrians and Equestrians

5.5.1 Requirements

Section 6.2 of the RTA Brief (Design Parameters) states that all through carriageways are to provide for cyclists. In addition, the RTA recognises the Pacific Highway as a "key regional route along the east coast of New South Wales".

In addition, Hastings Council has published a Regional Bike Plan (Ref 14) recommending the development of ten key routes to link the main townships in the Hastings area. The routes which have been planned around the townships of Kew, Kendall and Camden Haven include the following:

1. Camden Haven Bridge to Kew

Ocean Drive continues through Laurieton and West Haven from the Camden Haven Bridge. Shoulder sealing is noted as being required to 1.5m on part of the route through built up areas, with the remainder of the route requiring 2.0m shoulders.

2. Kew to Kendall

From the Pacific Highway at Kew into Kendall is noted as requiring upgrading of the road to provide 2.0m shoulders.

3. Wauchope to Kew

The southern 8km of this route is on the Pacific Highway where 3.3m wide shoulders are currently provided.

The Pacific Highway design cross-sections include a 2.5m left hand shoulder for the length of the upgraded section. This is considered adequate to accommodate cyclists, pedestrians and equestrians in safety.

General principles which should be followed to accommodate cyclists on the road pavement are provided in Austroads, Guide to Traffic Engineering Practice, Part 14, Bicycles, 1993 (Ref 1).

5.5.2 Provisions

Pedestrians would generally not be permitted within the road reserve along this section of the Pacific Highway. Provision for pedestrian movements across the highway are incorporated with the provision for local vehicle access. This includes improved pedestrian safety via the grade separation at Ocean Drive and the incorporation of separate raised footways beside western shoulder of the Herons Creek and Herons Creek Floodway Bridges to replace existing timber footbridges used by Herons Creek Primary School students.

Long distance cyclists would be able to use this section of the Pacific Highway. Continuous sealed shoulders with a minimum width of 2.5 m (which would also function as breakdown lanes) would be provided for all roadway sections of the Project. On the major bridge structures, the shoulders would be 2 m wide.

Cyclists would have an alternative route along the existing Pacific Highway through Johns River and Kew. This route is generally suitable for cyclists although there is not a continuous sealed shoulder. However, the forecast traffic volumes on this route after the opening of the bypasses will be less than 3000 vpd, which is consistent with Austroads' recommendations for safe, on-road cycling conditions (Ref 1).

5.6 Rest Areas

5.6.1 Existing Vehicle Rest Areas

The RTA's "Roadloc" data has been analysed to assess the location of existing vehicle rest areas on the Pacific Highway between Moorland and Herons Creek. The location of the existing rest areas is detailed in **Table 23**.

Table 23 - Location of Existing Vehicle Rest Areas

ROADLOC Section 8 Distance (km from Taree)	Location	Access Arrangement	Description
20.8 (outside Moorland to Herons Creek section)	*2km south of Coopernook*	*Entry/Exit from northbound carriageway only*	*Heavy vehicle rest area*
33.9 (outside Moorland to Herons Creek section)	*5km south of Johns River*	*Entry/Exit from northbound carriageway only*	*Vehicle rest area*
37.5	1.5km south of Johns River	Entry/Exit from northbound carriageway	Heavy vehicle rest area
43.6	0.5km south of Haydons Road turnoff	Entry/Exit from southbound carriageway	Heavy vehicle rest area
44.5	Just south of Watson Taylor Road	Entry/Exit from southbound carriageway	Shoulder widening only
45.6	1.5km north of Haydons Road turnoff	Entry/Exit from southbound carriageway	Heavy vehicle rest area
47.5	0.75 km south of Rossglen turnoff	Entry/Exit from southbound carriageway	Heavy vehicle rest area
48.3	100m north of Rossglen turnoff	Entry/Exit from northbound carriageway	Heavy vehicle rest area
50.0	1km north of Camden Haven River	Entry/Exit from southbound carriageway	Heavy vehicle rest area

5.6.2 Strategic Assessment Proposals

Working Paper 16 of the Pacific Highway Upgrading Strategic Assessment; Stopping Area Strategy Plan (Ref 6), proposes eight vehicle stopping areas between Taree and Kempsey. Two of these are in the section of highway between Moorland and Herons Creek and are noted below as Heavy Vehicle rest areas:

A. 44 km north of Taree for southbound vehicles only – Existing truck rest area site to be retained or replaced with highway upgrade for southbound trucks only.

B. 46 km north of Taree for southbound vehicles only – Existing truck rest area site to be retained or replaced with highway upgrade for southbound trucks only. However, B appears to be in error since there is no NB rest area near 46km. The only NB rest area in the vicinity is at 48km north of Taree.

5.6.3 The RTA's Rest Areas Strategy

The RTA's Highway Rest Areas Strategy Background Report (Ref 11) envisages major rest areas at the following locations between Moorland and Herons Creek:

- 32km north of Taree (ID 229) – New (Outside Moorland to Herons Creek section)
- 34km north of Taree (ID 230) – Existing (Outside Moorland to Herons Creek section)
- 44km north of Taree (ID 231) – Existing, as specified in WP16 of the Strategic Assessment for southbound traffic
- 46km north of Taree (ID 232) – Existing, as specified in WP16 of the Strategic Assessment for northbound traffic only. Error as identified in Section 5.7.2
- 67km north of Taree (ID 233) – Existing (Outside Moorland to Herons Creek section)

In addition, Connell Wagner in their EIS on the Pacific Highway upgrade between Coopernook and Moorland propose a rest area 500m north of Hannan Vale Road (28.5km north of Taree) for southbound vehicles only.

5.6.4 Rest Area Provisions

Current RTA guidance (Ref 11) states that major rest areas suitable for trucks should be planned every 100km, with secondary areas every 30 to 50km in between. For light vehicles stopping opportunities should be available every 50km on primary routes. Section 6.16 of the Brief states that one of the key project objectives is to retain or replace existing rest areas within the study area. In accordance with these, and the recommendations in the Strategic Assessment the following will be retained, closed or newly constructed in each section of the Project:

- Retention of:
  - existing southbound heavy vehicle rest area 0.75 km south of the Rossglen turnoff (near Camden Haven Airport).
- Closure of:
  - unsafe existing heavy vehicle rest area 100 m north of Rossglen turnoff.
  - existing southbound heavy vehicle rest area just south of Watson Taylor Road
  - existing southbound heavy vehicle rest area 0.5 km north of Stoney Creek
- Construction of:
  - new northbound heavy vehicle rest area of approximately 0.7 ha in the vicinity of Charles Yard Road.

According to the latest advice from RTA, new rest areas should now generally provide facilities for both heavy vehicle and light vehicle users. Where land area permits, the parking areas for the light and heavy vehicles should be separated, but the facilities can be shared.

- Rest areas should include:
- Parking for 10 light vehicles
- Parking for 8 to 10 B-Doubles
- Deceleration lanes to RDG requirements
- Acceleration lanes only in circumstances where they are necessary (i.e. poor sight distance to exit)
- Toilets to the new 'Pacific Highway' design
- Seating and shelter (usually 3 sets)
- Shade for vehicles (using current trees is available)
- Playgrounds at selected locations (allow 15 m x 15 m space)
- Provision for Driver-Reviver at selected locations

Based on these requirements the proposed location of the new northbound rest area is around Ch 10800, about 1 km south of the bridge over the railway line. The rest area would be accommodated within the existing road reserve and would be facilitated by relocating the Charles Yard Road connection to the highway by about 800 m further to the south.

The strategic assessment also suggested that an existing southbound heavy vehicle rest area about 0.3 km south of Haydons Road should be retained. However, this would not be possible due to the width restrictions imposed by the Middle Brother National Park and the adjacent railway.

5.7 Bus Operations

5.7.1 Bus Services

Bus Services operated by the Busways Group and Eggins Comfort Coaches currently use the Pacific Highway between Moorland and Herons Creek.

Busways operates school bus services which either cross or use the Highway between Moorland and Herons Creek, taking children to school in the morning and from school in the afternoon. **Table 24** lists school bus services.

School buses only operate during school term time and pick up/set down children at private property entrances at the side of the Highway as required.

In addition, Busways also operate a scheduled passenger service 334, Monday to Sunday between Kendall, Lakewood (via Kendall Road/Ocean Drive), Laurieton, then north to North Haven, Bonny Hills and Port Macquarie. This service returns along the same route.

Eggins Coaches currently operate one service between Moorland and Kendall, calling only at the Johns River township.

Table 24 - King Brothers School Bus Services

Busways School Services	AM Run	PM Run
Service 2: Kendall to Laurieton	Kendall Primary to St Joseph's Community School, Laurieton, crossing the Highway at Kew	Return
Service 3: Laurieton to Kendall via Lake Cathie/Bonny Hills	West Haven Depot thence Ocean Drive to Lake Cathie. Returns via Ocean Drive and Camden Haven High School to Kew. Crosses Highway to Kendall Primary School	As AM
Service 5: Kew to Johns River and Moorland, returning to Kew and Kendall	West Haven Depot to Kew via Ocean Drive then Pacific Highway to Johns River and Moorland (Moorland Hall). Then returns via the Highway to Laurieton, stopping at Stewarts River Road, Rossglen Road and Kendall Road to Kendall. Then from Kendall to Kew via Kendall Road and Ocean Drive to St Josephs Community College Laurieton	West Haven Depot to St Josephs Community College Laurieton then Camden Haven College. Then returns to Highway via Ocean Drive. Left onto Highway to Rossglen, Johns River and Moorland (Moorland Hall). Then back to West Haven Depot via Highway and Ocean Drive.
Service 7: Laurieton to Wauchope via Kendall/ Bago and King Creek	Waterview Heights to Kendall via Ocean Drive, turning right onto the Highway at Kew. Then turning north onto the Highway to Herons Creek, then Bago Road to Wauchope schools	As AM
Service 11: Kendall to Port Macquarie general passenger service	Kendall to Kew via Kendall Road, then Ocean Drive to Laurieton/North Haven/Bonny Hills and Lake Cathie. Then from Lake Cathie to Port Macquarie schools and hospitals.	As AM

Busways School Services	AM Run	PM Run
Service 15: Stewarts River and Lorne to Kendall	Laurieton Depot to Highway, then Highway to Stewarts River Road. Then Stewarts River Road to Lorne and Kendall Primary. Then Kendall to Camden Haven High School, crossing the Highway at Kew	Laurieton Depot to St Josephs Community College at Kendall Primary School via Ocean Drive/Kendall Road. Continues to Lorne, then returns to Kendall Primary. Then via Black Creek Road to Laurieton Depot.
Service 16: Dunboggan to Laurieton, North Haven and Kendall	Laurieton Depot to Kendall via Ocean Drive/Kendall Road. Then to Kew and St Albans to Dunboggan. Then from Dunboggan to Laurieton.	St Josephs Community School, Laurieton to Camden Head and Dunboggan. Then returning to Laurieton, North Haven, Ocean Drive to Kew and Kendall. Returns to Laurieton Depot.
Service 18: Herons Creek to Kendall and Laurieton	Laurieton Depot to Kew via Ocean Drive. Then north to Herons Creek via Highway and Bobs Creek Road. Then returning to Kendall via Highway. Then from Kendall to Camden Haven, Laurieton and North Haven.	Laurieton Depot to North Haven and Camden Haven. Then via Ocean Drive to Kew, turning north onto the Highway to Herons Creek and Bobs Creek. Then returning from Bobs Creek Road to Kew via Highway, thence Ocean Drive to Laurieton Depot.
Service 20: Laurieton to Port Macquarie via Herons Creek, Kings Creek and Sarahs Crescent	Laurieton to Kew via Ocean Drive, then Highway to Herons Creek. Then Kings Creek Road and Sarah Crescent to Port Macquarie	As AM
Service 23: Laurieton to Port Macquarie via Kendall/Coast Road	Laurieton to Kendall via Glen Haven Drive, then Kew . Then Lakeridge Drive and Ocean Drive to Lakeview, North Haven, Bonny Hills, Lake Cathie and Port Macquarie	As AM
Service 33: Batar Creek to Kendall/C.H.H.S/St Josephs (Laurieton)	Laurieton Depot along Batar Creek Road to O'Neils Dairy. Then Batar Creek Road to Kendall Primary School. Then Ocean Drive to Camden Haven High School and St Josephs Community College Laurieton.	Camden Haven High School to Kendall Primary School via Batar Creek Road. Then returning to Laurieton Depot via 1000 Lorne Road and Bellhaven Road.
Service 35: Bonny Hills, Laurieton and Kew to Kendall	Laurieton Depot to Bonny Hills and North Haven. Then to Kew via Glen Haven Drive. Then to Kendall via Ocean Drive/Kendall Road	Kendall Primary School to Kew and Laurieton via Ocean Drive/Kendall Road. Then to North Haven and Bonny Hills before returning to Laurieton Depot
Service 36: Kendall and Kew to Camden Haven High School	Kendall Primary to Kew via Kendall Road and then to Camden Haven High School	Return Run

5.7.2 Future Bus Facilities

Section 3 of the RTA's Road Design Guide (RDG) (Ref 2) states that at other locations on the Highway where school buses need to stop, stopping bays will need to be provided. Adequate provision should be made behind the kerb line at such locations, for a sufficient waiting area to allow passengers to assemble and disperse.

Services calling at Johns River, Kew and the other townships, will still be able to access existing bus stops in these centres. It is anticipated that services to these areas will utilise the on and off ramps to the Highway and stop on the Old Pacific Highway to pick up and set down passengers. No formal bus facilities are proposed on the upgraded Highway.

In addition to this, bus services will be able to utilise:

- The 2.5m left shoulder provided throughout the upgraded alignment
- Vehicle laybys with widened shoulders, generally provided at 1 km intervals along the northbound and southbound carriageways
- Short sections of shoulder widening provided at left-in/left-out property access points

School services stopping along the upgraded Highway are likely to be picking up or setting down very small numbers of students at any one point (generally at specific property entrances) and will not require any specific provisions for waiting areas.

5.8 Laybys

In addition to the location and provision of bus stopping bays, the RTA Road Design Guide gives guidance on the location and provision of vehicle laybys. Passenger vehicle laybys should be a minimum of 4.5m wide from the edge line and 20m long to accommodate two vehicles.

Where the predicted AADT exceeds 1000 (2001 AADT on the Highway at Kew is 11898), laybys should be located approximately 1km apart on each carriageway, staggered on alternate sides of the highway. Laybys should preferably be sealed, however a gravel surface is acceptable. Desirable locations for laybys include sags, flat areas near cutting/embankment lines, pick-up points for school buses and adjacent to property access points.

In accordance with these requirements, laybys with widened shoulders have been provided at approximately 1 km intervals on the northbound and southbound carriageways, taking into account the above location considerations.

5.9 Area Wide Traffic Impacts

Within the Hastings and Greater Taree Council areas, no other roads provide equivalent north-south access. The road via Camden Haven, Bonny Hills and Lake Cathie is the only other road that provides additional north-south access through the region.

The highway upgrade is expected to have little effect on other main roads in the region and it is unlikely that the highway upgrade will have any noticeable effect on the volume of traffic along any roads between Moorland and Herons Creek. This route is significantly longer than the Highway and serves only a local/tourist function.

5.10 Construction

Upgrading of the highway is likely to cause some disruption to highway traffic, as it involves the construction of new sections of roadway that will interface with the existing carriageway. Selection of the Preferred Option has considered road user delays during construction. In addition, upgrading the existing interchanges will also require a traffic management plan to ensure that there is as little disruption to highway traffic as possible.

The reader is referred to the Working Paper No. 2 - Concept Design, where issues surrounding potential delays to motorists due to construction, for the Preferred Option, are described in detail.

6. ACCIDENT DATA

Accident data has been provided by the RTA and has been split into three sections for the Highway between Moorland and Herons Creek. The three sections of highway are detailed as follows:

- Section 1: Moorland to Camden Haven River (12.5km)
- Section 2: Camden Haven River to Kew (4km)
- Section 3: Kew to Herons Creek (5.5km)

Due to the extended duration of the design and EIS process, each of the three sections has been analysed separately for two five-year periods. These are:

- January 1995 to December 1999 inclusive
- October 1998 to September 2003 inclusive

It should be noted that these periods overlap and hence should be considered as two separate periods of analysis.

6.1 Section 1: Moorland to Camden Haven River

6.1.1 January 1995 to December 1999

Table 25 summarises recorded accidents for Section 1, taken from the RTA database for the period January 1995 to December 1999.

Table 25 - Accidents by Severity & Description, Pacific Highway (Section 1)

By Severity	
Severity	**Number of Accidents**
Fatal accidents	1
Injury accidents	12
Tow-away/ non-injury accidents	25
Total	38

By Accident Description	
Description	**Number of Accidents**
Vehicle-Vehicle (Head on)	5
Vehicle–Vehicle (Right angle)	0
Vehicle–Vehicle (nose – tail)	6
Vehicle–Vehicle (Other angle)	4
Vehicle–object	6
Vehicle (off carriageway)	14
Vehicle U-Turning	2
Other	1

The average accident rate along this section of the highway during the 5 years, based on 38 accidents and the traffic volumes listed for Site 09122 in **Table 1** (linearly extrapolated between 1995 and 1999), is 19 accidents per 100-million-vehicle-kms (MVK) travelled. This rate is below the state-wide accident rate for a rural 2-lane undivided road of 32.8 accidents per 100 MVK (Ref 4).

One fatal accident occurred within Section 1 during the five-year period:

- On January 25th 1998, five people were killed when two vehicles collided in a head on collision 600m north of Algona Road. One vehicle was travelling on the wrong side of the road.

In the five-year period, 3% of reported accidents within Section 1 resulted in a fatality, compared with a state-wide average of 1.1% (Ref 3). The number of casualty accidents per kilometre per year over this section of the highway was 0.19. This is below the route average of 0.68 for the Pacific Highway between Hexham and Tweed Heads (Ref 3).

Based on current costs for each accident severity listed above (Ref 10), and the above accident data, accidents on this section of the Pacific Highway are currently costing the community over $450,000 per year, or an average of $59,000 per accident.

6.1.2 October 1998 to September 2003

Table 26 summarises recorded accidents for Section 1, taken from the RTA database for the period October 1998 to September 2003.

Table 26 - Accidents by Severity & Description, Pacific Highway (Section 1)

By Severity		By Accident Description	
Severity	**Number of Accidents**	**Description**	**Number of Accidents**
Fatal accidents	3	Vehicle-Vehicle (Head on)	4
Injury accidents	6	Vehicle–Vehicle (Right angle)	1
Tow-away/ non-injury accidents	9	Vehicle–Vehicle (nose – tail)	3
Total	18	Vehicle–Vehicle (Other angle)	0
		Vehicle–object	6
		Vehicle (off carriageway)	1
		Vehicle U-Turning	1
		Other	2

The average accident rate along this section of the highway during the 5 years, based on 18 accidents and the traffic volumes listed for Site 09.122 in **Table 1** (linearly interpolated between 1998, 2001 and approximate 2004 AADT data), is 8 accidents per 100 MVK travelled. This rate is below the state-wide accident rate for a rural 2-lane undivided road of 32.8 accidents per 100 MVK (Ref 4).

Three fatal accidents occurred within Section 1 during the five-year period:

- On the night of 26 August 2000, a pedestrian standing on the Pacific Highway carriageway was killed by an oncoming car, approximately 2 km north of the Johns River township.
- On 25 March 2001, two people were killed when two vehicles were involved in a head-on collision, 1.5 km south of Stewarts River Road, Johns River. The accident occurred during wet weather.

- On 4 June 2003, one person was killed and another injured when two vehicles were involved in a head-on collision, 30 m south of Middle Brother Road, Johns River.

In the five-year period, 17% of reported accidents within Section 1 resulted in a fatality, compared with a state-wide average of 1.0% (Ref 16). The number of casualty accidents per kilometre per year over this section of the highway was 0.10 This is below the route average of 0.68 for the Pacific Highway between Hexham and Tweed Heads (Ref 3).

Based on current costs for each accident severity listed above (Ref 10), and the above accident data, accidents on this section of the Pacific Highway are currently costing the community over $740,000 per year, or an average of $206,000 per accident.

6.2 Section 2: Camden Haven River to Kew

6.2.1 January 1995 to December 1999

Table 27 summarises recorded accidents for Section 2, taken from the RTA database for the period January 1995 to December 1999.

Table 27 - Accidents by Severity & Description, Pacific Highway (Section 2)

By Severity	
Severity	**Number of Accidents**
Fatal accidents	0
Injury accidents	11
Tow-away/ non-injury accidents	11
Total	22

By Accident Description	
Description	**Number of Accidents**
Vehicle-Vehicle (Head on)	1
Vehicle–Vehicle (Right angle)	5
Vehicle–Vehicle (nose – tail)	3
Vehicle–Vehicle (Other angle)	6
Vehicle–object	0
Vehicle (off carriageway)	4
Vehicle U-Turning	2
Other	1

The average accident rate along this section of the highway during the 5 years, based on 22 accidents and the traffic volumes listed for Site 09122 in **Table 1** (linearly extrapolated between 1995 and 1999), is 34 accidents per 100 MVK travelled. This rate is marginally higher than the state-wide accident rate for a rural 2-lane undivided road of 32.8 accidents per 100 MVK (Ref 4).

No fatal accidents were recorded within Section 2 during the five-year period. The number of casualty accidents per kilometre per year over this section of the highway was 0.55. This is below the route average of 0.68 for the Pacific Highway between Hexham and Tweed Heads (Ref 3).

Based on current costs for each accident severity listed above (Ref 10), and the above accident data, accidents on this section of the Pacific Highway are currently costing the community over $190,000 per year, or an average of $44,000 per accident.

6.2.2 October 1998 to September 2003

Table 28 summarises recorded accidents for Section 2, taken from the RTA database for the period October 1998 to September 2003.

Table 28 - Accidents by Severity & Description, Pacific Highway (Section 2)

By Severity		By Accident Description	
Severity	**Number of Accidents**	**Description**	**Number of Accidents**
Fatal accidents	1	Vehicle-Vehicle (Head on)	4
Injury accidents	8	Vehicle–Vehicle (Right angle)	10
Tow-away/ non-injury accidents	20	Vehicle–Vehicle (nose – tail)	4
Total	29	Vehicle–Vehicle (Other angle)	0
		Vehicle–object	8
		Vehicle (off carriageway)	2
		Vehicle U-Turning	0
		Other	1

The average accident rate along this section of the highway during the 5 years, based on 29 accidents and the traffic volumes listed for Site 09.122 in **Table 1** (linearly interpolated between 1998, 2001 and approximate 2004 AADT data), is 40 accidents per 100 MVK travelled. This rate is above the state-wide accident rate for a rural 2-lane undivided road of 32.8 accidents per 100 MVK (Ref 4).

One fatal accident occurred within Section 2 during the five-year period:

- On the night of 1 June 2002, three people were killed and another injured when two vehicles were involved in a head-on collision, 400 m south of Sunnyvale Road, Kew.

In the five-year period, 3% of reported accidents within Section 2 resulted in a fatality, compared with a state-wide average of 1.0% (Ref 16). The number of casualty accidents per kilometre per year over this section of the highway was 0.40. This is below the route average of 0.68 for the Pacific Highway between Hexham and Tweed Heads (Ref 3).

Based on current costs for each accident severity listed above (Ref 10), and the above accident data, accidents on this section of the Pacific Highway are currently costing the community over $380,000 per year, or an average of $66,000 per accident.

6.3 Section 3: Kew to Herons Creek

6.3.1 January 1995 to December 1999

Table 29 summarises recorded accidents for Section 3, taken from the RTA database for the period January 1995 to December 1999.

The average accident rate along this section of the highway during the 5 years, based on 16 accidents and the traffic volumes listed for Site 09122 in **Table 1** (linearly extrapolated between 1995 and 1999), is 18 accidents per 100 MVK travelled. This rate is below the state-wide accident rate for a rural 2-lane undivided road of 32.8 accidents per 100 MVK (Ref 4).

One fatal accident was recorded within Section 3 during the five-year period:

- On December 31st 1996, three people were killed in a head on collision between two vehicles 700m north of Ocean Drive. One was travelling on the wrong side of the road.

In the five-year period, 6% of reported accidents within Section 3 resulted in a fatality, compared with a state-wide average of 1.1% (Ref 3). The number of casualty accidents per kilometre per year over this section of the highway was 0.25. This is below the route average of 0.68 for the Pacific Highway between Hexham and Tweed Heads (Ref 3).

Table 29 - Accidents by Severity & Description, Pacific Highway (Section 3)

By Severity		By Accident Description	
Severity	**Number of Accidents**	**Description**	**Number of Accidents**
Fatal accidents	1	Vehicle-Vehicle (Head on)	3
Injury accidents	7	Vehicle–Vehicle (Right angle)	0
Tow-away/ non-injury accidents	8	Vehicle–Vehicle (nose – tail)	3
Total	16	Vehicle–Vehicle (Other angle)	2
		Vehicle–object	0
		Vehicle (off carriageway)	6
		Vehicle U-Turning	1
		Other	1

Based on current costs for each accident severity listed above (Ref 10), and the above accident data, accidents on this section of the Pacific Highway are currently costing the community over $330,000 per year, or an average of $105,000 per accident.

6.3.2 October 1998 to September 2003

Table 30 summarises recorded accidents for Section 2, taken from the RTA database for the period October 1998 to September 2003.

Table 30 - Accidents by Severity & Description, Pacific Highway (Section 3)

By Severity		By Accident Description	
Severity	**Number of Accidents**	**Description**	**Number of Accidents**
Fatal accidents	2	Vehicle-Vehicle (Head on)	2
Injury accidents	6	Vehicle–Vehicle (Right angle)	3
Tow-away/ non-injury accidents	15	Vehicle–Vehicle (nose – tail)	6
Total	23	Vehicle–Vehicle (Other angle)	2
		Vehicle–object	6
		Vehicle (off carriageway)	4
		Vehicle U-Turning	0
		Other	0

The average accident rate along this section of the highway during the 5 years, based on 23 accidents and the traffic volumes listed for Site 09.122 in **Table 1** (linearly interpolated between 1998, 2001 and approximate 2004 AADT data), is 23 accidents per 100 MVK travelled. This rate is below the state-wide accident rate for a rural 2-lane undivided road of 32.8 accidents per 100 MVK (Ref 4).

Two fatal accidents were recorded within Section 3 during the five-year period:

- On 8 June 2002, 3 people were killed when two vehicles were involved in a head-on collision, 500m south of Herons Creek Road, Herons Creek. The accident occurred in wet weather, with one vehicle crossing to the wrong side of the road.
- On the night of 28 November 2002, the driver of a B-Double was killed when his vehicle veered right, off the carriageway into the guardrail at Walters Creek, Kew.

In the five-year period, 9% of reported accidents within Section 3 resulted in a fatality, compared with a state-wide average of 1.0% (Ref 16). The number of casualty accidents per kilometre per year over this section of the highway was 0.22. This is below the route average of 0.68 for the Pacific Highway between Hexham and Tweed Heads (Ref 3).

Based on current costs for each accident severity listed above (Ref 10), and the above accident data, accidents on this section of the Pacific Highway are currently costing the community just under $550,000 per year, or an average of $119,000 per accident.

6.4 Entire 22km Route Length

6.4.1 January 1995 to December 1999

Table 31 summarises recorded accidents for the entire 22km route between Moorland and Herons Creek, taken from the RTA database for the period January 1995 to December 1999.

Table 31 - Accidents by Severity & Description, January 1995 to December 1999

By Severity		By Accident Description	
Severity	**Number of Accidents**	**Description**	**Number of Accidents**
Fatal accidents	2	Vehicle-Vehicle (Head on)	9
Injury accidents	30	Vehicle–Vehicle (Right angle)	5
Tow-away/ non-injury accidents	44	Vehicle–Vehicle (nose – tail)	12
Total	76	Vehicle–Vehicle (Other angle)	12
		Vehicle–object	6
		Vehicle (off carriageway)	24
		Vehicle U-Turning	5
		Other	3

The average accident rate along this section of the highway during the 5 years, based on 76 accidents and the traffic volumes listed for Site 09122 in **Table 1** (linearly extrapolated between 1995 and 1999), is 21 accidents per 100 MVK travelled. This rate is below the state-wide accident rate for a rural 2-lane undivided road of 32.8 accidents per 100 MVK (Ref 4).

In the five-year period, 3% of reported accidents along the entire route length resulted in a fatality, compared with a state-wide average of 1.1% (Ref 3). The number of casualty accidents per kilometre per year over this section of the highway was 0.27. This is below the route average of 0.68 for the Pacific Highway between Hexham and Tweed Heads (Ref 3).

Based on current costs for each accident severity listed above (Ref 10), and the above accident data, accidents on this section of the Pacific Highway are currently costing the community just under $1 million per year, or an average of $65,000 per accident.

6.4.2 October 1998 to September 2003

Table 32 summarises recorded accidents for the entire 22km route between Moorland and Herons Creek, taken from the RTA database for the period October 1998 to September 2003.

Table 32 - Accidents by Severity & Description, October 1998 to September 2003

By Severity		By Accident Description	
Severity	**Number of Accidents**	**Description**	**Number of Accidents**
Fatal accidents	6	Vehicle-Vehicle (Head on)	10
Injury accidents	20	Vehicle–Vehicle (Right angle)	14
Tow-away/ non-injury accidents	44	Vehicle–Vehicle (nose – tail)	13
Total	70	Vehicle–Vehicle (Other angle)	2
		Vehicle–object	20
		Vehicle (off carriageway)	7
		Vehicle U-Turning	1
		Other	3

The average accident rate along this section of the highway during the 5 years, based on 70 accidents and the traffic volumes listed for Site 09.122 in **Table 1** (linearly interpolated between 1998, 2001 and approximate 2004 AADT data), is 18 accidents per 100 MVK travelled. This rate is below the state-wide accident rate for a rural 2-lane undivided road of 32.8 accidents per 100 MVK (Ref 4).

In the five-year period, 9% of reported accidents within Section 3 resulted in a fatality, compared with a state-wide average of 1.0% (Ref 16). The number of casualty (or injury) accidents per kilometre per year over this section of the highway was 0.18. This is below the route average of 0.68 for the Pacific Highway between Hexham and Tweed Heads (Ref 3).

Based on current costs for each accident severity listed above (Ref 10), and the above accident data, accidents on this section of the Pacific Highway are currently costing the community just under $1.7 million per year, or an average of $120,000 per accident.

6.5 Summary

In terms of the number of accidents per 100 million vehicle kilometres, the highest accident rate in both five-year accident study periods occurs over Section 2 of the highway (Camden Haven to Kew). These accident rates are higher than the state-wide rate for a rural 2-lane undivided road of 32.8 accidents per 100 million-vehicle-kms (Ref 4).

In the five-year period January 1995 to December 1999, Section 3 has the highest average cost per accident at $105,000. Casualty accidents accounted for 44% of all recorded accidents over the five-year period, with one accident over this section involving the death of three people.

In the five-year period October 1998 to September 2003, Section 1 has the highest average cost per accident at $206,000. Casualty accidents accounted for 33% of all recorded accidents over the five-year period, with three accidents over this section resulting the death of four people in total.

When comparing the two five-years periods analysed, it can be seen that there has been a drop in the total number of reported accidents, from 76 (1995-1999) to 70 (1998-2003), due to a reduction in casualty accidents from 30 to 20. However the number of fatal accidents has increased from 2 to 6. None of the fatal accidents occurred in the overlap between the two accident periods analysed.

One of the key objectives detailed in the RTA brief is to:

“Develop a dual carriageway road with potential to reduce crash rates to 15 crashes per 100MVK over the project length”.

The existing crash rate of 18 accidents per 100 MVK is only marginally higher than the target 15 as identified above. The Preferred Option alignment bypasses the existing traffic signals at Kendall Road/ Ocean Drive (the only major intersection in the study area) and provides grade separation for the Highway. This is likely to reduce accident rates, particular with respect to rear-end accidents, in the Kew area.

If no upgrade was to occur, and as traffic volumes increase, it is likely that the current accident rate will remain the same or get worse. Data from the RTA (Ref 4) indicates that for a rural freeway standard road, the state-wide average accident rate is 18.8 accidents per 100 million-vehicle-kilometres. This would suggest that the proposed upgrade to RTA Pacific Highway design standards will contribute to a significant reduction in the number of traffic accidents causing fatalities and serious injuries, and enable the RTA target of 15 crashes per 100 million-vehicle-kilometres to be achieved.

In addition, if there was no upgrade, the difference in quality between sections of the highway would be accentuated within five years. The highway south of Moorland will be four-lane dual carriageway, whilst much of the highway north of Herons Creek will be of a similar standard. The stretch of Pacific highway between Moorland and Herons Creek would therefore become an isolated section of lower standard road. Experience from similar situations suggests that the accident rate on the lower standard road will increase above existing levels. The Road Environment Safety Guidelines (Ref 6) state that slow points in the context of a major road corridor may be "squeeze points and may well cause frustration and become accident blackspots".

7. CONCLUSIONS AND RECOMMENDATIONS

We conclude that for a 110 km/h design speed, Pacific Highway design standards, traffic volume projections as discussed in **Section 3.2.1**, and traffic intersection layouts as described in **Section 5.4**, that:

- a four-lane dual carriageway based on the Preferred Option alignment would operate at LoS B in 2011 (predicted opening date), with LoS C being reached in 2017, LoS D reached in 2027 and LoS E in 2035;
- two-stage priority intersections at Herons Creek and other lower volume locations meet the RTA criteria for LoS C or better, 20 years after the Highway upgrade;
- the Half Diamond Interchange at Kew is forecast to operate at LoS A in both 2011 and 2031;
- the Half Diamond Interchange at Johns River is forecast to operate at LoS A in both 2011 and 2031;
- vehicle rest areas be provided in the upgrade proposals as described in **Section 5.6** of this report; and
- the upgrade of the Highway would result in an overall reduction in the current level of accidents, particularly those involving head-on collisions, which result in a fatality or casualty. Research from the RTA suggests that the target of 15 crashes per 100 million-vehicle-kilometres can be achieved on a freeway standard road.