Failford Road to Tritton Road

Review of environmental factors - Appendix E

Traffic study

May 2008

RoadNet

Traffic Study

Proposed Upgrading of Pacific Highway Failford Road to Tritton Road, Possum Brush

for

RTA Technology and Technical Services, Business Section, Hunter Region

27 February 2006

TABLE OF CONTENTS

Prepared by: ***R<u>oadNet</u> Pty Ltd***
Planners and Engineers
PO Box 1381
Suite 2, No 8 Sixth Avenue
PALM BEACH QLD 4221
Tel 0755 257377
Email: gold.coast@roadnet.net.au

EXECUTIVE SUMMARY

Introduction

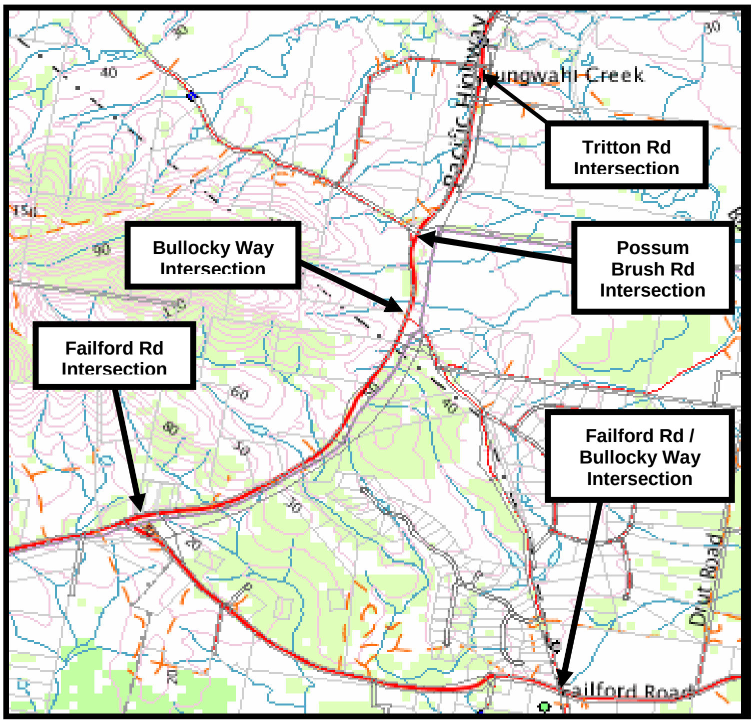
The RTA is investigating road improvements to the Pacific Highway between Failford Road and Tritton Road, Possum Brush, a distance of approximately 3.6km. The section is currently dual carriageways however the northbound carriageway is of lesser standard having previously been a section of a two way Highway. The road alignment contributes to the relatively high accident rate on the section. The project is being developed to improve the alignment of the northbound carriageway, reduce accidents, rationalise property access and upgrade intersections.

The project essentially involves improving northbound traffic flow within the section. A new southbound carriageway will be constructed parallel to and east of the existing relatively recent southbound carriageway, constructed during the 1980s. Northbound traffic will then travel on the existing southbound carriageway. Two main options are proposed, 'A' class with a combination of at grade and grade separation intersections and 'M' class with full access control and grade separation. It is assumed for analysis purposes that construction will commence in 2009 and be completed in 2010.

This traffic study contains traffic data, traffic modelling and economic analysis that are used to justify the project and to assist in the design of the road and intersections.

Traffic volumes have been obtained from historical data and recent traffic counts. Traffic projections have been made with regard to growth in through traffic and future urban development mainly to the east at Forster/Tuncurry and at Hallidays Point.

Figure 1 - Study area



Traffic Volumes

Table 1 shows projections of future traffic volumes on the Pacific Highway at Possum Brush based on a projection of historical traffic data from nearby permanent counting stations. Tables 2 & 3 show the level of service.

Table 1 – Projected AADT and 100th Highest Hour

Projected AADTs South of Failford Road

Year	AADT
2005	14850
2010	17736
2020	23507
2030	29278

Projected AADTs at Tritton Road

Year	AADT
2005	11974
2010	14399
2020	19248
2030	24098

Directional Splits - 100th Highest Hour

Year	Veh/ Hour	30% split	70% split	50% split
2005	1348	405	944	674
2010	1611	483	1128	806
2020	2135	641	1495	1068
2030	2660	798	1862	1330

Directional Splits - 100th Highest Hour

Year	Veh/ Hour	30% split	70% split	50% split
2005	1088	326	761	544
2010	1308	392	916	654
2020	1748	525	1224	874
2030	2189	657	1532	1094

The northbound carriageway will be transformed into a two-way service road for both the ‘A’ and ‘M’ Class Options. Traffic volumes will be different for the two options because more restricted access control is provided on the ‘M’ class option, particularly on the western side.

For the ‘M’ class option the western service road will carry traffic from the Failford Interchange, Possum Brush Road and Tritton Road. The estimated volumes and LOS is shown in Table 2.

Table 2 – Projected daily volumes & LOS on Western Service Road

	‘A’ Class Option	**‘M’ Class Option**
2010 LOS	1294 A	1434 A
2020 LOS	1626 A	1766 A
2030 LOS	1968 A	2108 A

Road Capacity

The Level of Service (LOS) for the predicted future Highway traffic volumes is shown is Table 3.

Traffic flow modelling indicates that this section will meet the requirement to provide LOS C (or better) up until at least 2030.

Table 3 - Projected Volumes and Level of Service (LOS) – Worst Case Split (70/30)

YEAR/OPTION	Pacific Hwy South of Failford Road (Two Way Daily Flow)	Pacific Hwy South of Failford Road (One Way 100th Highest Hour)
Existing Road		
2005	14850	944
LOS NB C/way	A	A
LOS SB C/way	A	A
2010	17736	1128
LOS NB C/way	B	A
LOS SB C/way	B	A
New Road		
2010	17736	1128
LOS 'A' Class	B	A
LOS 'M' Class	B	A
2020	23507	1495
LOS 'A' Class	B	B
LOS 'M' Class	B	B
2030	29278	1862
LOS 'A' Class	B	B
LOS 'M' Class	B	B

YEAR/OPTION	Pacific Hwy Tritton Road (Two Way Daily Flow)	Pacific Hwy Tritton Road (One Way 100th Highest Hour)
Existing Road		
2005	11974	761
LOS NB C/way	A	A
LOS SB C/way	A	A
2010	14399	915
LOS NB C/way	A	A
LOS SB C/way	A	A
New Road		
2010	14399	915
LOS 'A' Class	A	A
LOS 'M' Class	A	A
2020	19248	1224
LOS 'A' Class	B	B
LOS 'M' Class	B	B
2030	24098	1532
LOS 'A' Class	B	B
LOS 'M' Class	B	B

Intersection Capacity

Modelling indicates that the Failford Road intersection is currently operating above capacity. For all other intersections within the study area capacity issues are likely to develop by year 2010 without some form of upgrade.

For both the 'A' Class and 'M' Class Option intersections are expected to operate satisfactorily up to 2030.

Travel Savings

Modelling of traffic flows on the existing and proposed highway indicates that travel speeds on the northbound carriageway will increase from 80-90kph (the posted speed limit) to 105kph (110kph posted speed limit) when the upgrade is completed. Travel speeds on the southbound carriageway will increase from 100kph (the posted speed limit) to 105kph (110kph posted speed limit). The new northbound carriageway will also be 117m shorter than existing. These improvements represent a saving of 30 seconds per vehicle for northbound traffic and 6 seconds per vehicle for southbound traffic.

Travel time savings will be relatively minor for this 3.59km long section but when combined with other savings along the Pacific Highway will be significant in aggregate.

Accident Analysis

Accident data on the section of Pacific Highway from Tritton Road to Failford Road was analysed for a 5-year period from 01 January 1999 to 31 December 2004. In this period there were 86 reported accidents with 3 fatalities and 31 injury accidents (51 injuries) and 52 tow aways.

Figure 2 - Accidents

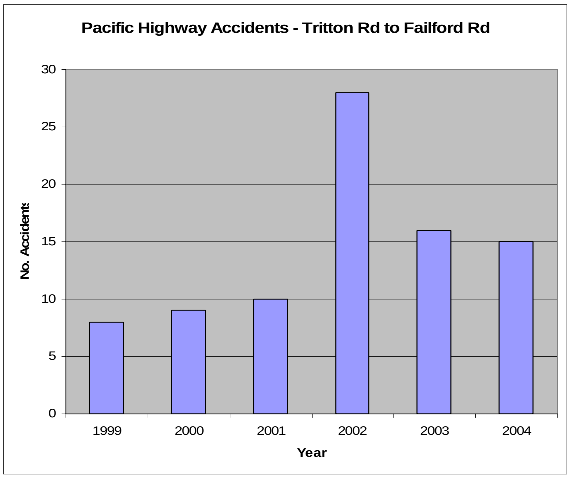


Table 4- Accident Severity by year

Accident Severity	Pacific Highway - Triton Road to Failford Road					
	1999	2000	2001	2002	2003	2004
Fatal Accident	0	0	1	2	0	0
Injury	3	2	3	10	9	4
Towaway	5	7	6	16	7	11
Total	8	9	10	28	16	15
AADT	12212	12748	13301	13870	14455	15057

Analysis of existing accident data and consideration of the nature of the new road indicate that there will be a considerable improvement in the safety performance of the improved road when compared to existing accident rates.

At present, there are 73 accidents per 100MVK on the section. On the basis of comparison with similar roads carrying similar traffic volumes, it is predicted that accident rate on the new road for the ‘A’ Class option will fall to 30 per 100MVK and for the ‘M’ Class option 15 per 100MVK. This represents a saving of at least 7 accidents per year. This is a significant reduction because the accidents are of the more serious nature being fatal, injury or tow away.

Economic justification

Both options provide significantly improved travel conditions along the route and as such will support economic development.

Based on RoadNet’s estimate of costs, both options will provide a return to the community of at least twice the investment, which is a key funding requirement for road projects.

The ‘A’ class option has a Benefit Cost Ratio (BCR) of 2.18 at 7% discount rate.

The ‘M’ class option has a Benefit Cost Ratio (BCR) of 2.22 at 7% discount rate.

Cyclists, Pedestrians and Buses

Provision is made in the design for cyclists to safely travel along the corridor by way of a 2.5m wide sealed shoulder. Squeeze points would be avoided in the detailed design (for example at drainage structures or bridges) unless suitable alternative arrangements are made for cyclists. Road crossing points would be limited to intersections at which provision would be made for safe pedestrian and cycle access.

Buses will travel along the deviation but it is unlikely that they will stop. It is expected that all bus stops would be on the local road network.

Pedestrian activity on the deviation would be minimal due to limited access. Accordingly, there is no special provision made for pedestrians. A 2.5m wide sealed shoulder will be provided where pedestrians can walk clear of the traffic if necessary.

Cumulative impacts on the road network

This project will provide only a small improvement to travel time but will have a significant improvement to safety. Together with other improvements to the Highway this project will have the cumulative effect of providing a route that is more attractive to potential users. It will facilitate additional travel on the Highway for tourist and for the movement of freight. It will marginally reduce the cost of travel for road users.

There does not appear to be any adverse cumulative impacts resulting from the proposal.

1 INTRODUCTION

The RTA is investigating road improvements to the Pacific Highway between Failford Road and Tritton Road, Possum Brush, a distance of approximately 3.6km. The section is currently dual carriageways however the northbound carriageway is of lesser standard having previously been a section of a two way Highway. The road alignment contributes to a relatively high accident rate on the section. The project is being developed to improve the alignment of the northbound carriageway, reduce accidents, rationalise property access and upgrade intersections.

The project essentially involves improving northbound traffic flow within the section. A new southbound carriageway will be constructed parallel to and east of the existing relatively recent southbound carriageway, constructed during the 1980s. Northbound traffic will then travel on the existing southbound carriageway. Two main options are proposed, the ‘A’ Class option with a combination of at grade and grade separation intersections and the ‘M’ Class Option with full access control and grade separation. It is assumed for analysis purposes that construction will commence in 2009 and be completed in 2010.

The Failford Road intersection is currently being upgraded to a seagull configuration as part of the Highway upgrading project immediately to the south. This is an interim measure pending the construction of the project identified in this traffic study.

The project requires an Environmental Impact Assessment (EIA) to be prepared as part of the approvals process. The EIA considers many issues including traffic, transport and economic analysis. RoadNet Pty Ltd has been engaged by RTA Technology and Technical Services, Business Section, Hunter Region to carry out a traffic study and economic analysis for the preferred option.

A detailed assessment process was undertaken that examined various access arrangements to ensure that the ‘Preferred Option’ best meets current social, economic and environmental objectives. The RTA undertook this selection process.

This traffic study provides existing and future predicted traffic volumes, conducts analysis of intersection performance and includes an economic analysis on the preferred option. The study also examines traffic impacts relating to construction and staging.

The report has been prepared with reference to RTA Guidelines, Austroads Guidelines, Australian Standards, Council’s Codes and Department of Planning EIS Guidelines.

2 SCOPE

This report contains:

- A description of the Traffic/Transport requirements on a local, regional and state basis;
- A review and full consideration of existing traffic studies;
- A detailed analysis of the traffic accident history of the section of existing Pacific Highway within the Study Area and of specific locations within that section;
- Consideration of:
    1. Level of Service requirements;
    2. Interchange/intersection options, both location and form;
    3. Property access;
    4. Public transport requirements;
    5. Cyclists/pedestrians;
    6. Heavy vehicles;
- Traffic modelling;
- Intersection modelling;
- Economic analysis;
- An assessment of potential impacts on traffic flows during construction.

3 METHODOLOGY

3.1 Review of existing traffic studies

The traffic volumes used in this study have been obtained from historical count data contained in the RTA's Traffic Volumes Publication and other Pacific Highway Planning Studies.

Reference is also made to existing reports such as:

- Sinclair Knight Merz. 'Cumulative Impacts Assessment on the Pacific Highway'. June 2000.
- Sinclair Knight Merz. ' Pacific Highway Upgrade Possum Brush to Bundacree Creek. Traffic Working Paper'. June 2001.
- Auslink Green Paper. 2001.
- GHD 'Great Lakes Road and Traffic Study' (Draft 2005)

3.2 Accident Analysis

A detailed analysis of the traffic accident history of the section of the existing Pacific Highway within the Study Area has been made. This has been carried out on the basis of accident data for the 5 year period from 01 January 1999 to 31 December 2004.

The analysis involves examining all elements of the accident records such as time of day, weather conditions, type and severity etc.

Predicted reductions in the number of accidents on the section are used as part of the justification of the project.

3.3 Traffic Data Collection and Analysis

Existing conditions have been quantified by way of vehicle classification traffic counts taken on the northern and southern sections of the project during 2005.

Council has provided classification counts taken in 2004 in Failford Road and classification counts taken on the Pacific Highway either side of the Study Area in March 2005.

RoadNet carried out peak hour intersection counts at the four junctions on the section in February 2005. A numberplate survey was also conducted over a four-hour period one weekday morning including the peak period to quantify traffic patterns in Bullocky Way.

Future volumes have been predicted from historic traffic data and from discussions with Council personnel in relation to future development in the immediate locality and in major centres such as Forster/Tuncurry and Hallidays Point.

Future conditions have been modelled for 10, 20 and 30 years into the future.

3.4 Traffic modelling

Traffic modelling has been carried out to determine the:

- Performance of the section of Highway in terms of travel speeds and Level of Service.
- Performance of intersections.

The performance of the section has been assessed using the Florida Department of Transport Level of Service software, which is based on the Highway Capacity Manual.

The performance of proposed intersections has been modelled using the SIDRA model.

3.5 Economic Analysis

An economic analysis for the Project has been carried out in accordance with the RTA's Economic Analysis Manual, 2004. Costs were based on December 2003 figures updated to June 2005 $. The objective is to generate an economic model for the project that provides a Benefit/Cost ratio that will give an indication of the economic viability of the proposal.

This has been done by quantifying the difference in performance between the existing and proposed traffic arrangements in the Study Area, applying a factor for expected traffic growth and carrying out an analysis in terms of the Economic Analysis parameters. Results are provided in terms of benefit cost ratio and first year rate of return.

This essentially means measuring the difference in travel times along the Highway between the existing arrangement (that has reduced speed limits) and the proposed arrangements (with a desirable 110kph speed limit), plus the difference between the existing cost of accidents and the predicted safer arrangements, plus the expected improvement in riding quality of the new road (which will reduce the wear and tear on vehicles and reduce fuel usage due to improved alignment). The difference in delays at intersections is also considered.

Estimates of cost included in the analysis are RoadNet's estimates to a strategic level of confidence.

It is assumed only for the purposes of modelling that construction will commence in year 2009 and would become available to traffic in 2010.

Other assumptions are detailed in the section 7.2 Traffic Modelling Assumptions.

3.6 Traffic impacts during construction

Staging of the proposal, method and duration of construction, and quantity and sources of fill material has been considered in the assessment of traffic and safety impacts during construction.

3.7 Justification of the Project

Justification of the project was determined in this traffic study in several ways. Both options will:

- Improve safety by reducing the number of accidents to a rate consistent with other sections of dual carriageway on the Pacific Highway;
- Improve capacity of intersections;
- Improve travel times;
- Provide a positive return on investment, i.e. a Benefit Cost Ratio greater than 2 (based on RoadNet's estimate of cost).

An assessment of the "do nothing" option has been undertaken in general terms to set the context for considering the proposed upgrading. This has been applied to the economic analysis where it is assumed that the Failford Road intersection must be upgraded in the foreseeable future to accommodate traffic growth resulting from local development and growth in through traffic on the Highway.

4 THE PROPOSAL

4.1 Location

The section of highway to be upgraded extends from new dual carriageway currently under construction immediately to the south of Failford Road and rejoins the existing dual carriageway alignment approximately 3.6km to the north at Tritton Road.

The southbound carriageway was constructed in the 1980's on a high standard alignment designed to form part of a future dual carriageway road. The northbound carriageway is of lesser standard having previously been a section of a two way Highway. It was retained to provide overtaking opportunities when the southbound carriageway was constructed.

The purpose of this current proposal is to provide a road with a standard of travel consistent with the sections of dual carriageway already existing to the north of Tritton Road and the proposed new section of dual carriageway to the south of Failford Road.

Appendix A contains aerial photographs showing the new alignment and options.

Figure 3 – Study Area

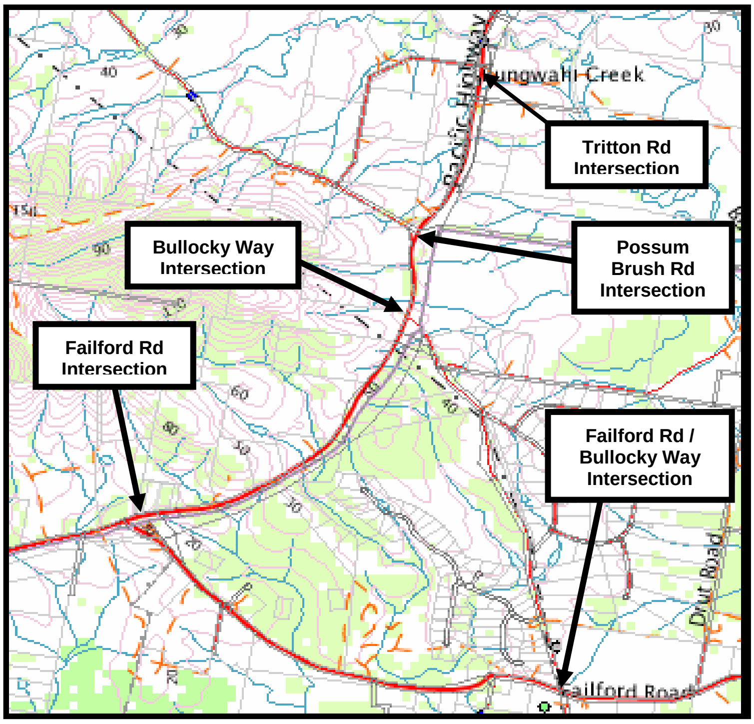


Figure 4 - Locality Sketch

4.2 Description of Proposal

The existing northbound carriageway of the Pacific Highway at Possum Brush was formerly a two-way section of the Highway and has an undulating and winding alignment. A new carriageway is proposed to replace this carriageway to make the Highway an access controlled four-lane Highway to 110km design speed.

The existing northbound carriageway will become a service road and a new southbound carriageway will be constructed parallel and east of the relatively recent southbound carriageway constructed during the 1980s. The existing southbound carriageway would then become the northbound carriageway.

The proposed upgrading of the Pacific Highway will provide a controlled access road which will restrict property access to service roads that will link to controlled intersections.

Two options are being considered for access - a ‘M’ class (motorway) option and an ‘A’ class (arterial) option. Both options involve a new interchange immediately south of Failford Road with the ‘M’ class option also involving an overpass at Bullocky Way.

The **‘M’ Class option** involves limiting access to the interchanges previously described. This would be achieved by way of service roads.

The existing northbound carriageway will become a two way service road linking the Failford Road interchange to Possum Brush Road and Tritton Road. The Failford Road interchange would be a ‘Dumbbell’ design with a single lane roundabout on each side to control traffic on the ramps and service roads.

The existing Failford Road intersection will be closed and Failford Road will link to the proposed interchange just to the south. A southbound offload ramp will be constructed just north of the existing Failford Road intersection for southbound traffic. This will connect to Failford Road just east of the Highway as a T intersection.

An overbridge will be constructed at Bullocky Way for the ‘M’ class option only, where the service road will cross the Highway to provide local access to Bullocky Way and along the eastern side of the new Highway. There will be no ramps to or from the Highway at this site.

See Appendix A for ‘M’ Class Option Layout Plans.

The **‘A’ Class option** would allow staged upgrading to eventually achieve the ‘M’ class option.

The existing northbound carriageway will be converted to a 2-way service road from the Failford Road interchange to Possum Brush Road. Property access on the western side of the Highway will be gained from the interchange.

Highway access at the Possum Brush Road intersection will allow left turns out for northbound traffic. The existing Highway north of Possum Brush Road will be converted to an onload ramp to the new northbound carriageway.

The Tritton Road intersection will be closed and the cross median access removed. Access to Tritton Road will be from Possum Brush Road. The Bullocky Way intersection will be restricted to left turns in and out only.

The existing Highway on the southern end is currently a single carriageway, two-lane road that is currently being upgraded to a dual carriageway standard. A seagull arrangement is being constructed for the Failford Road intersection as part of that work. Access to and from St Peters Close will be via left turn and downstream U Turns.

End treatments will be common to both options. The existing Highway on the southern end is a single carriageway two-lane road, which is currently being upgraded to a dual carriageway standard.

The proposed upgrade would link into an existing high standard dual carriageway section on the northern end.

4.3 Review of existing traffic studies

4.3.1 Sinclair Knight Merz. ‘ Pacific Highway Upgrade Possum Brush to Bundacree Creek. Traffic Working Paper’. June 2001.

The Study examined traffic volumes and patterns generally through the locality and specifically on several roads including the Pacific Highway at Nabiac and on Failford Road.

Pacific Highway

The Study identified from historic traffic data that the growth rate was 3% compound (4.2% linear) in recent years, i.e. leading up to year 2001.

The Study makes reference to the Cumulative Impacts Assessment for the Pacific Highway undertaken by Sinclair Knight Merz in year 2000. On the basis of that report and other analysis it was predicted that the Highway at Nabiac would have a year 2020 AADT of 21,380 that equates to a 3% compound or 4.2% linear growth rate on 2001 base year.

This equates to an AADV of 16,446. The design hour volume (30^{th} highest hour = 15% of AADV) in year 2020 was calculated as 2,467 (two way) and 1,480 (peak direction).

Failford Road

The Study identified a considerable variation in growth rates over time on Failford Road. Between 1985 and 1990 the rate was 6.3% pa, then 4.2% pa to 1997 then 13.5% pa to year 2000. The AADT in year 2000 was calculated as 3081 after seasonal adjustment.

The Study predicted the volumes shown in Table 5.

Table 5 – Predicted Volumes on Failford Road

Year	Predicted volumes @ (3% Growth Rate)	Predicted volumes (Extrapolated from data)
2005	3572	4694
2015	4800	7921
2020	5565	9534

4.3.2 GHD 'Great Lakes Road and Traffic Study' (Draft 2005)

The Great Lakes Road and Traffic Study mainly focuses on the built up areas of Forster and Tuncurry. It provides some existing and projected volumes on The Lakes Way but not on Failford Road. It has adopted a linear growth rate of 3% for predicting future volumes on The Lakes Way.

4.3.3 Auslink Green Paper. 2001.

The Study identified a significant increase in the movement of freight along the Pacific Highway by year 2020. The traffic implications have been taken into account for this project.

4.3.4 Sinclair Knight Merz. 'Cumulative Impacts Assessment on the Pacific Highway'. June 2000.

The Study identified that the Highway at Nabiac would have a year 2020 AADT of 21,380 that equates to a 3% compound or 4.2% linear growth rate on 2001 base year.

This equates to an AADV of 16,446. The design hour volume (30^{th} highest hour = 15% of AADV) in year 2020 was calculated as 2,467 (two way) and 1,480 (peak direction).

5 EXISTING ROAD AND TRAFFIC CONDITIONS

5.1 Description of the Study Area

Major towns in the vicinity of the site include Nabiac 6km to the south and Bulahdelah a further 55km to the south; Foster Tuncurry 20km to the east via Failford Road and The Lakes Way; 35km north to the Taree / Old Bar Road interchange.

The section of Pacific Highway subject of this study is rural in nature and passes through cleared agricultural land and forested areas.

Immediately to the north of the Failford Road intersection the Highway diverges into two carriageways. The northbound carriageway is on a winding and undulating alignment. The southbound carriageway is on a relatively straight and even alignment.

Intersections with the Highway from south to north are described in the following.

Failford Road leads off to the east and is the main route into Hallidays Point, Tuncurry and Forster. Directly opposite Failford Road is St Peters Close, which provides access to a small number of properties and the Failford cemetery. All traffic movements are permitted at this cross intersection.

Bullocky Way is also located on the eastern side of the Highway to the north of Failford Road. Bullocky Way provides access to rural residential properties and forms a link to Failford Road. Some vehicles use Bullocky Way to access Failford Road rather than using the Pacific Highway/Failford Road intersection. A wide median crossing exists for access to and from the northbound carriageway.

The Possum Brush Road intersection is located to the north of Bullocky Way on the western side of the Highway. This provides access to a quarry and rural properties. A break in the median exists for access to and from the southbound carriageway.

Tritton Road exists to the north of Possum Brush Road on the western side of the Highway linking back to Possum Brush Road to the west and provides access to a small number of rural properties.

5.2 Regional Road Network

The Pacific Highway is the major north south highway in NSW linking Sydney and Brisbane. It is classified as a State Road.

The Forster / Tuncurry area is a major regional centre and Hallidays Point is emerging as a major urban area. These centres attract significant volumes of tourist, commuter, shopping and business traffic from villages and towns located on the Mid North Coast of NSW. Failford Road is the prime access to these areas from the south. The Lakes Way, approximately 10 km to the north of Failford Road, is the main northern access to the coastal centres of Hallidays Point, Tuncurry and Forster. Both The Lakes Way and Failford Road are classified as Regional Roads.

5.2.1 Failford Road

Failford Road is a two-lane rural road that runs in an east-west direction for 5km until it meets The Lakes Way.

Failford Road forms a cross intersection with the Highway. A relatively narrow median separation is provided in the Highway with limited storage area that cannot fully contain a large truck. Vehicles turning right out of Failford Road (40 vph in the am peak hour) experience difficulties due to the narrow median and the heavy right turn movement into Failford Road.

Turning movements into and out of Failford Road are predominantly to and from the south (280vph in the am peak) compared to 55vph to and from the north. There is very little cross movement into St Peters Close.

A seagull intersection is currently being constructed at the intersection to increase safety in the immediate future.

5.2.2 The Lakes Way

The Lakes Way (Main Road 111) is a two-lane rural road and is the main northern access to Hallidays Point, Tuncurry and Forster. A grade separated interchange has recently been completed at The Lakes Way and Pacific Highway intersection. It joins the Pacific Highway approximately 10 km to the north of Failford Road and runs generally north south past Failford Road into Tuncurry and Forster.

Failford Road has been in recent times the signposted route from the north to Forster / Tuncurry due to road safety and road condition issues associated with the northern end of The Lakes Way.

5.3 Local Road Network

5.3.1 St Peters Close

St Peters Close is a deviated section of the Old Pacific Highway and now provides access to a cemetery and several properties on the western side of the Highway. It forms the western leg of a cross intersection with the Pacific Highway / Failford Road intersection.

5.3.2 Bullocky Way

Bullocky Way provides a link to Failford Road and services a rural residential estate. Vehicles bypassing the western end of Failford Road use the Bullocky Way intersection with the Highway. This is primarily due to the difficulties in turning right at Failford Road as described above. Bullocky Way has ample median island storage length and there are very few opposing right turn vehicles from the Highway. Pacific Blue Metal operate a quarry in Bullocky Way approximately 0.8km from the Highway.

The Bullocky Way intersection has recently been upgraded with a left turn deceleration lane for southbound traffic.

A load limit is imposed on Bullocky Way which forces quarry trucks to use Failford Road to gain access to the Highway.

5.3.3 Possum Brush Road

Possum Brush Road serves residential dwellings from the Pacific Highway and experiences relatively low volumes of traffic. A quarry (also operated by Pacific Blue Metal) is also located off Possum Brush Road approximately 3.0km from the Highway. Possum Brush Road and Pacific Highway intersection is a T intersection with a relatively large median storage area. The median storage area is adequate to cater for the low volumes of vehicles accessing the road.

5.3.4 Tritton Road

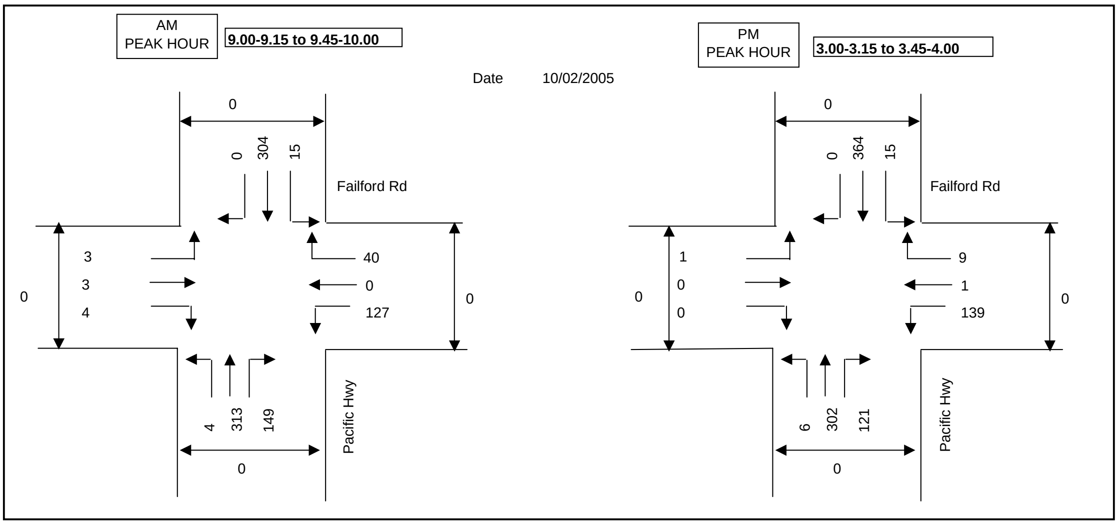
Tritton Road serves residential dwellings and links from the Pacific Highway to Possum Brush Road. It experiences relatively low volumes of traffic. The Tritton Road and Pacific Highway intersection is a T intersection with a median storage area. The median storage area is adequate to cater for the low volumes of vehicles accessing the road.

5.4 Existing Traffic Volumes

5.4.1 Intersection counts

Peak hour traffic counts were taken at all intersections on the Study length of the Pacific Highway in February 2005 for morning and evening peak hours. Refer to Figures 6 to 9. Side road activity would be highest during these periods however highway flow is often higher during the middle of the day.

Figure 6 - Traffic count at Failford Road/ Pacific Highway intersection



U-Turns Northbound Traffic

8:15 - 8:30 1 heavy
8:30 - 8:45 1 heavy
8:45 - 9:00 1 heavy
9:15 - 9:30 3 heavy
3:15 - 3:30 1 heavy
4:00 - 4:15 3
4:15 - 4:30 1
4:45 - 5:00 1

U-Turns Southbound Traffic

8:00 - 8:15 3
8:15 - 8:30 2
8:30 - 8:45 2

Figure 7 - Traffic count at Bullocky Way / Pacific Highway intersection

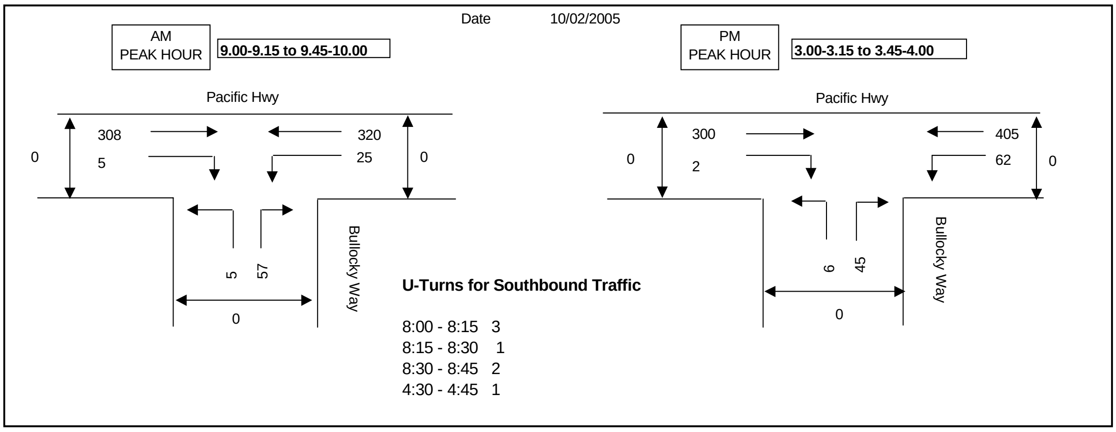
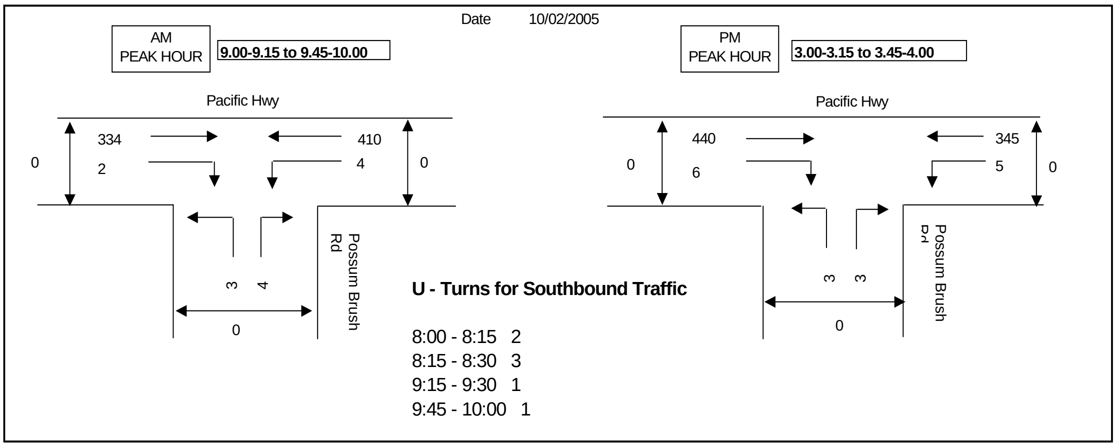
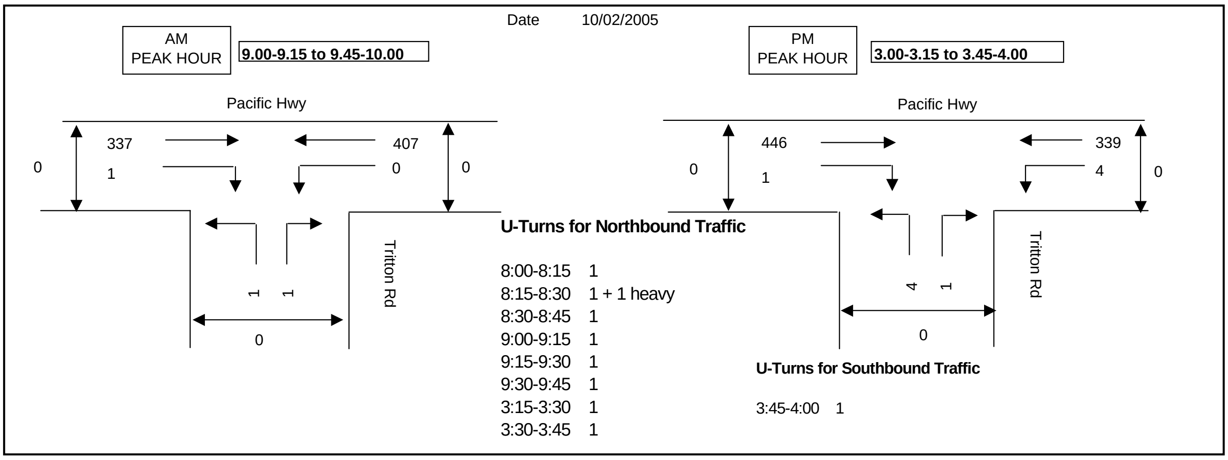


Figure 8 - Traffic count at Possum Brush Road / Pacific Highway intersection



A quarry operated by Pacific Blue Metal exists in Possum Brush Road approximately 3.0km from the Highway. The Quarry manager indicated that the quarry generates approximately 20 to 110 truckloads per day (average of 50 per day based on yearly material tonnage). These truck movements were not observed during the intersection counts but may equate to 10 trucks during peak hours and peak quarry operation. The quarry has also advised the RTA that it has approximately 90 years of life remaining at currently levels of extraction.

Figure 9 - Traffic count at Tritton Road / Pacific Highway intersection



5.4.2 Origin and Destination Survey – Bullocky Way

A number plate survey was conducted for Bullocky Way to determine the traffic volumes using Bullocky Way as an alternative route to gain access to the Pacific Highway and Failford Road.

The survey was conducted on the 10th February 2005 between the times of 7am and 11am. Numberplates were identified in both directions on both ends of Bullocky Way. There were 432 vehicles recorded during this time. Approximately 60% of vehicles using Bullocky Way were through traffic to/from the Pacific Highway or Failford Road. 40% of vehicles using Bullocky Way were local traffic with a destination along the route.

Table 6 – Percentage of through and local traffic (7am to 11am)

Movement in Bullocky Way	Northbound		Southbound		Total Percent
	Light	Heavy	Light	Heavy	
Total traffic	277	17	133	5	100
Local Traffic	102	13	48	4	39
Thru Traffic	175	4	85	1	61

5.4.3 Hourly Traffic Volumes

The volumes shown in the following figures are those taken on the survey period in February 2005 and adjusted to align with the AADT. A correction figure of 7% has been applied to the counted figures. This has been done by comparing the relevant historical data from a permanent counting station located 20km to the north contained in the RTA's Traffic Counting Publication.

Figure 10 – Hourly Volumes on Pacific Highway south of Failford Road.

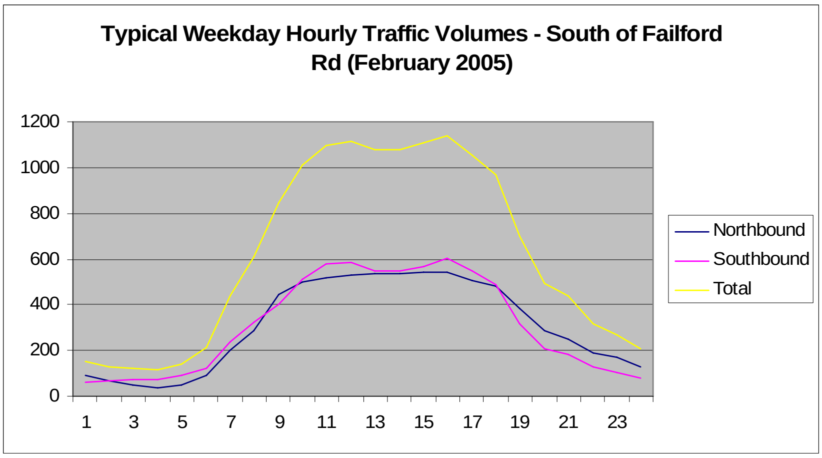
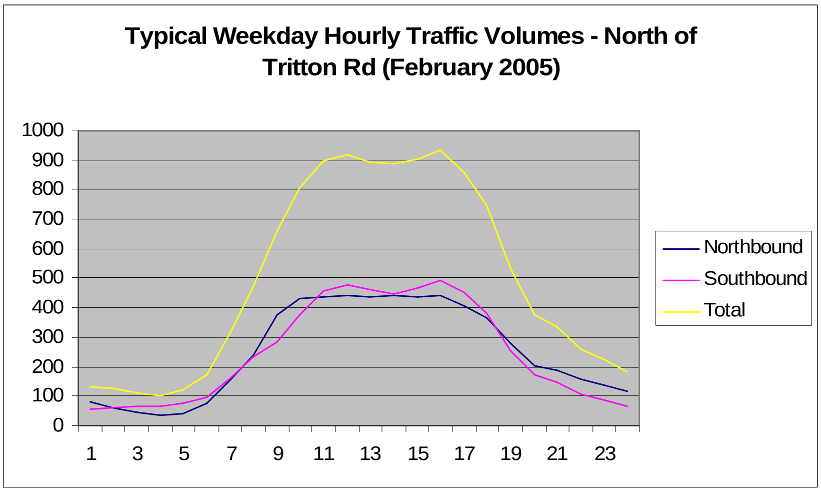


Figure 11 – Hourly Volumes on Pacific Highway north of Tritton Road



5.4.4 Daily Traffic Volumes

The volumes shown in the following figures are those taken on the survey period in February 2005 and adjusted by +7% to align with the AADT.

The corrected AADT (2005) 300m South of Failford Road is 14850 and for 80m North of Tritton Road 11974.

Figure 12 – Daily Volumes on Pacific Highway South of Failford Road

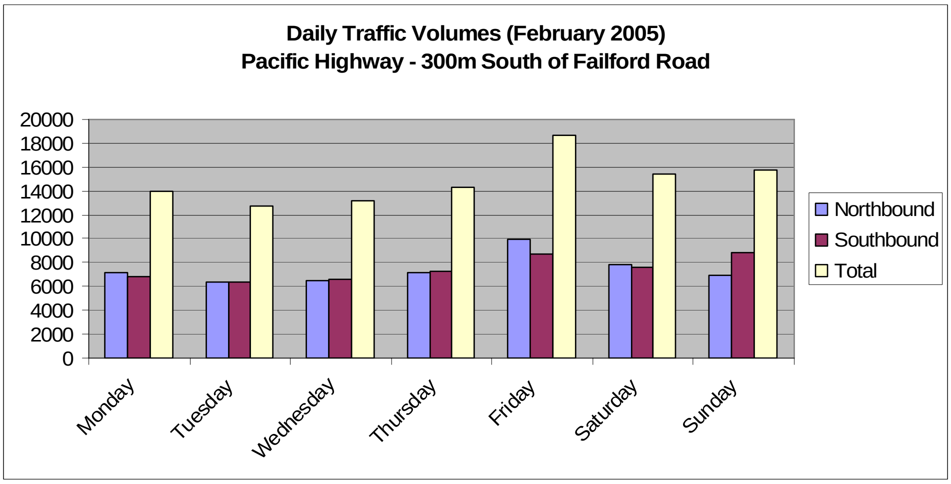
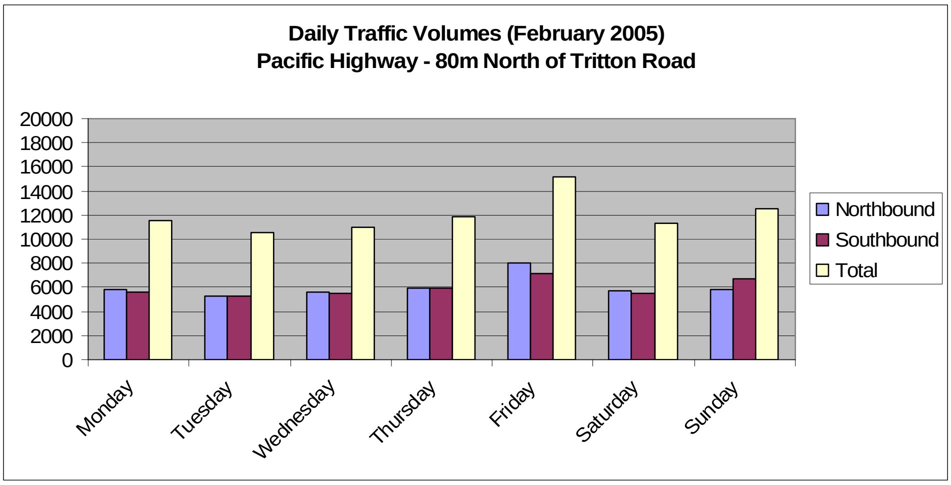


Figure 13 – Daily Volumes on Pacific Highway North of Tritton Road



The difference in volumes between the volumes in figures 12 and 13 relate to turning traffic at Failford Road, to and from the south. It is also interesting to note that Friday volumes are heavier northbound and on Sunday are heavier southbound.

Table 7 – Average Daily / Average Weekday Volumes

Ratio - Average Daily Traffic to Average Weekday Traffic

Location		Average Daily Traffic	Average Weekday Traffic	ADT / AWT
Pacific Highway - 300m South Of Failford Rd	Northbound	6922	6936	0.998
	Southbound	6952	6670	1.042
Pacific Highway - 80m North of Triton Road	Northbound	5659	5802	0.975
	Southbound	5601	5535	1.012

5.4.5 Heavy Vehicles

Heavy vehicles account for approximately 20-25% of total traffic on the Highway within the section.

Table 8 – Table showing vehicle types on Pacific Highway

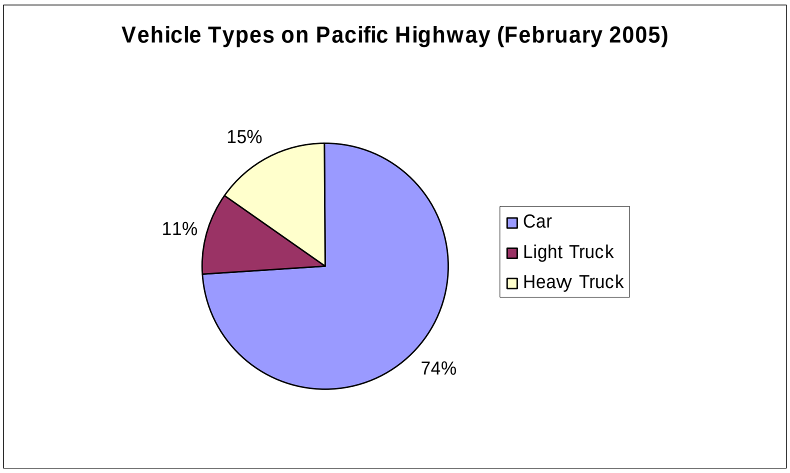
Location	Type of Vehicle	Percent
Pacific Highway - 80m North of Triton Road	Car	76.4
	Light Truck	10.5
	Heavy Truck	13
Pacific Highway - 300m South of Failford Road	Car	78.5
	Light Truck	10.7
	Heavy Truck	10.8

Car relates to vehicle classes 1 & 2.

Light truck relates to vehicle classes 3, 4 and 5.

Heavy Truck relates to vehicle classes 6 to 12.

Figure 14 – Vehicle Types on Pacific Highway



Pacific Blue Metal operates quarries in Bullocky Way, approximately 0.8km form the Highway, and in Possum Brush Road, approximately 3.0km from the Highway. The quarry manager indicated that the Possum Brush quarry generates approximately 20 to 110 truckloads per day (average of 50 per day based on yearly material tonnage). The Possum Brush Road quarry has approximately 90 years of remaining life and the Bullocky Way quarry has approximately 30 years of life left.

Trucks from the Bullocky Way quarry have to travel via Bullocky Way and Failford Road to the access the Highway as Council has imposed weight load restrictions on Bullocky Way north of the quarry.

5.5 Traffic Growth

Data from permanent traffic counting stations to the north and south of the study area were used and extrapolated to provide traffic projections for the project. Figure 14 shows volumes at a site approximately 75km to the north near the Oxley Highway. This has a projected growth rate of 4.56% linear. Figure 15 shows volumes of a site approximately 11km to the south at Nabiac. This has a projected growth rate of 4.05% linear.

The closest site at Nabiac with 4.05% growth is used for traffic projections on this project.

Figure 15 – Traffic Projection. Pacific Highway south of Oxley Highway

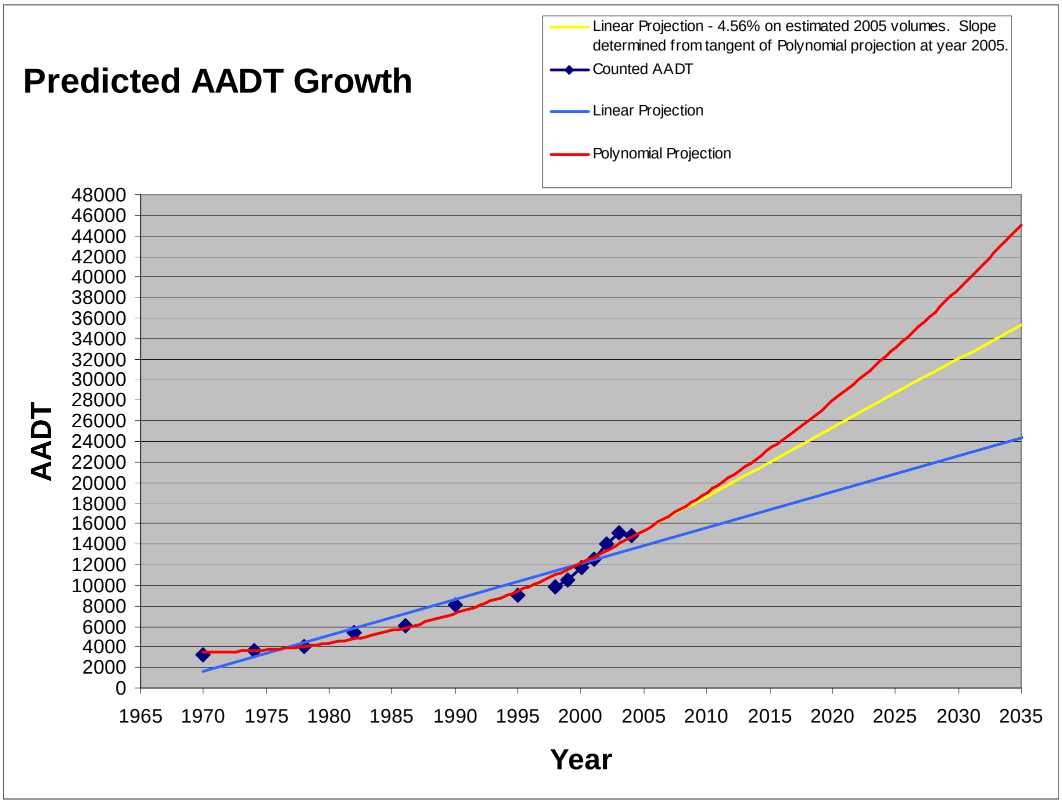
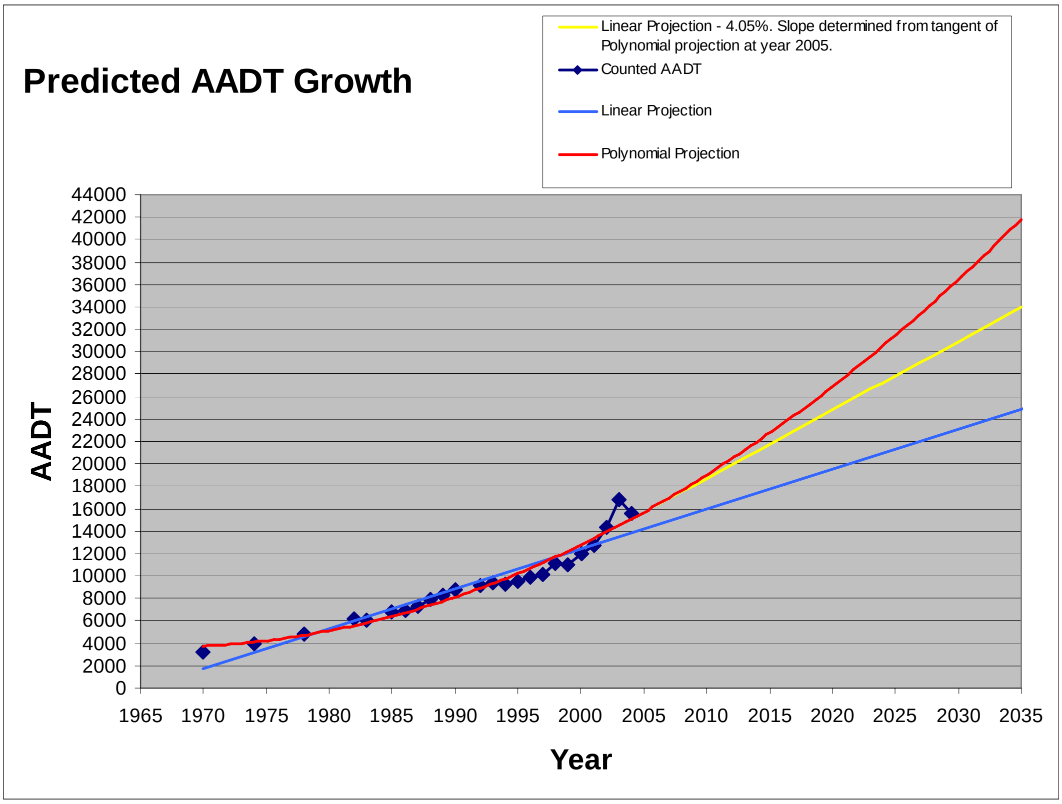


Figure 16 – Traffic Projection. Pacific Highway at Wallamba River, Nabiac



5.6 Calculation of the Design Hour

The project objectives require that the project be designed to accommodate the 100th highest hour at no worse than LOS 'C' 20 years after opening.

The design hour has been obtained using the following methodology.

- A typical week from classification counts undertaken in February 2005.
- The average daily traffic was calculated from this week and a growth factor of 1.065 applied to bring to survey period up to the AADT consistent with data from the previous year.
- 100th highest hour obtained from records of 2004 counts by RTA for all hours of the year. The raw count data had some inaccurate or corrupt data. This data amounted to 35% of the total hours and was deleted for the calculation.
- The 65th highest hour for year 2004 was utilised instead to take account of the reduced sample size. This hour is 61% of the highest hour for the year.

Table 9 – Sorted highest hours from permanent counting station at Wallamba River, Nabiac.

Highest Hour	Date	Time	NB	SB	Total
1	20050102	10:00	1189	1392	2581
60	20041226	12:00	1082	509	1591
61	20041009	11:00	660	917	1577
62	20040413	14:00	627	948	1575
63	20040412	13:00	613	954	1567
64	20041009	10:00	603	964	1567
100th 65	20040123	14:00	825	740	1565
66	20040412	14:00	542	1019	1561
67	20040614	15:00	562	997	1559
68	20040409	12:00	1026	529	1555
69	20041224	8:00	913	640	1553
70	20040614	11:00	439	1110	1549

Year 2004 data in axle pairs

- It was calculated that the 100th highest hour (before correction was 9.78% of the AADT) and the 65th highest hour was 10.57% of the AADT. The adopted percentage for this study is 10.57%.
- The 2005 AADT is calculated as 14850 (vehicles).
- The percentage of heavy vehicles is 19.2%.
- The 100th highest hour is 9.08% of the AADT - 1348vph.
- 1348vph has been increased by 4.05% over 25 years to year 2030 to give a design hour volume of 2660 (two way).
- The design hour volume (2660vph) is 112% higher than the year 2005 volumes. For modelling purposes intersection volumes are adjusted by the same proportion to reflect future demand. In addition, the 100th highest hour from historical data had an even directional split (53% northbound and 47% southbound). An examination of the data showed the 95th and 110th highest hours have directional splits of 70/30 in both directions. Both the even (50/50) and the worst-case (70/30) directional splits have been assessed in calculating the level of service.

Table 10 – Design hour directional splits 100th Highest Hour

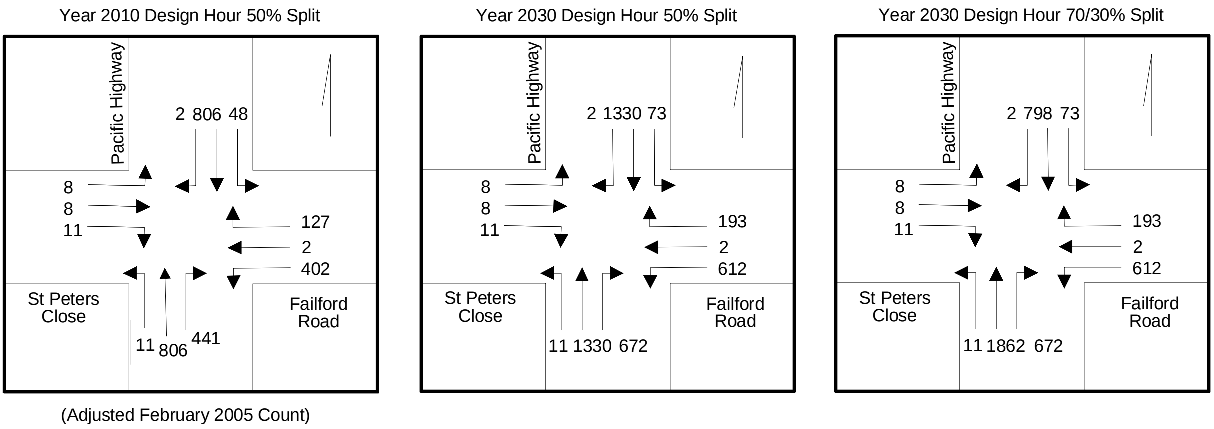
Directional Splits - south of Failford Road

Year	Veh/ Hour	30% split	70% split	50% split
2005	1348	405	944	674
2010	1611	483	1128	806
2020	2135	641	1495	1068
2030	2660	798	1862	1330

Directional Splits – north of Tritton Road

Year	Veh/ Hour	30% split	70% split	50% split
2005	1088	326	761	544
2010	1308	392	916	654
2020	1748	525	1224	874
2030	2189	657	1532	1094

Figure 17 - Example of Design hour at the Failford Road intersection



5.7 Travel Speeds

Table 11 shows existing and proposed speed limits on the Highway. As with the existing driver behaviour the 85th percentile travel speeds are expected to be similar to the posted limit.

Table 11 - Existing and Proposed speed limits.

Pacific Highway	Existing Limit (km/h)	Proposed Speed Limit (km/h)
South of Failford Road both carriageways	80	110
Northbound carriageway 1km south Possum Brush Rd and north	90	110
Northbound carriageway 500m north Possum Brush Rd and north	110	110
Southbound carriageway north of Possum Brush Road	110	110
Southbound carriageway south of Possum Brush Road	100	110

Intersections (including on and offload ramps) would be designed to take account of the new speed environment.

5.8 B-Doubles

An objective of the Pacific Highway upgrading in general is to cater for efficient movement of freight.

The design of the project makes provision for use by B-Doubles, including adequate turning paths at intersections.

5.9 Cyclists, Pedestrians and Equestrians

The existing northbound carriageway on the Highway is on a winding and undulating alignment with a narrow outside shoulder. The road is unsuitable for bicycle use.

Provision is made in the design of the new carriageway for cyclists to safely travel along the road by way of a 2.5m wide sealed shoulder. Squeeze points would be avoided in the detailed design (for example at drainage structures or bridges) unless suitable alternative arrangements are made for cyclists.

Crossing points on the Highway would be at Failford Road for both ‘A’ and ‘M’ class options and at Bullocky Way for the ‘M’ class option only by way of road overpasses.

Service roads would connect to the overpass. The service roads would carry little traffic and would be suitable for cycle use. Pedestrian activity is currently low and would not be expected to increase significantly. No special facilities are proposed for pedestrians. This means that they would need to walk on the shoulder or grassed verges of the service roads.

Although the existing Highway is set in a typically rural setting no provision is made for equestrians. Equestrians are not expected to use this section of Highway into the future and no special facilities are proposed for equestrians.

5.10 Public Transport

Busways currently operate a public bus service in the Great Lakes region, which also extends to Newcastle and Sydney. Buses for this service travel on the Pacific Highway through the study site but do not stop within the limits of the site.

Busways also operate a school bus service in the area during school semesters in the mornings and afternoons. School buses currently stop within the study site between Bullocky Way and Tritton Road on the southbound carriageway and between Failford Road and Bullocky Way on the northbound carriageway. School buses also stop on the Highway to the north and south of the study site.

Private Coach Services would travel through the section on route north and south, and vice versa, but would be unlikely to stop within the section.

Provision would be made in the design of the project to accommodate school bus stops within the section of the Pacific Highway. Bus stops may be located on the service roads. Incorporating commercial bus stops into the proposed upgrades is not seen as necessary. Public buses and Coaches are not expected to stop at the site.

5.11 Rest Areas

No rest areas or truck stopping bays lie within the study site however adequate stopping opportunities exist to the north and south of the site. A rest area exists 10km north of the site and the small town of Nabiac is located approximately 6km south of the site. Both areas provide adequate stopping opportunities for vehicles.

Rest areas are not seen as necessary within the subject site and are not proposed as part of the Highway upgrade.

6 TRAFFIC ANALYSIS

6.1 General

Traffic modelling has been carried out to compare existing and future traffic conditions on the Highway and intersections throughout the section.

- The Florida Department of Transportation (FDOT) Quality/Level of Service Handbook and analysis software has been used to predict future capacity and performance along the corridor. Reference is also made to AUSTROADS Guide to Traffic Engineering Practice Part 2, Roadway Capacity.
- Intersection modelling has been carried out using the SIDRA model that simulates peak hour flows. The performance is measured by level of service (LOS) and delays.

6.2 Assumptions

General

Traffic on the Pacific Highway will grow at 4.56% linear for the next 25 years.

By year 2010 the Pacific Highway Realignment will have been constructed from Failford Road to Tritton Road.

All future through traffic will use an improved Pacific Highway with a 110km/h travel speed.

The project will be constructed as either the ‘A’ Class option, consisting of an interchange at Failford Road and ‘at grade’ improvements to the remaining intersections within the site, or the ‘M’ Class option where grade separation will be provided at Bullocky Way by way of an overbridge.

Population Growth

Population of the urban areas to the east of the Highway will grow at 3% linear over the next 20 years as predicted in the GHD Traffic Study for Great Lakes Council.

Development will occur at a constant rate over the 20-year period.

Planning Years

Traffic forecasts on the basis of historical information at the 100^{th} highest hourly volume are provided for the following periods:

Year 2005 – existing traffic volumes

Year 2010 – open to the public.

Year 2020 – 10 years after construction for noise assessment.

Year 2030 – 20 years after construction to enable analysis of design to operate at a Level of Service ‘C’ 20 years after construction.

6.3 Highway Capacity

The project aims for a Level of Service no worse than ‘C’ for the 100^{th} Highest Hourly Volume in 20 years after opening.

A detailed analysis was carried out using the Florida Department of Transportation’s (FDOT) software package for the calculation of Level of Service and flows. This software makes provision for more detailed input of the various operational parameters. These include AADT, terrain, % overtaking opportunity, % HV, presence of medians, sheltered turning bays, posted speed zoning, directional flow and design hour flow as a % of AADT. Tables 12 and 13 relate to daily flows with calculations incorporated into the figures that consider the peak hour and directional splits. Table 14 gives details of the output from one direction hourly flow.

Description of Level of Service

A Free Flow whereby drivers are virtually unaffected by others in the traffic stream and can choose their own travel speeds.

B Stable flow with slight inconvenience from others in the traffic stream. Drivers have reasonable freedom to choose their own travel speeds.

C Stable flow with drivers restricted to select desired speed and ability to manoeuvre.

D Approaching unstable flow with drivers being severely restricted in travel speeds in freedom to manoeuvre.

E Unstable flow close to capacity. Minor disturbances in the traffic stream cause breakdown.

F Forced flow with more vehicles approaching than can fit. Queuing and delays result.

Table 12 - Level of Service Vs AADT (FDOT software) BASED ON 70/30 directional split

Rural conditions	A	B	C	D	E
'A' class option. Controlled access 4 lane divided. 100 kph speed limit	15600	25800	36000	43800	48700
'M' class option. Controlled access 4 lane divided. 110 kph speed limit	15400	25300	34300	40700	45100

Table 13 - Level of Service Vs AADT (FDOT software) BASED ON 50/50 directional split

Rural conditions	A	B	C	D	E
'A' class option. Controlled access 4 lane divided. 100 kph speed limit	21800	36100	50400	61300	68100
'M' class option. Controlled access 4 lane divided. 110 kph speed limit	21600	35400	48100	57000	63200

Table 14 - Level of Service Vs VPH – HOURLY FLOW IN PEAK DIRECTION
ie ONE WAY ONLY (FDOT software)

Rural conditions	A	B	C	D	E
'A' class option. Controlled access 4 lane divided. 100 kph speed limit	1150	1910	2660	3240	3600
'M' class option. Controlled access 4 lane divided. 110 kph speed limit	1140	1870	2540	3010	3340

Table 15 shows projections of future traffic volumes on the Pacific Highway at Possum Brush based on a projection of historical traffic data from nearby permanent counting stations. Table 16 shows the level of service.

Table 15 – Projected AADT and 100th Highest Hour

Projected AADTs South of Failford Road

Year	AADT
2005	14850
2010	17736
2020	23507
2030	29278

Projected AADTs at Tritton Road

Year	AADT
2005	11974
2010	14399
2020	19248
2030	24098

Directional Splits - 100th Highest Hour

Year	Veh/ Hour	30% split	70% split	50% split
2005	1348	405	944	674
2010	1611	483	1128	806
2020	2135	641	1495	1068
2030	2660	798	1862	1330

Directional Splits - 100th Highest Hour

Year	Veh/ Hour	30% split	70% split	50% split
2005	1088	326	761	544
2010	1308	392	916	654
2020	1748	525	1224	874
2030	2189	657	1532	1094

Table 16 - Projected Volumes and Level of Service (LOS) – Worst Case Split (70/30)

YEAR/OPTION	Pacific Hwy South of Failford Road (Two Way Daily Flow)	Pacific Hwy South of Failford Road (One Way 100th Highest Hour)
Existing Road		
2005	14850	944
LOS NB C/way	A	A
LOS SB C/way	A	A
2010	17736	1128
LOS NB C/way	B	A
LOS SB C/way	B	A
New Road		
2010	17736	1128
LOS ‘A’ Class	B	A
LOS ‘M’ Class	B	A
2020	23507	1495
LOS ‘A’ Class	B	B
LOS ‘M’ Class	B	B
2030	29278	1862
LOS ‘A’ Class	B	B
LOS ‘M’ Class	B	B

YEAR/OPTION	Pacific Hwy Tritton Road (Two Way Daily Flow)	Pacific Hwy Tritton Road (One Way 100th Highest Hour)
Existing Road		
2005	11974	761
LOS NB C/way	A	A
LOS SB C/way	A	A
2010	14399	915
LOS NB C/way	A	A
LOS SB C/way	A	A
New Road		
2010	14399	915
LOS ‘A’ Class	A	A
LOS ‘M’ Class	A	A
2020	19248	1224
LOS ‘A’ Class	B	B
LOS ‘M’ Class	B	B
2030	24098	1532
LOS ‘A’ Class	B	B
LOS ‘M’ Class	B	B

The existing northbound carriageway will be transformed into a two-way service road for both the ‘A’ and ‘M’ Class Options. For both options the western service road will carry traffic from Failford Road, Possum Brush Road, Bullocky Way and Trittons Road. Traffic volumes on the service road would not be expected to exceed 500 vehicles per day and it operate at LOS “A”.

6.4 Performance of Intersections

The performance of the four intersections along the existing road has been modelled for both existing conditions (year 2005) and for predicted future conditions at 2010 (opening of highway) and at 2030 (20 years after opening).

Intersections are also modelled for proposed improvements including the final design layout.

Table 18 contains a summary of the modelling results.

6.4.1 Pacific Highway / Failford Road

The existing cross intersection is controlled with Give Way signs in Failford Road and in St Peters Close. The intersection currently operates at Level of Service ‘E’ with average peak hour delays to cross traffic of 37 seconds. By 2010 the intersection will operate at LOS ‘F’ if no upgrades are undertaken.

A seagull intersection is currently being constructed at the intersection. This will operate at a LOS ‘C’ when opened in late 2005. In 2010 the seagull intersection will operate at a LOS ‘F’. By this time a grade separated interchange will be constructed at the intersection.

The grade separated interchange will be constructed for both the ‘A’ and ‘M’ Class Options to provide adequate capacity at LOS ‘C’ for the projected traffic volumes in 20 years after opening.

6.4.2 Pacific Highway / Bullocky Way

A ‘T’ junction with a wide median storage area is currently provided. It currently operates at LOS ‘C’. Traffic has little difficulty in turning in or out of Bullocky Way. Traffic can cross the southbound carriageway and wait to turn onto the northbound carriageway in the median crossing. By 2010 the intersection will operate at a LOS ‘E’ and by 2030, LOS ‘F’ if no upgrade is undertaken.

For the ‘A’ Class option Bullocky Way will be restricted to left turns in and out only.

For the ‘M’ Class Option the Bullocky Way intersection at the Highway will be closed and an overbridge will be constructed connecting Bullocky Way to the western service road. No access to the Highway will be provided from Bullocky Way. The intersection will operate at a LOS ‘B’ for the life of the project.

6.4.3 Pacific Highway / Possum Brush Road

A ‘T’ junction with a wide median storage area is currently provided, which currently operates at LOS ‘C’. Very little traffic turns in and out of the intersection and it has little difficulty in doing so. However, if no upgrade is undertaken the intersection will operate at a LOS ‘E’ by 2010 and LOS ‘F’ by 2030, due to increased Highway traffic.

6.4.4 Pacific Highway / Tritton Road

A ‘T’ junction with wide a median storage area is currently provided. It currently operates at LOS ‘C’. Traffic has little difficulty in turning in or out. Very little traffic turns in and out of the intersection however by 2010 the intersection will operate at a LOS ‘E’ and by 2030, LOS ‘F’ due to increased Highway traffic. Tritton Road will be closed for both the ‘A’ Class and ‘M’ Class options.

Table 17 Summary of modelling results for the 100th Highest Hour to Year 2030

Intersection	Year	LOS (Level Of Service)		
		Existing - Do Nothing	A' Class Option	M' Class Option
Failford Rd	2005	E	C	C
	2010	F	C	C
	2030	F	C	C
Possum Brush Rd	2005	D	C	C
	2010	F	C	C
	2030	F	C	C
Bullocky Way	2005	C	B	B
	2010	E	B	B
	2030	F	B	B
Triton Rd	2005	C	-	-
	2010	E	-	-
	2030	F	-	-

6.5 Travel Time Savings

Modelling of traffic flows on the existing and proposed highway indicates that:

- On the northbound carriageway the current average travel speed is 80-90kph (the posted speed limit). This will increase to 105kph when the new carriageway is completed which will have a posted speed limit of 110kph. The new carriageway will also be 117m shorter. These upgrades represent a saving of 30 seconds per vehicle.
- On the southbound carriageway the current average travel speed is 100kph (the posted speed limit). This will increase to 105kph when the new carriageway is completed which will have a posted speed limit of 110kph. A saving of 6 seconds per vehicle.

Travel time savings will be relatively minor for this 3.59km long section but when combined with other savings along the Pacific Highway will be significant in aggregate.

7 ECONOMIC ANALYSIS

7.1 General

An economic analysis for the Project has been carried out for various funding scenarios in accordance with the RTA's Economic Analysis Manual, 1999. The objective is to generate an economic model for the work that provides a strategic Benefit/Cost Ratio (BCR) that will give an indication of the economic viability of the work.

This has been done by setting up a spreadsheet model that carries out an analysis of the corridor in terms of the Economic Analysis parameters. Results are provided in terms of Benefit/Cost Ratio and first year rate of return. Concept Design stage estimates have been used in the benefit cost ratio calculation.

7.2 Assumptions

7.2.1 Options Considered

Two options were considered, the 'A' Class option and the 'M' Class option.

- Option A - Arterial conditions. Constructed 2009, opened to traffic 2010.
- Option M - Motorway conditions. Constructed 2009, opened to traffic 2010.

7.2.2 Construction

The new road will be constructed in both the existing road reserve and partly on acquired land, serviced by adjacent 2 lane dual carriageways. Both options involve grade separation at Failford Road for the opening in 2010. Option 'M' involves grade separation at Bullocky Way in 2010.

7.2.3 Estimate of Cost

RoadNet's estimates of cost were used in the economic model. These estimates were:

- Assume \$2.75M per lane carriageway for Option A.
- Assume \$3.25M per lane carriageway for Option M.

7.2.4 Traffic Volumes

Average Daily Traffic has been used for the analysis, with 2005 figures and growth figures based on the volumes generated for the noise assessment. These figures show actual traffic movements split into light and heavy vehicles as required for calculation of User costs.

7.2.5 Maintenance

Pavement assumed to be "Asphalt over cement". Costs based on Waratah District Office 2001 figures updated to June 2005 \$.

7.2.6 User Costs

Calculation on methodology set out in RTA Economic Analysis Manual 1999. Costs based on December 2003 figures updated to June 2005 \$.

7.2.7 Cost Updating

Maintenance costs adjusted in line with movement of Maintenance Cost Index.

User costs (VOC, Travel Time and Accidents) adjusted in line with Road Cost Index.

7.2.8 Analysis Period

Period of analysis is 30 years from opening - i.e. 2010 to 2040. New road will be open for 25 years for analysis purposes.

7.3 Benefit Cost Ratio (BCR)

Annual costs over the period 2010 to 2040 have been made for the operation of the existing highway and the construction and operation costs of the new Deviation. The annual costs are then discounted to provide net present values (NPVs) of these future costs. The costs include such things as vehicle operating costs, travel time costs, accident costs and maintenance costs. The NPV of the savings between the base case (existing highway) and new road option is compared with the NPV of the project cost to obtain a BCR.

7.4 Factors in analysis

7.4.1 Timetable

For the purposes of this analysis it is assumed that the whole project may be opened in 2010. A 30-year period from 2010 has been adopted for this economic analysis. With the adoption of 2040 as the end date for analysis, the shortest period of service of the new road would then be 25 years.

7.4.2 Corridors for analysis

The corridors analysed consist of:

- Base case – the continued operation of the existing Pacific Highway.
- Replacement of the northbound carriageway to run parallel with the southbound carriageway. The two main options proposed are ‘A’ class with at grade intersections and ‘M’ class with access control and grade separation.

7.4.3 Sections for analysis

The section analysed consists of a section of the Pacific Highway at Possum Brush from the start of the deviated carriageway to Tritton Road, 3.59km to the north. The section includes the intersections of Failford Road, Bullocky Way, Possum Brush Road and Tritton Road.

7.4.4 Pavement types

The existing Pacific Highway between Failford Road and Tritton Road essentially consists of a flexible pavement made up of a flush seal surface on a granular base.

This analysis assumes:

- Base case – Retain existing Seal on Granular as basis for life cycle costing.
- ‘A’ and ‘M’ Class Options.
  - Southbound Carriageway. Asphalt on cemented base for life cycle costing (This will provide a high quality riding surface in keeping with the project.)

7.4.5 Travel speeds

- Travel speed calculations have been based on the existing and proposed speed zoning. Modelling of traffic flows on the existing and proposed highway indicates that:
  - Existing Highway
    - 80-90kph for northbound section
    - 100kph for southbound section
  - Alignment of northbound carriageway
    - 110kph for northbound section

  - 110kph for southbound

- The affect of traffic volumes on travel speeds has been calculated using the Florida DOT Level of Service software package. This package is based on the US DoT Highway Capacity Manual – 2000.
  - For the base case – retention of the existing Pacific Highway – there are significant declines in travel speed with increased traffic volumes. From about 2008 there will be a need to extend the length of the peak period to permit the movement of the volume expected.
  - By 2033, the existing Pacific Highway would need to flow at peak capacity for 21 hours per day to permit the overall traffic flow predicted.
  - With the provision of dual carriageways and controlled access, travel speeds in the Deviation are not reduced by the traffic volumes predicted within the analysis period.

7.4.6 Geometric parameters

- The alignment and grading can be analysed on the basis of Table B1 of Appendix B of the RTA's Economic Analysis Manual – "Total vehicle operating costs for base grade 2% and base curvature conditions".

7.4.7 Costs

- Construction
  - Analysis has been on the basis of RoadNet's estimates of the cost for the project. These costs are to strategic level and include all costs planning, design, property acquisition, construction and provision for contingencies. The estimated construction cost of the 'A' Class Option is $2.75 million per lane carriageway and the 'M' Class Option $3.25 million per lane carriageway.

- Agency Maintenance Costs
  - Agency maintenance costs have been based on the figures contained in RoadNet's report for the Pacific Highway Office "Pacific Highway – Hexham to Queensland. Development of Maintenance Diaries and Assessment of funding needs 2001 to 2015" – January 2002.
  - The report includes details of the cost of the various maintenance activities for the RTA Port Macquarie District Office, and life cycle maintenance requirements for various pavement types.
  - Costs have been updated in accordance with changes to the Road Cost Index.
  - The maintenance scenarios adopted are based on:
    - A "Typical Life Cycle" for the new corridors and Existing corridor.
    - A "Holding Life Cycle" for the Base case – retention of the existing highway.
    - Allowance has been made for the pavement type and effective age of pavement when applying maintenance regimes to the eastern and western sections.
- Rural Vehicle Operating Costs (VOC)
  - VOCs are calculated on the basis of the RTA's Economic Analysis Manual – Appendix B Part II – Rural Road Parameters 2002.
  - The vertical alignment essentially consists of low grades, generally less than 4%. As a result, VOCs have been based on Table B1 – "Total Vehicle Operating costs for Base Grade 2% and Base Curvature Conditions."

- Pavement condition has been adopted as:
  - New corridor – S4 – Sealed, Good.
  - Base case – existing road – S3 – Sealed, Fair.
- Road Volume Capacity Ratio has been set at:
  - New corridor = 0.3.
  - Base case = 0.8.

- Rural Accident Costs
  - Accident rates have been extrapolated on the basis of existing rates and expected rates for new works.
  - The average cost of a rural accident at 2002 prices is $126,400. (Economic Analysis Manual.)
- Travel Time Costs
  - Travel Time Costs are calculated on the basis of the RTA's Economic Analysis Manual – Appendix B Part II – Rural Road Parameters 2002. (Table 17.)
  - Both 'A' and 'M' Class Options will force some vehicles accessing side roads to travel further than the base case scenario. These vehicles are relatively low compared to Highway traffic and the increase in travel time generated for these vehicles will have very little impact on the BCR. Furthermore, the increased performance of intersections in the 'A' and 'M' Class Options will offset the increase in travel time for these vehicles further minimising the effect on BCR. Therefore the increase in travel distances and travel time for the 'A' and 'M' Class Options has not been assessed in the Economic Analysis.

7.5 Economic assessment

7.5.1 Economic justification

The overall economic efficiency of the Project has been examined. This is reflected in the achieved Benefit Cost Ratio (BCR). The 'A' Class option shows a BCR of 2.18 and the 'M' Class option 2.22 when standard discount rate of 7% is used. This indicates that both options will provide a return to the community of at least twice the investment, which is a key funding requirement for road projects. The results have been summarised in the spreadsheet attached as Appendix B.

7.5.2 Timing of the project

Data has been provided to establish how suitable the time frame is for expenditure on the project. This is done by comparison of the First Year Rate of Return (FYRR) with the Discount Rate (DR) used for analysis. If the FYRR is greater than the DR, then the time is appropriate to carry out the work. The FYYR of the preferred corridor is 15% for both options. The results have been summarised in the spreadsheet attached as Appendix B. This assessment is indicative only and is subject to funding constraints associated with the competing demands in the RTA's construction programme for works throughout NSW.

7.5.3 Support for economic development

Savings are available from an improvement in travel speeds on the northbound and southbound carriageways that will increase from 80-90kph to 110kph. The improvements will marginally reduce transport costs and incrementally improve accessibility.

Funding for construction of the work will also provide an immediate boost to the local economy by providing construction jobs and business for local suppliers.

Both the 'A' and 'M' Class options will provide a return to the community of at least twice the investment, which is a key funding requirement for road projects.

8 ACCIDENT ANALYSIS

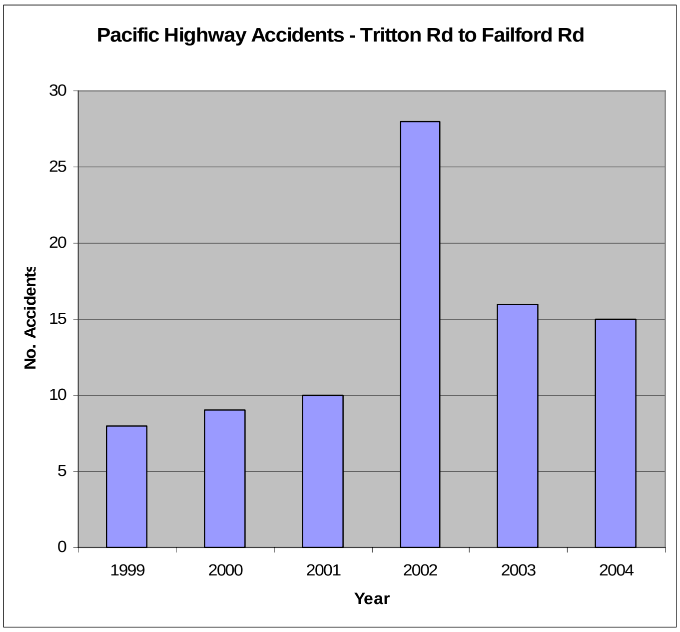
8.1 Accident History

Accident data on the section of Pacific Highway from Tritton Road to Failford Road, Failford was analysed for a 6-year period from 01 January 1999 to 31 December 2004. In this period there were 86 reported accidents with 3 fatalities and 31 injury accidents (51 injuries) and 52 tow aways (refer Table 18). In 2002 there were almost twice as many reported accidents as any other year. This is shown in figure 18.

Table 18 - Accident Statistics

Accident Severity	Pacific Highway - Tritton Road to Failford Road					
	1999	2000	2001	2002	2003	2004
Fatal Accident	0	0	1	2	0	0
Injury	3	2	3	10	9	4
Towaway	5	7	6	16	7	11
Total	8	9	10	28	16	15
AADT	12212	12748	13301	13870	14445	15057

Figure 18 - Accidents per Year



The accident rate per million vehicle kilometres (Mvk) has been calculated for years 1999 to 2004 for the study section. The accident rate per year for the section is shown in Table 19.

Table 19 - Accident Rates (Per Million Vehicle Kilometres – Mvk)

Section	1999	2000	2001	2002	2003	2004	Average
Accident Rate	0.49	0.53	0.57	1.4	0.69	0.69	0.73

The accident rate is derived from the following.
[No. Accidents x $1*10^6$] / [AADT * 365 * Route Length (km) x number of years]

Table 19 shows that the rate is actually increasing. The average accident rate for the study area over the 5-year period is 0.73 per Mvk. A typical new grade separated dual carriageway highway would have an average rate of 0.15 per Mvk.

Further analysis of accidents in the study area is provided in Tables 21-24.

The location, type and number of accidents recorded are shown on Figure 19.

8.2 Traffic Units Involved

Table 20 shows the type of vehicle involved in accidents.

Cars were involved in 88% of accidents while trucks were involved in 11%.

74% of accidents involved only one vehicle.

Table 20 - Accidents by Vehicle Type

Vehicle Type	1999	2000	2001	2002	2003	2004	Total
Car	6	9	12	35	18	15	95
Motorbike	0	0	0	0	0	0	0
Large Truck	0	1	1	0	2	3	7
Light	2	0	0	2	0	1	5
Other	0	0	1	0	0	0	1

8.3 Time of Day Distribution

Table 21 shows the accident breakdown by time of day for each year.

The table shows that there is a spread of accidents throughout the 24-hour period across each year. It also shows a concentration of accidents in the period between 12 noon and 4 pm. Approximately one half of fatal and injury accidents occurred in this time period.

Table 21 - Accidents by Hour of the Day

Hour		1999	2000	2001	2002	2003	2004	Total	Percent
00-02	AM	0	0	0	0	0	2	2	2.3
02-04	AM	0	0	1	0	0	0	1	1.2
04-06	AM	0	0	1	3	0	0	4	4.7
06-08	AM	0	0	0	2	0	1	3	3.5
08-10	AM	1	3	0	3	1	1	9	10.5
10-12	AM	0	0	2	2	2	2	8	9.3
12-14	PM	2	2	1	6	2	1	14	16.3
14-16	PM	1	2	2	2	3	4	14	16.3
16-18	PM	2	1	0	2	1	1	7	8.1
18-20	PM	1	1	0	1	3	1	7	8.1
20-22	PM	1	0	4	4	1	1	11	12.8
22-24	PM	0	0	0	4	2	0	6	7

8.4 Age Group Distribution

Table 22 shows the accident breakdown by age group.

There is generally an even spread of values across all age groups and years. The drivers at fault in the 3 fatal accidents was over 74 years old. These 3 accidents also involved 2 to 3 injuries each.

Table 22 - Accidents by Age Group

Age Group	1999	2000	2001	2002	2003	2004	Total	Percent
16-19	0	0	0	1	1	1	3	3.5
20-29	5	1	2	2	6	4	20	18.6
30-39	0	2	1	4	4	3	14	23.3
40-49	1	4	3	4	2	4	18	20.9
50-59	1	0	1	6	2	3	13	15.1
60-69	1	2	0	2	2	0	7	8.1
70+	0	0	2	5	0	0	7	8.1
Unknown	0	0	1	3	0	0	4	4.7

8.5 Weather

An analysis of the weather conditions and accident frequency indicates that 66% of accidents occurred on a wet road surface.

Further details relating to carriageway and curves are shown in Table 24.

8.6 Accident Types

An analysis of the number off accidents per accident type for the years 1999 to 2004 found that 74% of accidents for the section of highway were Run Off Road accidents. Vehicles travelling in adjacent directions (at intersections) comprised 16% while the remaining accidents were due to On Path collisions, U-Turns, Side Swipes, Lane Changes and Rear End collisions.

A further analysis of the Run Off Road accidents shows that 72% of accidents occurred on the northbound carriageway, 91% of these accidents occurred when the road surface was wet.

Of the Run Off Road accidents that occurred on the southbound carriageway, 67% occurred when the road surface was wet.

Table 23 shows the Run Off Road accident breakdown and the percentage of those accidents in wet weather.

Table 23 - Run Off Road Accidents

Accident Type	Number of Accidents	Percent	Percent in Wet Weather
Run Off Road (Northbound)	45	71.4	91.1
Run Off Road (Southbound)	18	28.6	66.6

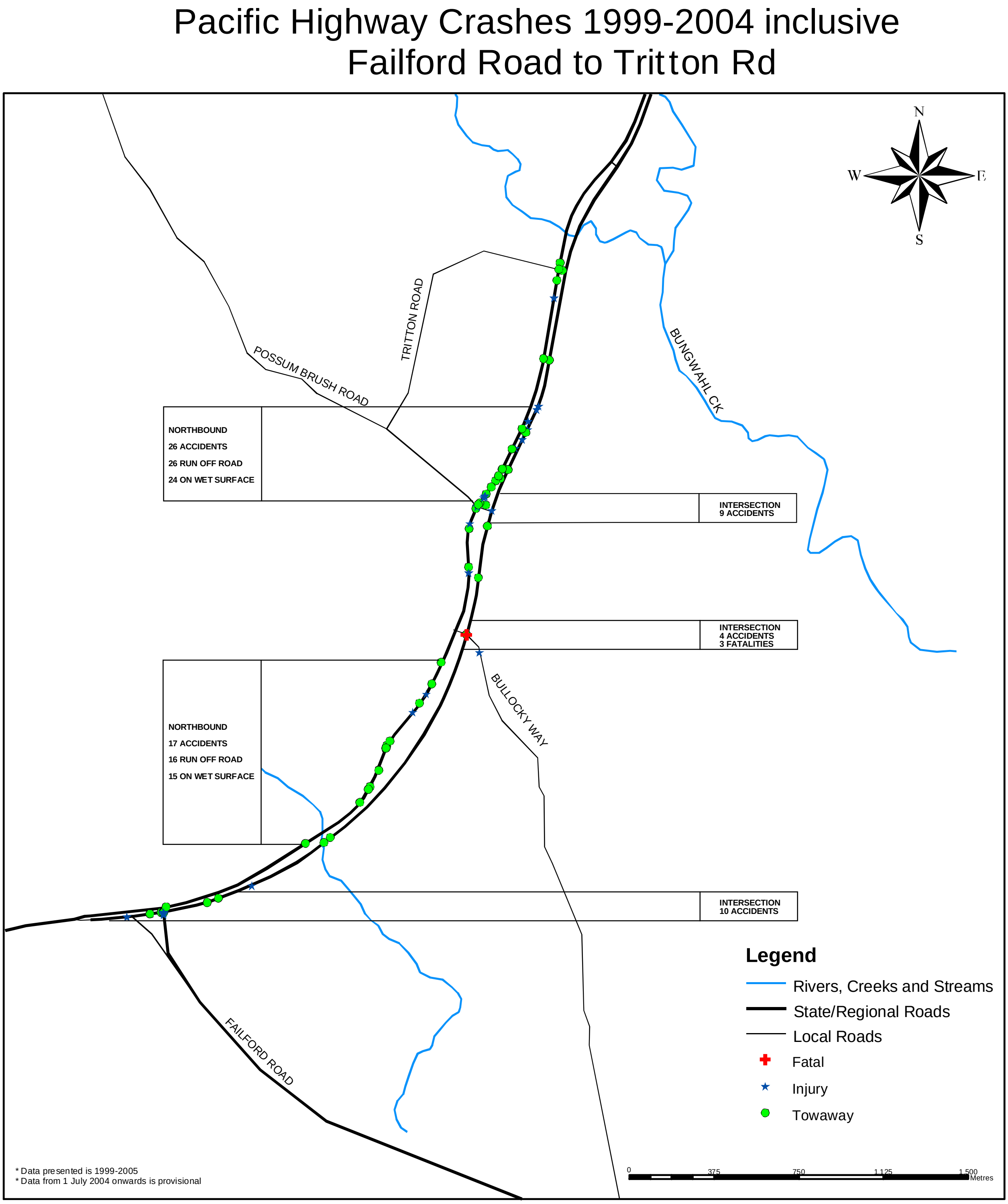
8.7 Accident Locations

A map of accident locations is provided as Figure 19. The figure indicates that accident concentrations occur at the following locations:

- Pacific Highway northbound carriageway 500m section North of Possum Brush Road
- Pacific Highway northbound carriageway 1300m section South of Bullocky Way
- Possum Brush Road and Pacific Highway intersection
- Bullocky Way and Pacific Highway intersection
- Failford Road and Pacific Highway intersection

This data indicates that as well as there being accident concentrations at the above locations, the 3 fatal accidents over the five year period occurred on the southbound carriageway of the Pacific Highway at the Bullocky Way intersection. All 3 accidents involved a vehicle turning at the intersection and a driver over the age of 65 years old. All 3 accidents occurred in fine daylight conditions with a dry surface.

Figure 19 - Accident Locations



8.8 Accident Summary

A high number of accidents occurred on the northbound carriageway and at the Pacific Highway and Possum Brush Road junction. The proposed upgrades to the site will improve safety and may reduce accidents at the intersection.

The realignment of the northbound carriageway may help reduce the number of Run Off Road accidents, which account for 70% of accidents.

At present, there are 73 accidents per 100MVK on the section. On the basis of comparison with similar roads carrying similar traffic volumes, it is predicted that accident rate on the new road will fall to 15 per 100MVK. This represents a saving of at least 7 accidents per year. This is a significant reduction because the accidents are of the more serious nature being fatal, injury or tow away.

9 CUMULATIVE TRAFFIC IMPACTS

The cumulative traffic impact of this proposal would be negligible because dual carriageway already exists. The proposal will simply improve the standard of travel and safety along the section. It will also marginally reduce travel time for through traffic by increasing the speed limit.

Overall it will make the Highway more attractive by reducing travel times and improving safety. The work is therefore likely to marginally increase travel on the Highway.

10 RISK ASSESSMENT

10.1 General

Hazards and risks are associated with the construction and operation of the project.

The following sections identify the major hazards and risks associated with construction and operation of the proposal and assess their impact on the project. The issues associated with the construction phase are addressed under the section on Construction Risks and Hazards. The operational issues are addressed in the following section under Operational Risks and Hazards.

10.2 Construction Risks and Hazards

The main risks associated with construction relate to:

- The spillage of fuels or chemicals either by way of leakages of stored materials or by vehicle/ machinery accidents;
- Traffic accidents at construction access points; and
- Workplace accidents.

Construction work will be undertaken by contract and as such these issues will be responsibility of the contractor.

As part of the contract, the contractor would be required to have an approved environmental management system and a Project Environmental Plan for the project that contains procedures for the management of risks and hazards. Furthermore, the requirements for addressing Occupational Health and Safety issues are fully addressed in the standard specifications used in RTA contracts. Notwithstanding this requirement, the RTA is currently endeavouring to give more consideration to OH&S issues earlier in the planning process.

The contractor would be required to have a quality system that contains mechanisms for handling and storage of hazardous materials and for monitoring procedures to ensure compliance.

The contractor would also need an approved Traffic Management Plan and Traffic Control Plans for specific sites. Appropriate traffic control will be required at the main access points from the construction areas to the existing highway.

Where practical all construction traffic movements should be limited to the new carriageway to avoid conflicts with Highway traffic.

The measures identified are aimed at minimising the risk of an incident and the severity of any occurrence during construction.

10.3 Operational Risks and Hazards

The Highway is the primary north south route for trucks transporting dangerous goods. The most common dangerous goods are flammable and combustible liquids, liquefied petroleum gases, flammable gases, toxic materials and reactive materials.

Heavy vehicles account for approximately 20% of total traffic (10% light commercial and 10% heavy commercial). Only a small percentage of these would carry dangerous goods. Research shows that dangerous goods as a percentage of all heavy vehicles in NSW is 1.15%. (Source: EIS Pacific Highway Upgrade Coopernook to Moorland Feb 2000). The likelihood of an incident would therefore be small.

The transport of dangerous goods is controlled by the provisions of Dangerous Goods Act 1997 which defines the categories of goods, labelling, packaging for transport and compatibility with one another for transport. These safeguards minimize the impacts of the severity of any incident.

In terms of response time to an incident full time Fire Stations are provided at Taree and Foster Tuncurry. The NSW Fire Brigade has the responsibility for managing chemical and fuel spills. For spillages it operates under the EPA Guidelines ‘Chemical Responses Manual’. The EPA is responsible for offering advice on containment and cleanup. The RTA has procedures for assisting these authorities in the management and cleanup of such incidents. Together these agencies and procedures are considered adequate to fully address any incidents on the options under consideration for this project.

The section of Highway does not pass through environmentally sensitive land (rivers, wetlands etc) so any spillages would likely have a small impact on natural systems.

In the event of an incident traffic could be diverted and traffic flow maintained with only minor inconvenience on road users due to flexible traffic arrangements available with dual carriageways.

The construction of a new high standard carriageway road would provide a far safer transport corridor than the existing winding northbound carriageway.

Turning bays and stopping areas for maintenance vehicles are required along the route. It is suggested that at least one and possible two turning bays are created. Widened shoulders for maintenance vehicles should be provided where practicable along the route to allow vehicles and workmen to stand clear of passing traffic.

10.4 Constructability

A number of factors need to be considered in assessing the constructability of the second carriageway. The more significant of these have been summarised below.

10.4.1 Funding Risk

The timeframe for completion of construction may be influenced by many factors. Availability of funding across the period of construction is the most critical factor. At this time it appears that funding will available to complete construction by the end of 2010.

10.4.2 Pavement Type

Pavement type has not been established at this time. However, indications are that a concrete pavement could be provided without undue impact on Highway traffic flow.

Alternatively, an Asphaltic Concrete base layer on a cemented sub base would provide the maximum constructability with a high standard finished road product.

10.4.3 Number and size of structures

A series of culverts will be provided on the eastern end and through the project. The purchase and installation of these should not cause any environmental or delay problems.

10.4.4 Relocation of Utilities

The relevant utility service providers have been contacted and have indicated that relocations can be completed within the construction period at the appropriate stages of construction.

10.4.5 Property acquisition

Upon completion of concept design and environmental approval of the preferred option, relevant properties will be acquired. There is the potential for delays in obtaining properties however this should not affect the timeline for the project. Construction is not due for commencement before year 2009.

10.4.6 Availability of Construction Materials

Part of the current design is to reduce the imported fill requirement and to maximise the use of the existing northbound pavement material, however some additional imported fill will be required. All material for the interchange and overbridge will need to be imported.

Material would likely be generated by quarries operated by Pacific Blue Metal in Possum Brush Road approximately 3km for the Highway and in Bullocky Way approximately 0.8km for the Highway. Quarry operators indicated they could generate general fill material to the quantities required from these two quarries. However, if there was any shortfall, their competitors at Jandra Quarry, approximately 3km to the North of the project, could also generate the material.

10.4.7 Haulage

The overpass at Failford Road and the service road is in the first stage, whether it be ‘A’ or ‘M’ Class. Part of the current design is to reduce the imported fill requirement and to maximise the use of the existing northbound pavement material with some excess material requiring disposal. However, it is estimated that some imported fill material will be transported to the site. These volumes are estimated to be:

- 74,100m^3 (solid volume) for the ‘A’ class option and;
- 105,000m^3 (solid volume) for the ‘M’ class option.

If a bulking factor of 1.3 is applied for the earth material, this volume can be translated to:

- 96,330m^3 for the ‘A’ class option and;
- 136,500m^3 for the ‘M’ class option.

A Class Option

This is expected to generate 97 laden truck movements per day (or 195 two way truck movements) on the basis of 12 weeks construction time for earthworks. Refer to table 25 below for details. This number of truck movements would require a positive traffic control at the access points to the section.

Table 24 – Haulage Movements for Imported Fill Material

Haulage Movements - 'A' Class Option

Fill	Volume (m 3)	Time in Weeks	Operating days per week	Truck and Trailer capacity (m 3)	Laden trips per day	Total trucks per day (two way)	Hours per day	Trucks per hour (two way)
Imported Fill	96330	12	6	15	97	195	8	24

Assumptions: Bulking factor of 1.3 for fill material

M Class Option

This is expected to generate 106 laden truck movements per day (or 212 two way truck movements) on the basis of 12 weeks construction time for earthworks. Refer to table 25 below for details. This number of truck movements would require a positive traffic control at the access points to the section.

Table 25 – Haulage Movements for Imported Fill Material

Haulage Movements - 'M' Class Option

Fill	Volume (m 3)	Time in Weeks	Operating days per week	Truck and Trailer capacity (m 3)	Laden trips per day	Total trucks per day (two way)	Hours per day	Trucks per hour (two way)
Imported Fill	105000	12	6	15	106	212	8	27

Assumptions: Bulking factor of 1.3 for fill material

Trucks from the Possum Brush Road quarry would be able to access the construction site via Possum Brush Road and the Highway directly. Trucks from the Bullocky Way quarry will have to access the construction site by heading south via Bullocky Way and Failford Road to access the Highway, a distance of approximately 4.7km. This is due to load restrictions and planning approvals placed on Bullocky Way to the north of the quarry to stop heavy vehicle movement on that section.

The effects of additional truck movements resulting from the haulage of construction material is significant on the existing highway. The truck movements in and out of the construction site will be in the vicinity of 24 per hour for the ‘A’ class option and 27 per hour for the ‘M’ class option. The peak hour traffic on the Highway will be over 1000 vehicles in either direction. This means that proper traffic control is necessary at the site access points in order to ensure safety.

With relatively high haulage movements (>25 per hour) forms of traffic control such as temporary traffic signals are likely to be required. If the haulage movements are reduced by an increased construction time or a reduced imported fill quantity other forms such as manual traffic control along with warning signs and speed reduction could be considered.

10.4.8 Noise/Vibration/Dust

Noise, vibration and dust impacts may be an issue due to the proximity of dwellings in Possum Brush Road and Bullocky Way. While noise and vibration issues are dealt with in detail in the Noise Report it is worth mentioning in this traffic study as it may affect constructability in terms of times of operation, construction noise levels, dust control.

These issues should not adversely affect the constructability of the project and will be addressed in detail the environmental management plan for the project and incorporated into the contract documentation.

10.4.9 Management of wildlife – avoidance of clearing during breeding / migration

Environmental management measures contained in the studies covering fauna and flora will identify how this can be best achieved. It is not expected that these restrictions would significantly affect or prolong the construction period.

10.5 Summary

An assessment has been made of the risks associated with the project. It is concluded that the risk identified are of a manageable proportion and do not constitute a hindrance to the successful and timely completion of the project.

At the time of preparing this report the issues identified above are not envisaged to be of sufficient magnitude that would delay the delivery of the project by the end of 2010.

11 CONCLUSIONS

Progressive upgrading of the existing northbound carriageway under traffic would be very expensive and lead to an unsatisfactory long-term outcome in terms of traffic efficiency and safety.

The ‘A’ Class and ‘M’ Class upgrade options proposed for the section of Pacific Highway will provide an adequate LOS to all road users, increase safety and reduce accidents, offer small reductions in travel time and will be economically viable providing value for money.

Modelling and traffic projections indicate by 2030 (20 years after opening) the Pacific Highway for both the ‘A’ Class and ‘M’ Class options will operate at a LOS ‘C’ for the 100th Highest Hour. Intersection modelling indicates the Failford Road intersection is currently operating at near capacity and that the other intersections within the study site will be near capacity by the year 2010. Modelling of intersections for both the ‘A’ class and ‘M’ class options indicates intersections will operate at an adequate LOS for the life of the project.

The average travel speed on both the southbound and northbound carriageways will increase to 105kph when the proposal is complete with 110kph sign-posted limit. This represents a saving of 6 seconds per vehicle for southbound traffic and 30 seconds per vehicle for northbound traffic.

Travel time savings will be relatively minor for this 3.5km long section but when combined with other savings along the Pacific Highway will be significant in aggregate.

Economic analysis shows that both options will provide a return to the community of at least twice the investment, which is a key funding requirement for road projects.

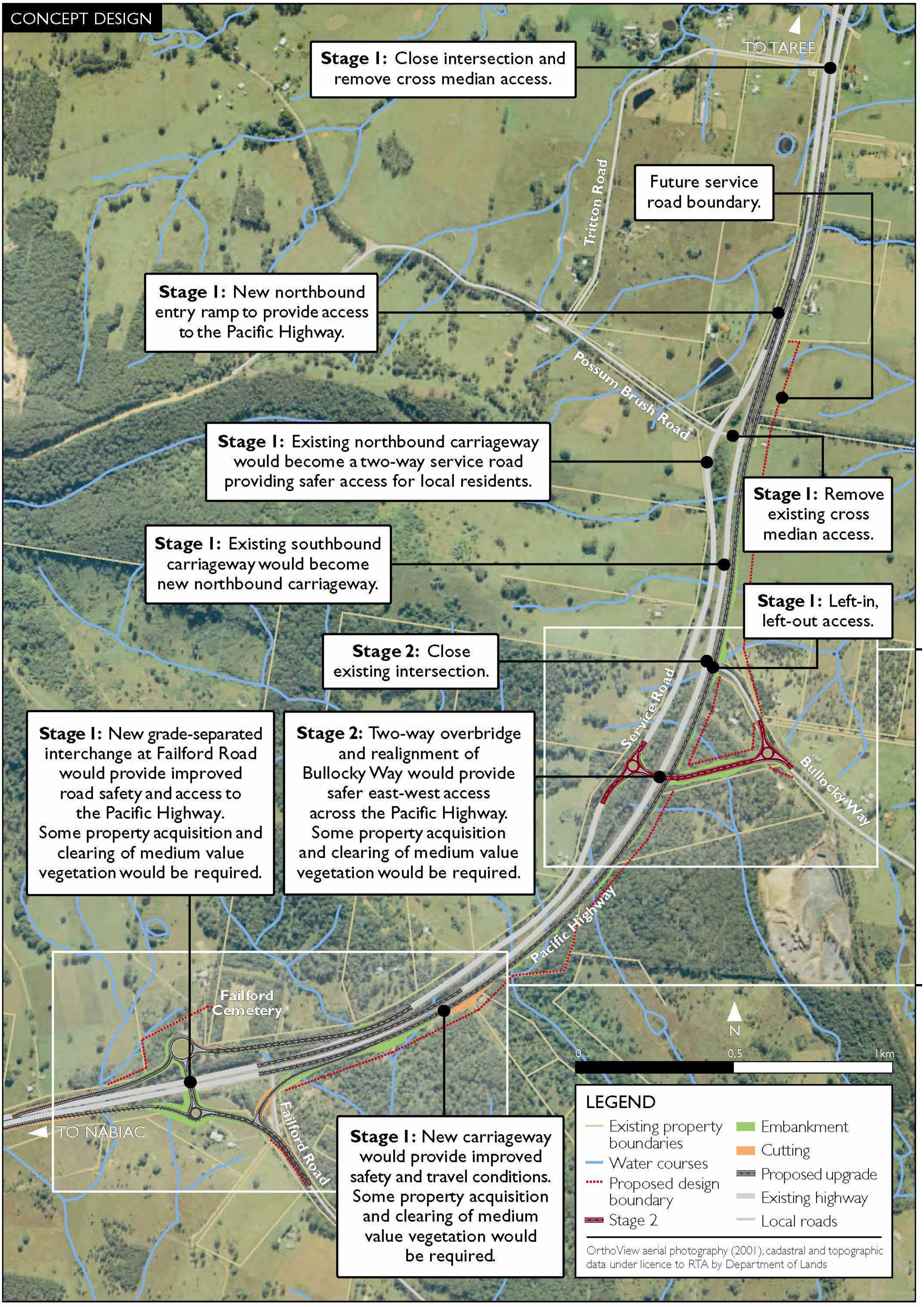
Analysis of existing accident data and consideration of the nature of the new road indicate that there will be a considerable improvement in the safety performance of the improved road when compared to existing accident rates.

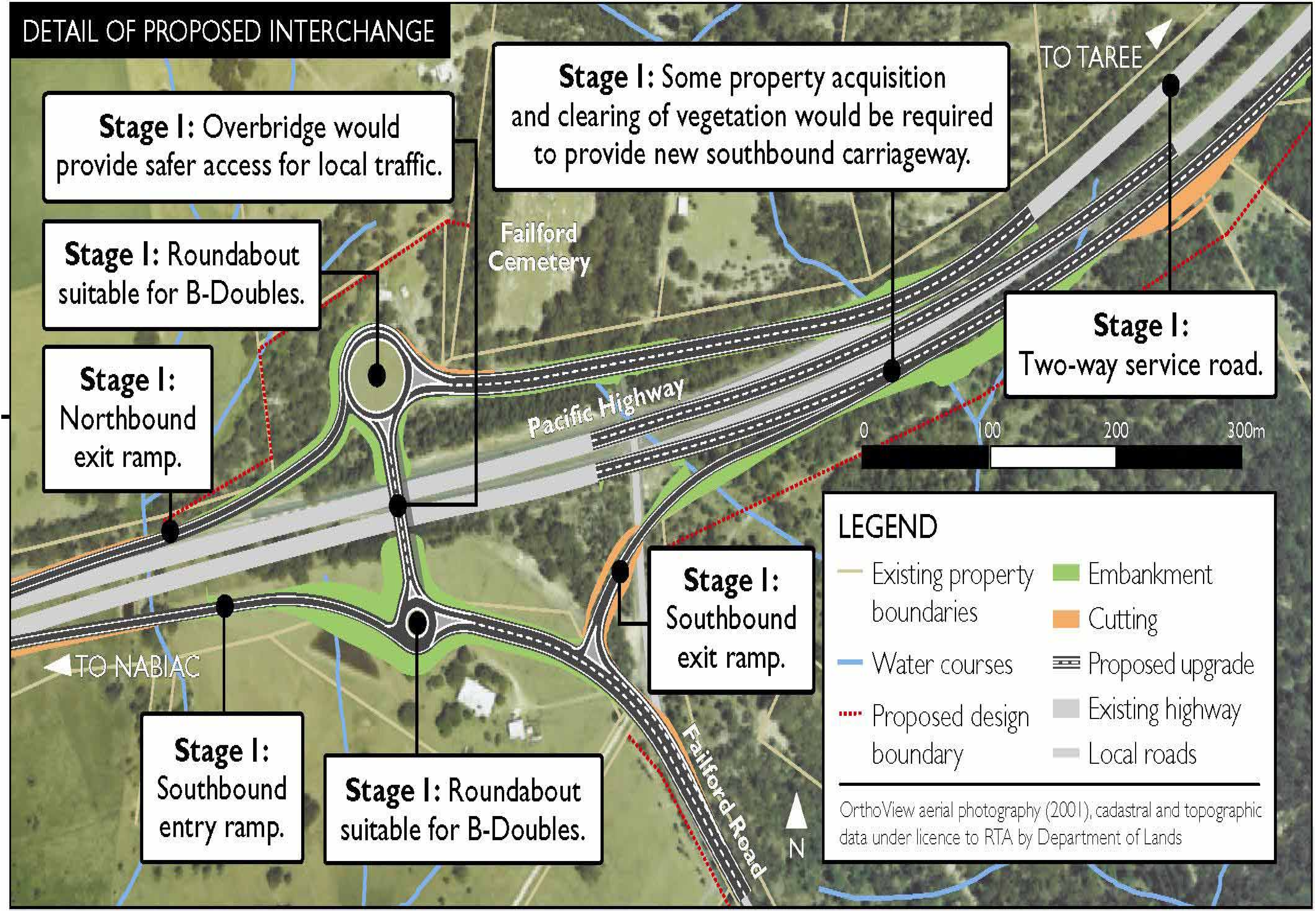
At present, there are 73 accidents per 100MVK on the section. On the basis of comparison with similar roads carrying similar traffic volumes, it is predicted that the accident rate on the new road will fall to 15 per 100MVK. This represents a saving of at least 7 accidents per year. This is a significant reduction because the accidents are of the more serious nature being fatal, injury or tow away.

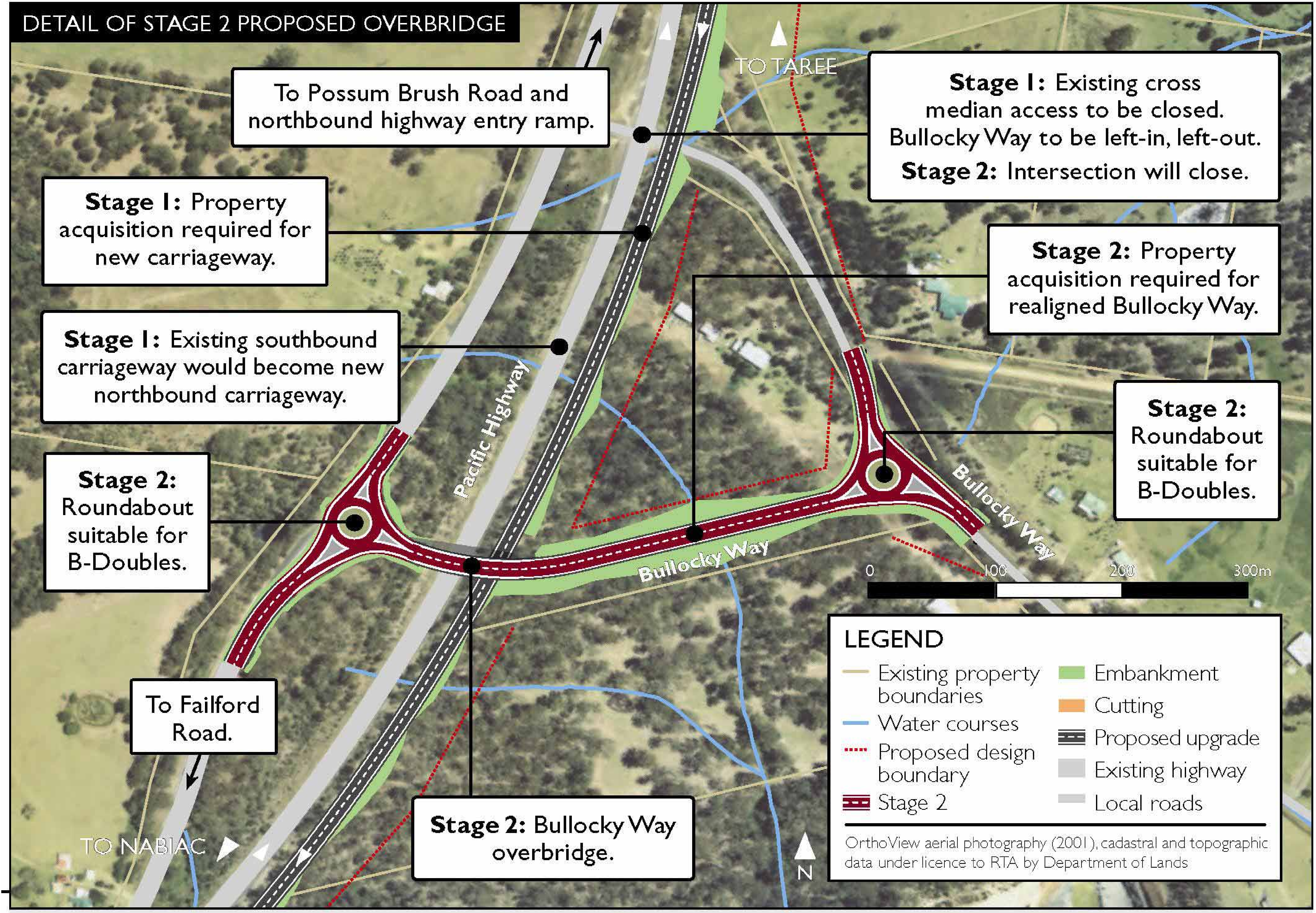
Both options provide significantly improved travel conditions along the route and as such will support economic development. A return to the community of at least twice the investment is expected for the proposal, which is a key funding requirement for road projects.

APPENDIX A

PLAN SHOWING OPTIONS


CONCEPT DESIGN
Stage 1: Close intersection and remove cross median access.
TO TAREE
Future service road boundary.
Tritton Road
Stage 1: New northbound entry ramp to provide access to the Pacific Highway.
Possum Brush Road
Stage 1: Existing northbound carriageway would become a two-way service road providing safer access for local residents.
Stage 1: Remove existing cross median access.
Stage 1: Existing southbound carriageway would become new northbound carriageway.
Stage 1: Left-in, left-out access.
Stage 2: Close existing intersection.
Service Road
Stage 1: New grade-separated interchange at Failford Road would provide improved road safety and access to the Pacific Highway. Some property acquisition and clearing of medium value vegetation would be required.
Stage 2: Two-way overbridge and realignment of Bullocky Way would provide safer east-west access across the Pacific Highway. Some property acquisition and clearing of medium value vegetation would be required.
Bullocky Way
Pacific Highway
Failford Cemetery
N
0
0.5
1km
TO NABIAC
Failford Road
Stage 1: New carriageway would provide improved safety and travel conditions. Some property acquisition and clearing of medium value vegetation would be required.
LEGEND
Existing property boundaries
Water courses
Proposed design boundary
Stage 2
Embankment
Cutting
Proposed upgrade
Existing highway
Local roads
OrthoView aerial photography (2001), cadastral and topographic data under licence to RTA by Department of Lands


DETAIL OF PROPOSED INTERCHANGE
Stage 1: Overbridge would provide safer access for local traffic.
Stage 1: Some property acquisition and clearing of vegetation would be required to provide new southbound carriageway.
TO TAREE
Stage 1: Roundabout suitable for B-Doubles.
Failford Cemetery
Stage 1: Northbound exit ramp.
Pacific Highway
Stage 1: Two-way service road.
0
100
200
300m
LEGEND
Existing property boundaries
Embankment
Cutting
Water courses
Proposed upgrade
Proposed design boundary
Existing highway
Local roads
OrthoView aerial photography (2001), cadastral and topographic data under licence to RTA by Department of Lands
TO NABIAC
Stage 1: Southbound exit ramp.
Stage 1: Southbound entry ramp.
Stage 1: Roundabout suitable for B-Doubles.
Failford Road
N



DETAIL OF STAGE 2 PROPOSED OVERBRIDGE
To Possum Brush Road and northbound highway entry ramp.
TO TAREE
Stage 1: Existing cross median access to be closed. Bullocky Way to be left-in, left-out.
Stage 2: Intersection will close.
Stage 1: Property acquisition required for new carriageway.
Stage 2: Property acquisition required for realigned Bullocky Way.
Stage 1: Existing southbound carriageway would become new northbound carriageway.
Pacific Highway
Stage 2: Roundabout suitable for B-Doubles.
Stage 2: Roundabout suitable for B-Doubles.
Bullocky Way
Bullocky Way
0
100
200
300m
To Failford Road.
LEGEND
Existing property boundaries
Water courses
Proposed design boundary
Stage 2
Embankment
Cutting
Proposed upgrade
Existing highway
Local roads
OrthoView aerial photography (2001), cadastral and topographic data under licence to RTA by Department of Lands
TO NABIAC
Stage 2: Bullocky Way overbridge.
N

APPENDIX B

ECONOMIC ANALYSIS DETAILS

BCR – Analysis Period 2010 to 2040 (Values in June 2005 $M)

Option A - $M June 2005

	Agency Costs		Road User Costs			Overall	
NPV	Const'n	Mtce	VOC	Tr Time	Accidents	Savings	BCR
4%	16.88	2.52	14.60	10.00	26.44	53.56	3.17
7%	16.12	2.20	9.26	6.48	17.13	35.07	2.18
11%	16.03	1.83	5.93	4.25	11.23	23.23	1.45

First Year Rate of Return 7% discount rate Based on NPV 2005 of costs and benefits		
Costs	2010 Benefit	FYRR
16.12	2.47	15%

Note: First year rate of return is not dependant on the length of the analysis period.

Option M - $M June 2005

	Agency Costs		Road User Costs			Overall	
NPV	Const'n	Mtce	VOC	Tr Time	Accidents	Savings	BCR
4%	19.95	2.52	4.30	22.28	35.40	64.51	3.23
7%	19.05	2.20	2.79	14.43	22.94	42.36	2.22
11%	18.94	1.83	1.83	9.46	15.04	28.16	1.49

First Year Rate of Return 7% discount rate Based on NPV 2005 of costs and benefits		
Costs	2010 Benefit	FYRR
19.05	2.91	15%

Note: First year rate of return is not dependant on the length of the analysis period.

Travel Costs

State wide values for rural travel - December 2003

VALUE OF TRAVEL TIME - RURAL						
Vehicle Type	**Proportion**	**Occupancy**	**Value**		**Freight**	**Total**
			$/pers.h	**$/Veh.h**	**$/Veh.h**	**$/Veh.h**
Private Car	43%	1.7	10.15	17.26		17.26
Business Car	23%	1.3	32.48	42.22		42.22
Light commercial	22%	1.3	21.25	27.63	0.53	28.16
Heavy commercial	10%	1	22.87	22.87	10.88	33.76
Road Trains	1%	1	24.27	24.27	30.09	54.35
		Weighted Average - $27.59 per vehicle hour				

CALCULATED Study values for rural travel on SH10 at site June 2005

VALUE OF TRAVEL TIME - RURAL						
Vehicle Type	**Proportion**	**Occupancy**	**Value**		**Freight**	**Total**
			$/pers.h	**$/Veh.h**	**$/Veh.h**	**$/Veh.h**
Private Car	38.43%	1.7	10.49	17.83		17.83
Business Car	20.56%	1.3	33.56	43.63		43.63
Light commercial	19.66%	1.3	21.96	28.55	0.55	29.10
Heavy commercial	19.25%	1	23.63	23.63	11.24	34.88
Road Trains	2.10%	1	25.08	25.08	31.09	56.18
		Weighted Average - per vehicle hour				**$ 29.44**

Vehicle Operating Costs for Rural Roads

Total Vehicle Operating Costs for Base Grade 2% and Base Curvature Conditions
Cents/km (December 2003 Prices)

LIGHT VEHICLES
ROAD VOLUME CAPACITY RATIO = 0

SPEED	ROAD SURFACE/PAVEMENT CONDITIONS										
km/h	E	G1	G2	G3	G4	G5	S1	S2	S3	S4	S5
10	44.6	38.0	34.9	32.5	31.3	30.6	30.2	28.0	26.4	25.2	24.6
20	39.9	33.2	30.1	27.7	26.5	25.8	25.4	23.2	21.5	20.3	19.6
30	38.3	31.7	28.5	26.2	24.9	24.2	23.8	21.6	20.0	18.8	18.1
40	37.8	31.1	28.0	25.6	24.3	23.6	23.2	21.0	19.4	18.2	17.5
50	37.6	30.9	27.8	25.4	24.1	23.4	23.0	20.8	19.1	17.9	17.2
60	37.7	31.0	27.9	25.5	24.2	23.5	23.1	20.9	19.2	18.0	17.2
70	37.8	31.1	28.0	25.6	24.3	23.6	23.2	21.0	19.3	18.1	17.4
80	38.1	31.4	28.3	25.9	24.6	23.9	23.5	21.3	19.6	18.4	17.6
90	38.5	31.8	28.7	26.3	25.0	24.3	23.9	21.7	19.9	18.7	18.0
100	39.0	32.3	29.2	26.8	25.5	24.7	24.4	22.1	20.4	19.1	18.4
110	39.6	32.8	29.7	27.3	26.0	25.2	24.9	22.6	20.9	19.7	18.9

LIGHT VEHICLES
ROAD VOLUME CAPACITY RATIO = 1

SPEED	ROAD SURFACE/PAVEMENT CONDITIONS										
km/h	E	G1	G2	G3	G4	G5	S1	S2	S3	S4	S5
10	49.9	43.2	40.2	37.8	36.6	35.9	35.4	33.3	31.7	30.5	29.9
20	44.1	37.4	34.3	31.9	30.7	30.0	29.6	27.4	25.7	24.5	23.8
30	42.3	35.6	32.5	30.1	28.8	28.1	27.7	25.6	23.9	22.7	22.0
40	41.6	34.9	31.8	29.4	28.2	27.5	27.1	24.9	23.2	22.0	21.3
50	41.5	34.8	31.6	29.3	28.0	27.3	26.9	24.7	23.0	21.8	21.1
60	41.6	34.9	31.8	29.4	28.1	27.4	27.0	24.8	23.1	21.9	21.2
70	41.8	35.1	32.0	29.6	28.3	27.6	27.2	25.0	23.3	22.1	21.4
80	42.3	35.6	32.4	30.1	28.8	28.0	27.7	25.5	23.7	22.5	21.8
90	42.9	36.1	33.0	30.6	29.3	28.6	28.2	26.0	24.3	23.0	22.3
100	43.6	36.8	33.7	31.3	30.0	29.3	28.9	26.7	24.9	23.7	22.9
110	44.3	37.6	34.4	32.0	30.7	30.0	29.6	27.4	25.6	24.4	23.6

HEAVY VEHICLES
ROAD VOLUME CAPACITY RATIO = 0

SPEED	ROAD SURFACE/PAVEMENT CONDITIONS										
km/h	E	G1	G2	G3	G4	G5	S1	S2	S3	S4	S5
10	181.2	156.1	153.2	143.3	136.7	131.3	140.6	128.5	120.4	113.7	108.2
20	152.2	127.1	124.1	114.2	107.5	102.1	111.5	99.3	91.1	84.4	78.7
30	141.6	116.5	113.6	103.7	97.1	91.7	101.0	88.9	80.8	74.1	68.6
40	137.4	112.3	109.4	99.6	93.0	87.6	96.9	84.8	76.7	70.1	64.6
50	135.3	110.2	107.3	97.4	90.8	85.5	94.8	82.7	74.6	68.0	62.4
60	134.8	109.7	106.7	96.9	90.2	84.8	94.2	82.0	73.9	67.2	61.6
70	134.8	109.7	106.7	96.9	90.2	84.8	94.2	82.0	73.8	67.1	61.6
80	135.4	110.3	107.3	97.4	90.8	85.3	94.7	82.5	74.3	67.6	62.0
90	136.3	111.1	108.1	98.2	91.5	86.1	95.5	83.3	75.1	68.3	62.7
100	137.5	112.3	109.3	99.4	92.7	87.3	96.7	84.4	76.2	69.5	63.8
110	139.1	113.9	110.9	101.0	94.3	88.8	98.2	85.9	77.7	70.9	65.2

HEAVY VEHICLES
ROAD VOLUME CAPACITY RATIO = 1

SPEED	ROAD SURFACE/PAVEMENT CONDITIONS										
km/h	E	G1	G2	G3	G4	G5	S1	S2	S3	S4	S5
10	201.0	175.9	173.0	163.1	156.5	151.1	160.4	148.3	140.2	133.5	128.0
20	167.1	141.9	138.9	129.0	122.4	116.9	126.3	114.1	105.9	99.2	93.6
30	154.7	129.6	126.7	116.8	110.2	104.8	114.1	102.0	93.9	87.2	81.7
40	150.0	124.9	122.0	112.2	105.6	100.2	109.5	97.4	89.3	82.7	77.2
50	147.7	122.6	119.7	109.9	103.3	97.9	107.2	95.1	87.0	80.4	74.9
60	147.4	122.2	119.3	109.5	102.8	97.4	106.8	94.6	86.5	79.8	74.2
70	147.7	122.6	119.6	109.7	103.1	97.7	107.0	94.9	86.7	80.0	74.4
80	148.7	123.6	120.6	110.7	104.1	98.6	108.0	95.8	87.6	80.9	75.3
90	150.1	124.9	121.9	112.0	105.4	99.9	109.3	97.1	88.9	82.2	76.5
100	151.9	126.8	123.8	113.9	107.2	101.7	111.1	98.9	90.7	83.9	78.2
110	154.3	129.1	126.1	116.1	109.4	104.0	113.4	101.1	92.8	86.1	80.3

Vehicle Operating Costs for Rural Roads

Total Vehicle Operating Costs for Base Grade 4% and Base Curvature Conditions Cents/km (December 2003 Prices)

LIGHT VEHICLES
ROAD VOLUME CAPACITY RATIO = 0

SPEED	ROAD SURFACE/PAVEMENT CONDITIONS										
km/h	E	G1	G2	G3	G4	G5	S1	S2	S3	S4	S5
10	44.9	38.2	35.2	32.8	31.6	30.9	30.5	28.3	26.7	25.5	24.9
20	40.3	33.7	30.5	28.2	26.9	26.2	25.8	23.6	21.9	20.8	20.1
30	38.7	32.0	28.9	26.5	25.3	24.6	24.2	22.0	20.3	19.1	18.4
40	38.1	31.4	28.3	26.0	24.7	24.0	23.6	21.4	19.7	18.5	17.8
50	38.0	31.3	28.2	25.8	24.6	23.8	23.5	21.3	19.6	18.4	17.7
60	38.2	31.4	28.3	25.9	24.7	23.9	23.6	21.3	19.6	18.4	17.7
70	38.3	31.6	28.4	26.1	24.8	24.1	23.7	21.5	19.8	18.6	17.9
80	38.5	31.8	28.6	26.3	25.0	24.2	23.9	21.7	19.9	18.7	18.0
90	38.9	32.1	29.0	26.6	25.3	24.6	24.2	22.0	20.3	19.0	18.3
100	39.3	32.6	29.4	27.0	25.7	25.0	24.6	22.4	20.6	19.4	18.7
110	39.8	33.1	29.9	27.5	26.2	25.5	25.1	22.9	21.1	19.9	19.1

LIGHT VEHICLES
ROAD VOLUME CAPACITY RATIO = 1

SPEED	ROAD SURFACE/PAVEMENT CONDITIONS										
km/h	E	G1	G2	G3	G4	G5	S1	S2	S3	S4	S5
10	50.2	43.5	40.4	38.1	36.9	36.2	35.7	33.6	32.0	30.8	30.2
20	44.6	37.9	34.8	32.4	31.1	30.4	30.0	27.8	26.1	25.0	24.3
30	42.6	35.9	32.8	30.5	29.2	28.5	28.1	25.9	24.2	23.0	22.4
40	41.0	35.3	32.2	29.8	28.5	27.8	27.4	25.2	23.6	22.4	21.7
50	41.9	35.2	32.0	29.7	28.4	27.7	27.3	25.1	23.4	22.2	21.5
60	42.1	35.4	32.2	29.9	28.6	27.9	27.5	25.3	23.6	22.3	21.6
70	42.3	35.6	32.5	30.1	28.8	28.1	27.7	25.5	23.8	22.6	21.9
80	42.6	35.9	32.8	30.4	29.1	28.4	28.0	25.8	24.1	22.9	22.2
90	43.2	36.5	33.3	30.9	29.7	28.9	28.6	26.3	24.6	23.4	22.6
100	43.8	37.1	33.9	31.5	30.3	29.5	29.2	26.9	25.2	23.9	23.2
110	44.5	37.8	34.6	32.2	30.9	30.2	29.8	27.6	25.9	24.6	23.9

HEAVY VEHICLES
ROAD VOLUME CAPACITY RATIO = 0

SPEED	ROAD SURFACE/PAVEMENT CONDITIONS										
km/h	E	G1	G2	G3	G4	G5	S1	S2	S3	S4	S5
10	181.7	156.6	153.7	143.9	137.3	131.9	141.2	129.1	121.0	114.4	108.8
20	153.6	128.5	125.5	115.6	109.0	103.5	112.9	100.7	92.6	85.9	80.2
30	141.9	116.9	114.0	104.2	97.6	92.2	101.5	89.4	81.3	74.7	69.2
40	139.2	114.1	111.2	101.4	94.8	89.5	98.8	86.7	78.6	72.0	66.5
50	138.7	113.6	110.7	100.8	94.2	88.8	98.2	86.0	77.9	71.3	65.7
60	139.4	114.3	111.3	101.4	94.8	89.3	98.7	86.5	78.4	71.7	66.0
70	139.5	114.4	111.4	101.5	94.8	89.4	98.8	86.6	78.4	71.7	66.0
80	140.1	114.9	112.0	102.0	95.4	89.9	99.3	87.1	78.9	72.1	66.5
90	141.0	116.0	113.0	103.1	96.4	90.9	100.4	88.1	79.9	73.1	67.4
100	142.9	117.7	114.7	104.7	98.0	92.5	102.0	89.7	81.5	74.7	69.0
110	145.7	120.4	117.4	107.4	100.7	95.2	104.7	92.3	84.0	77.2	71.4

HEAVY VEHICLES
ROAD VOLUME CAPACITY RATIO = 1

SPEED	ROAD SURFACE/PAVEMENT CONDITIONS										
km/h	E	G1	G2	G3	G4	G5	S1	S2	S3	S4	S5
10	201.1	176.0	173.1	163.2	156.6	151.3	160.5	148.4	140.3	133.7	128.2
20	168.2	143.1	140.1	130.2	123.6	118.1	127.5	115.3	107.2	100.5	94.9
30	154.7	129.7	126.8	116.9	110.3	105.0	114.3	102.2	94.1	87.5	82.0
40	151.7	126.7	123.8	113.9	107.4	102.0	111.3	99.2	91.1	84.5	79.0
50	151.3	126.2	123.3	113.4	106.8	101.4	110.7	98.6	90.5	83.9	78.3
60	152.2	127.0	124.1	114.2	107.5	102.1	111.5	99.3	91.1	84.4	78.8
70	152.7	127.5	124.5	114.6	108.0	102.5	111.9	99.7	91.5	84.8	79.1
80	153.6	128.4	125.5	115.5	108.9	103.4	112.8	100.6	92.4	85.6	80.0
90	155.2	130.0	127.0	117.1	110.4	104.9	114.4	102.1	93.9	87.1	81.4
100	157.5	132.3	129.3	119.4	112.7	107.2	116.6	104.4	96.1	89.3	83.6
110	161.1	135.9	132.9	122.9	116.1	110.6	120.1	107.8	99.5	92.7	86.9

APPENDIX C

VOLUMES FOR NOISE ASSESSMENT

State Highway 10 – Pacific Highway
Existing and Predicted Traffic Flows
South of Failford Road

Vehicles per day adjusted to AADT

Year	AADT
2005	14850
2010	17736
2020	23507
2030	29278

Hourly distribution of vehicles - 300m South of Failford Road (Vehicle Class 1 - 12) Representative of years 2005, 2010 & 2020

Hour start	% of VPD in hour	% Cars (CL 1-2)	% Heavy Vehicles (CL 3-5)	% Heavy Vehicles (CL 6-12)
0	1.0	37.5	9.7	52.8
1	0.9	32.0	11.5	56.6
2	0.8	28.6	15.2	56.3
3	0.8	31.8	17.8	50.5
4	0.9	45.7	13.2	41.1
5	1.5	64.4	11.9	23.3
6	3.1	74.0	13.1	12.7
7	4.3	76.8	13.3	9.8
8	5.9	82.0	11.9	6.1
9	7.1	82.1	12.6	5.2
10	7.7	82.7	12.5	4.8
11	7.8	82.7	12.2	5.1
12	7.6	83.7	11.3	5.0
13	7.6	83.9	10.2	5.9
14	7.7	85.0	9.4	5.6
15	8.0	84.2	9.9	5.8
16	7.4	84.4	8.8	6.8
17	6.8	84.2	8.5	7.3
18	4.9	81.3	8.4	10.3
19	3.4	77.6	8.5	13.9
20	3.0	71.3	8.8	19.7
21	2.2	64.4	8.4	27.2
22	1.9	53.4	8.7	37.5
23	1.4	44.6	10.9	44.6

Year 2005 - Existing Traffic Volumes

Hour start	No. of Vehicles Per Hour in Day	No. of Cars (CL 1-2)	No. of Heavy Vehicles (CL 3-5)	No. of Heavy Vehicles (CL 6-12)
0	154	58	15	81
1	131	42	15	74
2	120	34	18	67
3	115	36	20	58
4	138	63	18	57
5	216	139	26	50
6	457	338	60	58
7	634	487	84	62
8	879	722	105	53
9	1050	862	132	54
10	1140	943	142	54
11	1160	959	141	59
12	1124	941	127	57
13	1123	942	115	67
14	1151	978	108	64
15	1185	998	118	69
16	1096	925	97	74
17	1007	848	86	73
18	726	590	61	74
19	510	396	43	71
20	453	322	40	89
21	331	213	28	90
22	281	150	24	106
23	215	96	23	96

Year 2010 - Predicted Traffic Volumes

Hour start	No. of Vehicles Per Hour in Day	No. of Cars (CL 1-2)	No. of Heavy Vehicles (CL 3-5)	No. of Heavy Vehicles (CL 6-12)
0	184	69	18	97
1	156	50	18	88
2	143	41	22	81
3	137	43	24	69
4	165	75	22	68
5	258	166	31	60
6	546	404	72	69
7	757	582	101	74
8	1050	862	125	64
9	1253	1029	158	65
10	1361	1126	170	65
11	1385	1146	169	70
12	1342	1123	151	68
13	1341	1125	137	80
14	1374	1168	129	77
15	1415	1192	141	82
16	1309	1105	116	89
17	1203	1013	102	88
18	867	705	73	89
19	609	473	52	85
20	540	385	48	106
21	396	255	33	108
22	336	179	29	126
23	256	114	28	114

Year 2020 - Predicted Traffic Volumes

Hour start	No. of Vehicles Per Hour in Day	No. of Cars (CL 1-2)	No. of Heavy Vehicles (CL 3-5)	No. of Heavy Vehicles (CL 6-12)
0	244	91	24	129
1	207	66	24	117
2	190	54	29	107
3	181	58	32	91
4	219	100	29	90
5	342	220	41	80
6	723	535	95	92
7	1003	771	134	99
8	1392	1142	165	84
9	1661	1364	209	86
10	1804	1492	225	86
11	1836	1519	224	93
12	1779	1489	201	90
13	1777	1491	181	106
14	1821	1549	171	102
15	1876	1580	187	109
16	1735	1464	153	118
17	1594	1343	136	116
18	1149	935	97	118
19	808	627	69	113
20	716	510	63	141
21	524	338	44	143
22	445	238	39	167
23	340	151	37	151

State Highway 10 – Pacific Highway
Existing and Predicted Traffic Flows
North of Tritton Road

Vehicles per day adjusted to AADT

Year	AADT
2005	11974
2010	14399
2020	19248
2030	24098

Hourly distribution of vehicles - Nth of Tritton Road (Vehicle Class 1 - 12) Representative of years 2005, 2010 & 2020

Hour start	% of VPD in hour	% Cars (CL 1-2)	% Heavy Vehicles (CL 3-5)	% Heavy Vehicles (CL 6-12)
0	1.2	31.5	9.7	60.5
1	1.1	26.5	11.1	62.4
2	1.0	26.7	14.3	59.0
3	0.9	32.3	18.8	51.0
4	1.1	42.0	12.5	45.5
5	1.6	59.6	11.2	28.6
6	2.9	69.2	14.7	16.4
7	4.3	76.1	12.3	12.0
8	6.0	81.7	11.3	7.1
9	7.3	81.4	12.2	6.5
10	8.1	82.0	12.0	6.0
11	8.3	82.4	11.4	6.1
12	8.1	83.6	10.8	5.6
13	8.1	83.9	9.1	6.7
14	8.2	83.7	9.3	6.9
15	8.4	83.0	10.1	7.2
16	7.8	82.5	9.5	8.4
17	6.8	82.6	8.9	8.8
18	4.8	78.4	8.8	13.0
19	3.4	72.0	9.1	18.9
20	3.0	65.7	9.9	24.7
21	2.4	58.0	9.4	33.5
22	2.0	46.7	9.5	43.8
23	1.7	40.4	11.1	49.1

Year 2005 - Existing Traffic Volumes

Hour start	No. of Vehicles Per Hour in Day	No. of Cars (CL 1-2)	No. of Heavy Vehicles (CL 3-5)	No. of Heavy Vehicles (CL 6-12)
0	144	45	14	87
1	136	36	15	85
2	122	33	17	72
3	111	36	21	57
4	130	55	16	59
5	187	111	21	53
6	347	240	51	57
7	511	389	63	62
8	716	585	81	51
9	874	712	107	57
10	974	799	117	58
11	995	820	114	60
12	971	812	105	55
13	966	810	88	65
14	981	821	92	67
15	1010	838	102	73
16	930	768	88	78
17	809	669	72	71
18	579	454	51	75
19	406	293	37	77
20	362	238	36	89
21	284	165	27	95
22	244	114	23	107
23	199	80	22	98

Year 2010 - Predicted Traffic Volumes

Hour start	No. of Vehicles Per Hour in Day	No. of Cars (CL 1-2)	No. of Heavy Vehicles (CL 3-5)	No. of Heavy Vehicles (CL 6-12)
0	173	54	17	105
1	163	43	18	102
2	147	39	21	87
3	134	43	25	68
4	156	66	20	71
5	225	134	25	64
6	417	289	61	68
7	614	468	75	74
8	862	704	98	61
9	1051	856	128	68
10	1171	961	141	70
11	1197	986	137	73
12	1167	976	126	66
13	1162	975	106	78
14	1180	987	110	81
15	1215	1008	123	88
16	1118	923	106	94
17	973	804	87	85
18	697	546	61	91
19	489	352	45	92
20	436	286	43	108
21	342	198	32	114
22	293	137	28	128
23	239	96	27	117

Year 2020 - Predicted Traffic Volumes

Hour start	No. of Vehicles Per Hour in Day	No. of Cars (CL 1-2)	No. of Heavy Vehicles (CL 3-5)	No. of Heavy Vehicles (CL 6-12)
0	231	73	22	140
1	218	58	24	136
2	196	52	28	116
3	179	58	34	91
4	209	88	26	95
5	301	179	34	86
6	558	386	82	91
7	821	625	101	99
8	1152	941	131	82
9	1406	1144	172	91
10	1566	1284	189	93
11	1600	1318	183	97
12	1560	1305	168	88
13	1553	1303	142	105
14	1577	1320	147	108
15	1624	1348	164	118
16	1495	1234	142	125
17	1301	1075	116	114
18	931	730	82	121
19	653	470	60	123
20	582	383	58	144
21	457	265	43	153
22	392	183	37	172
23	319	129	35	157