Not used

9.0 Project cost, economic analysis and safety

9.1 Introduction

An economic appraisal has been undertaken to determine the magnitude of benefits generated relative to the expenditure required to develop the project. This chapter presents the methodology, assumptions and results of an economic appraisal of the feasible options for the upgrade.

9.2 Objectives, options and scope

The objective of this economic appraisal is to assess whether the development of one of the options would be more beneficial for the community and road users than a "without project" case. A discussion on each of the options is presented in **Chapter 8**.

This economic appraisal uses a cost-benefit framework to assess the desirability of each option. The appraisal focuses on the benefits and costs accrued by road users, which include vehicle operating cost savings, travel time savings, accident cost savings, environmental impacts, construction and maintenance costs. Benefits arising from each option are based on net decreases in road user costs relative to the "without project" case.

9.3 Quantitative assessment of costs and benefits

9.3.1 Introduction

Modelling for the economic appraisal has been carried out according to NSW Government Guidelines. These guidelines are provided by two documents: the RTA Economic Analysis Manual[14], Version 2, 1999 and the NSW Treasury Guidelines for Economic Appraisals (TPP 97-2)[15], which addresses issues that are not explicitly covered by the RTA Economic Analysis Manual.

Rural-based economic parameters from the RTA Economic Analysis Manual provide unit rates for the quantification of road user benefits in this appraisal. The RTA Economic Analysis Manual notes that a rural road is located within a predominantly rural area as designated by the Australian Bureau of Statistics. *The 2006 Australian Standard Geographical Classification*, published by the Australian Bureau of Statistics, defines categories for urban areas with different populations. The smallest category of "Other Urban" area is for towns with a population of between 1,000 and 4,999. This category would include both Gerringong and Berry. Bomaderry with a population of approximately 25,000 would also be categorised as "Urban Other". Given that the length of these sections are relatively minor compared to the remainder of the study area which crosses rural land, the "Rural" road user parameters in the RTA manual have been applied in the appraisal.

In May 2006, the RTA issued revised economic parameter estimates, expressed in December 2005 dollars. These parameters have been updated to June 2007 dollars for this appraisal.

9.3.2 Key economic parameters

Key parameters used in this economic appraisal are discussed as follows:

Discount rate: A seven per cent per annum real discount rate is adopted in the evaluation to calculate present values. This study also undertakes sensitivity tests at alternative discount rates.

Price year: All costs and benefits in the evaluation are presented in June 2007 prices.

Where required, parameter values contained within the RTA Economic Analysis Manual were converted from December 2005 dollars to June 2007 dollars.

For accident and value of time parameters, an increase of 3.5 per cent was applied to convert to June 2007 values. This rate corresponds to the real increase in Average Weekly Earnings[16] between November 2005 and June 2007.

Post June 2007, in order to express future values in June 2007 dollars and account for real increases in Average Weekly Earnings, both parameters were increased at a (real) rate of 1.4 per cent per annum which reflects the expected real increase in Average Weekly Earnings over time. This assumption assumes continuing nominal Average Weekly Earnings growth of 4.1 per cent per annum and average Consumer Price Index of 2.7 per cent per annum. Both of these growth assumptions are based on the 10 year average growth rate in Average Weekly Earnings and Consumer Price Index between 1997 and 2007.

All other parameters were inflated by 4.2 per cent[17] which reflects the increase in the Consumer Price Index between December 2005 and June 2007.

Evaluation horizon: An evaluation horizon of 30 years from the conclusion of construction has been adopted for this study. All construction has been assumed to be completed by 2015 with full scheme operation from 2016 onwards.

The NSW Treasury Guidelines do not pre-specify the evaluation horizon. It does suggest a horizon of 20 years, but notes that individual projects may have a longer or shorter life. It concludes by noting that there is no single appropriate horizon, but due to the difficulties in forecasting cash flows beyond 30 years, 30 years should be considered as a maximum horizon. Given the long-life nature of road assets, an investment horizon of 30 years has been adopted for this appraisal.

9.4 Traffic analysis

9.4.1 Introduction

The traffic volumes using the project road as well as the Sandtrack, the other main north-south road in the region, are estimated in the Preliminary Traffic Assessment Report (**Appendix D**) and summarised in **Chapter 2**. This chapter draws on this report as the basis for the traffic predictions used in the economic appraisal.

For any road project, there are three types of traffic which are considered: normal, diverted and generated traffic:

- Normal traffic consists of those vehicles and road users who would use the road whether or not the project is implemented. Normal traffic also includes 'normal growth' or that expansion of traffic which would occur even without the road investment due to other exogenous factors.
- Diverted traffic is that traffic which would switch from another route or mode of transport if the project is implemented, whilst still travelling between the same origin and destination.

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14 RTA, Economic Analysis Manual, Version 2, prepared by the Economic Services and Support Branch, July 1999.

15 NSW Treasury, NSW Government - Guidelines for Economic Appraisal, TPP97-2, June 1997

16 Australian Bureau Statistics (2007): Total Earnings, All Persons, NSW

17 Australian Bureau Statistics (2007), Consumer Price Index, Sydney

- Generated traffic arises where the implementation of the project stimulates additional road traffic which would not have made the journey (by any means) in the absence of the project. Generated traffic is closely related to the development potential of the project area. Predictions of generated traffic are always difficult to make involving a measure of judgement, based on the expected response of road users to a reduction in the cost of road transport due to an improved road. It is only likely to be significant in those cases where the road investment brings about substantial reductions in transport costs. Given the lack of a transport network model, the estimation of generated traffic has not been undertaken. However, the development potential resulting from the upgrade is discussed further in **Section 9.9**.

Each of these types of traffic has been considered (and economic benefits estimated) separately in the economic appraisal. The quantification of each of these traffic types is discussed below.

9.4.2 Traffic estimates

For the traffic analysis, the first task is to determine the level of traffic, beginning with the base year and proceeding to estimate future year volumes in the "without project" case over the analysis period. These volumes have been derived from observed traffic counts and factored up, based on the RTA Southern Region's strategic traffic model, to produce estimates for the forecast year (2027). The results of this analysis are summarised in **Table 9.1**. The table also shows the proportion of heavy vehicles by section.

Table 9.1 Current and future traffic on the project road

Section	AADT* 2007	AADT 2027	% HGV* 2007
Princes Highway, north of Fern Street	20,700	36,300	8.3%
Princes Highway, north of Tannery Road	11,500	20,800	13.3%
Princes Highway, north of Cambewarra Road	13,400	22,500	10.0%

Source: Maunsell Preliminary Traffic Report
* AADT = Annual Average Daily Traffic
*HGV = Heavy Goods Vehicles

Traffic estimates for years beyond the 2027 forecast year have been derived by extrapolating the growth rate between 2007 and 2027.

9.4.3 Diverted traffic

The development and construction of any of the options can be expected to have an impact on the existing distribution of traffic on the road network in the area. The other main north-south road in the area is the Sandtrack. Based on the assumptions used in the Preliminary Traffic Report, the level of diversion predicted is summarised in **Table 9.2**.

Table 9.2 Current and future traffic on the Sandtrack

Section	AADT* 2007	AADT 2027 Non diverted	AADT 2027 Diverted to Princes Highway
Sandtrack	10,100	6,400	11,150

Source: Maunsell Preliminary Traffic Report
* AADT = Annual Average Daily Traffic

To derive estimates of diverted traffic prior to 2027, the general growth rate of traffic in the corridor between 2007 and 2027 has been applied to deflate the 2027 traffic volumes accordingly to obtain estimates in each year. Traffic levels beyond 2027, have been derived by extrapolating the traffic growth rate between 2007 and 2027.

9.5 Road user costs

9.5.1 Introduction

Annual user benefits have been estimated as the sum of:

- Vehicle operating cost savings.
- Travel time savings.
- Accident cost savings.
- Environmental benefits.
- Net changes in road maintenance costs.

In order to quantify these impacts, unit values for each parameter are required. These have been derived by reference to Appendix B of the RTA's Economic Analysis Manual and are summarised in the following sections.

9.5.2 Vehicle operating cost savings

Vehicle Operation Costs estimates prepared for this economic appraisal encapsulate:

- Fuel and oil.
- Depreciation.
- Maintenance.
- Wear on tyres and brakes.

The Vehicle Operation Costs parameters used in this economic appraisal are based on rural road parameters[18], which account for the following attributes:

- Vehicle class.
- Average vehicle speed.
- Road surface and pavement conditions.
- Horizontal alignment.
- Grading.
- Road-volume capacity.

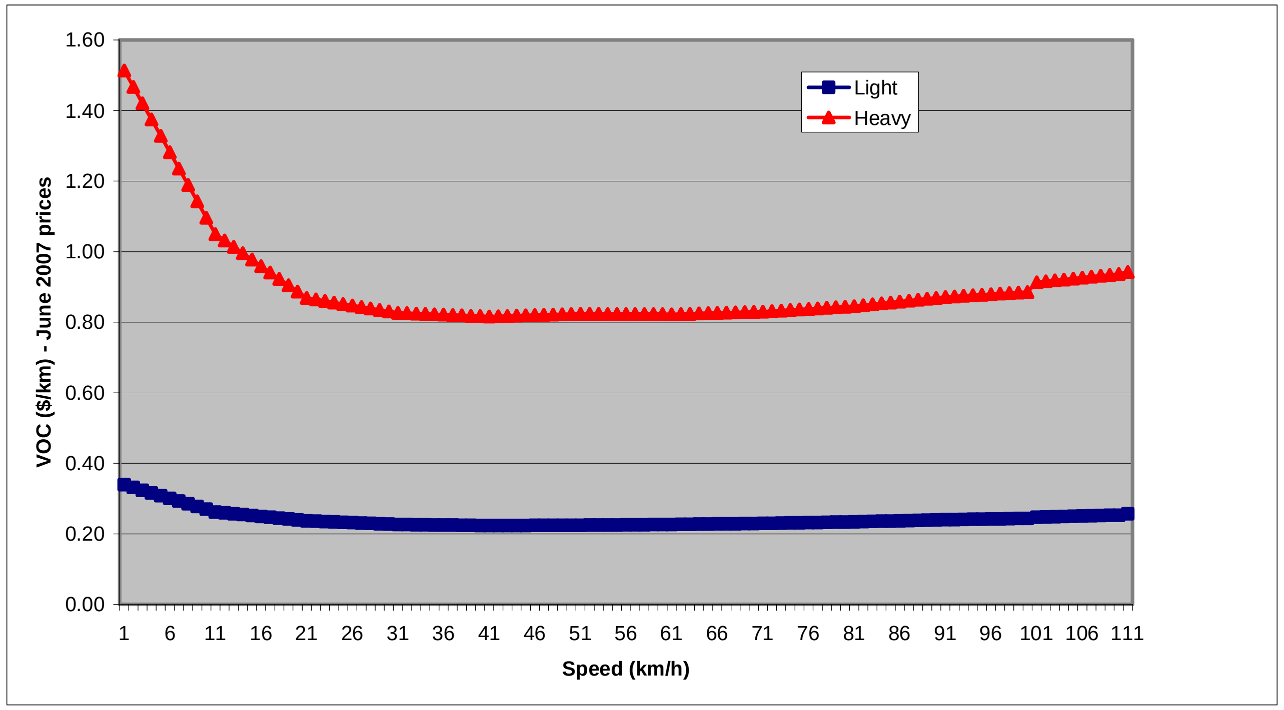
Many sections of the existing Princes Highway, in particular between Gerringong and Berry, are characterised by increased curvatures and undulations which increase vehicle operating costs. Consequently, for the "without project" case, the unit Vehicle Operation Costs rates have been increased to the 80 km/h design speed category (as per the RTA Economic Analysis Manual). This results in unit Vehicle Operation Costs rates increasing by approximately 20 per cent.

[18] As shown in Appendix B, pp. 18-22, RTA Economic Analysis Manual

The final adjustment made included an allowance for congestion on the upgrade at certain times of the day and at certain times of the week. This particularly occurs on section of road in the vicinity of Berry at weekends and public holidays, as well as instances where queues build up behind slow moving vehicles on the sections of road which have increased curvature and limited over taking possibilities. To reflect periods of increased traffic congestion, Vehicle Operation Costs rates were determined assuming an average volume capacity ratio of 0.5.

The RTA Economic Analysis Manual advises that Vehicle Operation Costs change with increases in vehicle speed. At low speeds, unit Vehicle Operation Costs rates decrease with increasing vehicle speed as vehicle engines function more efficiently. However, beyond a certain speed, between 50-60 km/h for most vehicle types, unit Vehicle Operation Costs increase as engine efficiency is reduced. The relationship between vehicle speed and Vehicle Operation Costs is summarised in **Figure 9.1**.

Figure 9.1 Vehicle Operation Costs by vehicle type for different speeds (assuming volume capacity ration - 0.0)



Source: Maunsell

To derive unit Vehicle Operation Costs for each road section, the travel speed calculations estimated in the Preliminary Traffic Assessment Report have been utilised. These are summarised in **Table 9.3**. To simplify the analysis, a weighted average speed on the existing road was derived and this is applied to the estimation of journey time and vehicle operating cost in the "without project" situation. In "with project" case, the average vehicle speed is assumed to increase to 100 km/h.

Table 9.3 Travel speed assumption by section

Section	Average speed (km/h)
Princes Highway, north of Fern Street	85
Princes Highway, north of Tannery Road	65
Princes Highway, north of Cambewarra Road	75
Weighted average (based on distance)	72

Source: Maunsell, Preliminary Traffic Assessment Report
Note: section speeds rounded to the nearest 5km/h

Based on the speeds above, the unit Vehicle Operation Costs on the existing highway are estimated to be $0.28 per kilometre for light vehicles and $1.01 per kilometre for heavy vehicles (2007 dollars). Given the shape of the curves in **Figure 9.1**, it is evident that Vehicle Operation Costs do not vary significantly in the speed range of 50-80 km/h, rather it is only at extreme speeds (either very low or very high) that Vehicle Operation Costs change. For the "with project" case, the unit Vehicle Operating Costs were estimated to be $0.24 per kilometre for light vehicles and $0.87 per kilometre for heavy vehicles (2007 dollars).

Vehicle Operation Costs, based on estimated Annual Average Daily Traffic and trip lengths, were estimated for each case, with Vehicle Operating Cost savings estimated for each option by taking the difference between the Vehicle Operation Costs of the route options and the Vehicle Operation Costs on the existing road.

9.5.3 Travel time savings

Rural Values of Time parameters were used for the economic appraisal. Values of Time are based on the following factors:

- Trip type.
- Occupancy.
- Presence of freight.

The RTA Economic Analysis Manual recommends a value of time parameter of $29.53 per vehicle hour. However, with a higher proportion of heavy vehicle traffic (8-13 per cent on different sections of the project road) than what was used to derive the above estimate (1 per cent), the following table was composed to develop Values of Time parameters independent of vehicle class. The various steps involved in calculating these parameters is shown in **Table 9.4**.

Table 9.4 Value of Time parameters - December 2005 prices

Vehicle	Prop. of All Vehicles	Prop. within group	Occupancy	VOT* $/ person hr	Value of Freight time per vehicle hr	VOT ($ per vehicle hr)
Car	46%	46%	1.80	$11.05		$19.84
Business	25%	25%	1.38	$35.34		$48.82
Light commercial	29%	29%	1.30	$21.65	$0.58	$28.73
All light vehicles						**$29.70**
Heavy commercial	0.07%	88%	1.00	$22.93	$14.13	$37.06
Road train	0.01%	12%	1.00	$23.95	$33.17	$57.12
All heavy vehicles						**$39.60**

Source: Maunsell calculations based on Table 17 RTA Economic Analysis Manual, p. B-14. Values are expressed in December 2005 prices.
* VOT = Value of Time

Table 9.4 shows that the Values of Time parameter is based on the Values of Time of five groups, namely private car users, business car users, business car users, light commercial truck users, heavy commercial truck users and road train users.

To calculate an estimate of Values of Time for light and heavy vehicles, users were disaggregated by vehicle class (light and heavy), with the proportion of each type of user within each vehicle class estimated. From these proportions, a weighted Values of Time parameter was calculated for light and heavy vehicle users. It was estimated that the Values of Time for each vehicle hour was $29.7 and $39.6 for light and heavy vehicles respectively (expressed in December 2005 prices). These estimates were then inflated by 3.5 per cent, representing the change in Average Weekly Earnings over the period, to $30.7 and $41.0 for light and heavy vehicles respectively to generate Values of Time estimates in June 2007 prices.

Travel time savings for each of the route options was calculated by taking the difference between travel time costs for each option and the "without project" case.

9.5.4 Accident cost savings

Accident cost unit rates have been estimated based on historic accident data for the study area and published accident cost rates in the RTA Economic Analysis Manual. Unit accident cost rates make an allowance for the following costs:

- Human costs including ambulance, hospital and medical costs.
- Vehicle costs including repairs and towing.
- General costs including travel delays, police and property.

A standard accident rate published in the RTA Economic Analysis Manual for rural roads was used to estimate the cost of future road accidents. This states that the average cost of a rural accident is $151,500 (in December 2005 prices). This was inflated by 3.5 per cent to estimate an accident cost in June 2007 dollars ($156,800).

The Preliminary Traffic Report contains an analysis of accidents on the study road over the period 2001-2005. A review of accident rates between 2001 and 2005 reveals that there were 243 accidents on the highway in the study area.

Based on the recent Annual Average Daily Traffic and length of each section of the road, a unit crash rate has been derived which is expressed in terms of the number of crashes per 100 million vehicle kilometres. Based on the sections listed above, these crash rates are summarised in **Table 9.5.**

Table 9.5 Crash rates per one hundred million kilometres for the study road

Section	Length (km)	2003 AADT*	Crash rate per 100 MVKM*
Princes Highway, north of Fern St.	2.27	19,293	66.3
Princes Highway, north of Tannery Rd	15.38	10,271	35.0
Princes Highway, Tannery Rd - Victoria St Berry	1.95	11,790	76.3
Princes Highway, Victoria St Berry to Cambewarra Road	12.30	11,790	21.5
Weighted average (based on distance)			35.0

Source: Maunsell, Preliminary Traffic Assessment Report
* AADT = Annual Average Daily Traffic
*MVKM = Million Vehicle Kilometres

To simplify the analysis, a weighted average crash rate has been derived which is applied to all project road sections in the "without project" case. Based on the information contained in **Table 9.5**, the standard crash rate is estimated to be 35 crashes per 100 million vehicle kilometres.

There has been a significant amount of research undertaken to determine average crash rates for different types of road. Data provided by the RTA[19] indicates that the crash rate for rural two-lane non-divided road is 32.8 crashes per 100 million vehicle kilometres. This is broadly consistent with the estimate provided in **Table 9.5**. The research also indicates that there is a noticeable reduction in crash rates as opposing flows are separated.

More recent research by Austroads indicates that the upgrade of links to divided two lane two way road can have a 25 - 50 per cent [20] reduction impact on crash rates. Consequently for the "with project" cases, it is assumed that the crash rates by section in **Table 9.5** are reduced by one third to reflect the improvement in road operational safety. Consequently, the "with project" crash rate is estimated to be 23 crashes per 100 million vehicle kilometres. This was cross-checked against crash rates on similar type roads in NSW including the recent Pacific Highway upgrades and was found to be broadly consistent.

Accident costs were estimated by taking the product of the average cost of a rural accident in June 2007 dollars ($156,800), annual daily traffic, section length and the crash rate by section.

9.5.5 Environmental externalities

As part of a preliminary appraisal, environmental externalities resulting from future traffic levels have also been estimated. These are based on the RTA values as described in the Economic Appraisal Manual and are summarised in **Table 9.6**. These unit values (based on 2005 values) have been increased by the retail price index factor (4.2 per cent) to convert them to June 2007 value equivalents and subsequently have been multiplied by the modelled vehicle kilometre estimates for each scenario to determine the environment externality impact of each alternative.

[19] Rural Crash Rates - Road Stereotypes Summary Report (Johansen, 1993)

[20] Austroads Guide to Project Evaluation Data, Part 4, page 13

Table 9.6 Environmental externality values - (cents per vehicle km - December 2005 prices)

Item	Passenger vehicles	Light vehicles	Heavy vehicles
Noise	0.00	2.60	0.26
Air pollution	0.02	23.71	1.13
Water pollution	0.03	2.25	1.47
Greenhouse	1.69	4.52	4.52
Nature and landscape	0.11	2.60	1.13
Urban separation costs	0.00	2.25	0.00

Source: RTA Economic Analysis Manual, Table 18.

9.6 Route option assessment

The details of the upgrade routes are outlined in **Chapter 8** and are summarised as follows:

- Section A: Mount Pleasant to south Gerringong section - Red route.
- Section B: South Gerringong to north Berry section - Pink, Green and Yellow routes.
- Section C: Berry Township section - Blue and Orange routes.
- Section B/C: South Gerringong to south Berry - Brown route.
- Section D: Berry to Bomaderry section - Purple route.

The economic analysis considers the relative merits of upgrading each section individually as well as in combination. Given the sub options within each section, it means that there are seven upgrade combinations for the entire length of the upgrade.

These are summarised as follows:

- Option 1: Red + Pink + Blue + Purple.
- Option 2: Red + Green + Blue + Purple.
- Option 3: Red + Yellow + Blue + Purple.
- Option 4: Red + Pink + Orange + Purple.
- Option 5: Red + Green + Orange + Purple.
- Option 6: Red + Yellow + Orange + Purple.
- Option 7: Red + Brown + Purple.

Each of the combinations has been assessed in the economic appraisal.

9.7 Option costs and benefits

9.7.1 Construction costs

Concept costs for all alignment options have been estimated and included in the economic appraisal. **Table 9.7** outlines the construction costs assumed for each alignment option.

Table 9.7 Construction cost estimates

Option	Cost ($million approx)	Total length (km)
1	760	30.5
2	840	30.0
3	880	30.5
4	750	30.5
5	840	30.0
6	880	30.5
7	810	30.0

Source: Maunsell
Note: cost estimates are approximate only

For planning purposes, it has been assumed that the construction cost is spread across a six-year period between 2010 and 2015 with costs spread equally between the six years. It has been assumed that Sections B and C will be upgraded just between 2010 and 2012, with Sections A and D upgraded subsequently between 2013 to 2015. In each case the project benefits are assumed to occur when each of the sections is completed.

9.7.2 Maintenance cost impacts

Route maintenance costs have been derived by reference to other recent road upgrade studies in NSW. In these studies, maintenance cost estimates were estimated to be approximately $55,000 per kilometre for a two lane road. This cost was used to derive maintenance costs in the "without project" situation. For the "with project" situation, the upgrade options include providing a four lane road which will be more costly to maintain than the existing road, given the larger area of pavement. Based on recent experience of the Pacific Highway upgrades, a unit maintenance cost of $95,000 per kilometre has been applied.

Unit maintenance costs have been multiplied by the road lengths in the "without project" and "with project" scenarios to determine the net effect on road maintenance costs.

9.7.3 Normal traffic benefits

Benefits to normal traffic included in the analysis include:

- Travel time savings resulting from higher vehicle speeds.
- Vehicle operating cost savings resulting from higher vehicle speeds and changes in journey distance.
- Environmental benefits resulting from a reduction in Vehicle Kilometres Travelled.
- Accident cost reductions resulting from a reduction in Vehicle Kilometres Travelled as well as reduced accident rates due to vehicles travelling on safer roads.

9.7.4 Diverted traffic benefits

Trips redistributed to the upgrade from the Sandtrack are assigned 50 per cent of the benefits compared to existing trips in the corridor. Justification is that a car user who presently uses the Sandtrack presumably finds it more beneficial than using the existing highway. Therefore, a user switching to the upgrade would gain less than an existing corridor user from using the new link. Some users will attract a benefit close to that for existing users while others will attract only a small marginal benefit. The standard assumption in economic evaluation is that a corridor switcher would gain on average, half the benefits on the existing corridor.

9.8 Economic appraisal results

9.8.1 Introduction

The appraisal models all cash flows over a 36-year period, including the six years of construction between 2010 and 2015, at a (real) discount rate of seven per cent per annum. All cash flows have been discounted to 2007. The discounted cash flows from the "without project" case and each of the development options were subsequently used in the calculation of the economic indicators. Three economic indicators were calculated as outputs of the economic appraisal to evaluate the relative attractiveness for each of the development options. A brief description of each indicator is provided as follows.

Net Present Value: measures the difference between benefits and costs, whilst accounting for the timing of benefits and costs. Net cash flows are discounted at the prescribed discount rate of seven per cent, reflecting the notion that future benefits and costs have less value compared to current benefits and costs. A project with a Net Present Value greater than zero would be considered desirable, with the project having the highest modelled Net Present Value being the most desirable.

Net Present Value Per Dollar of Investment: measures the return on a dollar of investment. The Net Present Value per Dollar of Investment is calculated by dividing the net present value by the present value of investment (construction costs have been used as the proxy for investment). A project with a Net Present Value per Dollar of Investment greater than zero would be considered desirable, with the project having the highest modelled Net Present Value being most desirable.

Benefit Cost Ratio: measures the return received per dollar of costs. The Benefit Cost Ratio is calculated by dividing the present value of all benefits by the present value of all costs. A project with a Benefit Cost Ratio greater than one would be considered desirable, with the project having the highest Benefit Cost Ratio being most desirable.

The Net Present Value per Dollar of Investment and Benefit Cost Ratio provide a scale in which to compare the relative attractiveness of different projects where the level of expenditure varies between projects.

It is important to note that the above economic indicators, individually, have various weaknesses in assessing the optimum project. Hence, the RTA and NSW Treasury Guidelines suggest a range of economic indicators to ensure the best outcome is selected.

9.8.2 Economic appraisal results

The results for the combined routes are shown in **Table 9.8**. All option combinations produce positive economic returns with Option 4 (Red + Pink + Orange + Purple) being the best performing with a Net Present Value of $149 million and a Benefit Cost Ratio of 1.28. The result is slightly higher than Option 1 which has a similar route distance producing similar economic benefits but for a slightly higher cost (an additional $5 million).

Table 9.8 Economic appraisal results for combined sections

Option combination	NPV* ($ million)	BCR*	NPVI*
Option 1	143.0	1.27	0.27
Option 2	104.2	1.18	0.18
Option 3	46.3	1.08	0.08
Option 4	148.8	1.28	0.28
Option 5	106.1	1.18	0.18
Option 6	46.3	1.07	0.07
Option 7	128.9	1.23	0.23

Source: Maunsell estimates
Note: Note all costs and benefits are discounted to June 2007 values using a 7 per cent discount rate.
*NPV = Net Present Value
*BCR = Benefit Cost Ratio
*NPVI = Net Present Value per Dollar of Investment

9.8.3 Sensitivity analysis

A sensitivity analysis was conducted on key parameters used to underpin the model to test the robustness of inferences made in the previous section. Sensitivity tests were conducted on the following parameters:

- Level of traffic minus 20 per cent.
- Construction costs plus 20 per cent.
- High discount rate 10 per cent).
- Low discount rate 4 per cent

The results of the economic appraisal are shown in **Table 9.9**. For simplicity, only the Benefit Cost Ratio results have been generated.

Table 9.9 Sensitivity analysis (Benefit Cost Ratio's by option)

Option combination	Base case	Traffic -20%	Increased capex (+20%)	10% discount rate	4% discount rate
Option 1	1.27	1.01	1.06	0.88	1.96
Option 2	1.18	0.94	0.98	0.81	1.82
Option 3	1.08	0.86	0.90	0.74	1.67
Option 4	1.28	1.02	1.07	0.89	1.98
Option 5	1.18	0.94	0.98	0.82	1.83
Option 6	1.07	0.86	0.90	0.74	1.67
Option 7	1.23	0.98	1.02	0.85	1.90

The results suggest that the economic appraisal results are sensitive to the variables tested under the different scenarios although the ranking of options does not change. Under all scenarios Option 4 and Option 1 have the highest Benefit Cost Ratio, with Option 4 providing slightly higher returns than Option 1.

9.8.4 Summary

Overall the economic appraisal indicates that Option 4 which is the combination of the Red + Pink + Orange + Purple routes provides the highest economic return. However, this result is only marginally better than Option 1 which is the combination of Red + Pink + Blue + Purple routes.

9.9 Qualitative analysis

9.9.1 Background

A range of factors has been identified that, at this stage, have not, or are not able to be quantified. The *NSW Guidelines for Economic Appraisals* and the *RTA Economic Analysis Manual* allow scope for the detailing of attributes that may impact on the economic viability in qualitative terms. The possible impact of the above mentioned attributes on the economic viability of a road link is described briefly below.

9.9.2 Economic development

An upgraded road link has the potential to promote economic development through the provision of greater accessibility and mobility. The reduction in travel time savings combined with better connectivity of industrial areas to high-speed highway links provides the opportunity to consolidate and develop these areas to take advantage of improved access to key markets. For instance, the road freight business would be expected to be a major beneficiary from reduced travel times and vehicle operating costs. This is particularly true for highway dependent businesses in the Nowra region which rely on markets and or suppliers further north in Wollongong and Sydney.

The upgrade will also assist in reducing travel times for visitors to the region and to popular holiday destinations located on the South Coast of NSW such as Jervis Bay, Bateman's Bay, Ulladulla and Eden. The reduction in travel times and improved safety conditions through the upgrade will assist the development and further growth of the tourism industry along the NSW South Coast.

Berry and Gerringong are both currently tourist destinations in their own right offering the charms of country towns in a spectacular rural setting, which generates significant employment opportunities for the local population.

The evidence from other bypass schemes in NSW in recent years suggests the significant positive environmental improvements are likely to occur in terms of reductions in congestion, noise and air pollution as well as road safety benefits and improved parking availability which would have the potential to boost the a town's amenity and attractiveness to visitors. These effects would be expected to increase the likelihood of motorists stopping in the towns and consequently would boost local economic activity.

However, it is possible that there might be some negative impacts on local business that depend on revenue generated by passing trade. Some existing businesses in Berry could experience changes in trade levels with the provision of a bypass. The extent of these impacts is likely to vary in response to factors such as:

- The nature of the business.
- Its reliance on highway-related trade.
- Its ability to develop new / different markets.
- Ameliorative measures incorporated in the design and implementation of the upgrade such as access arrangements and systems to provide advance information to highway users.

Overall, the negative impact on businesses is not expected to be significant providing planning to take advantage of the road improvements are initiated at an early stage.

Finally, the construction spend on the development of an upgraded road link has potential to generate long term growth in employment within the region. Whilst construction positions will be created, the economic multiplier effects from expenditure on construction generally have longer run positive impacts.

9.9.3 Property values

Road developments potentially have ambiguous effects on property values. On one hand, a reduction of traffic has the ability to improve amenity, providing a positive effect on residential property values. Residential, commercial and industry land values can be further enhanced by greater accessibility and mobility provided by the development of a new road.

On the other hand, commercial property values may be adversely affected by a diversion. Reduced throughput on a road decreases the potential for passing trade and in turn, decreases the economic rent that landowners are able to extract from tenants. If economic activity is significantly impacted, this may have longer term flow on effects on general land values. Severance caused by a new road link may also reduce property values through reduced access and productivity.

9.9.4 Safety

A key imperative for highway upgrade projects such as the Princes Highway proposal is the achievement of road safety improvements principally for highway users but also for local vehicular and pedestrian traffic where this access currently occurs on sections of the highway or intersects with it. Road safety benefits have been quantified in the analysis, however, it is important to note that these safety benefits are likely to accrue across the wide 'community' of existing and future highway users as well as local communities where residents currently have to access or cross the highway for a variety of day-to-day activities.

Not used