

**SOCIO-ECONOMIC IMPACT OF  
THE BELLS LINE EXPRESSWAY**

**Prepared for: Bells Line Expressway Group**

**By the Western Research Institute**

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## EXECUTIVE SUMMARY

This report has been commissioned by the Bells Line Expressway Group to provide an assessment of the economic impact of upgrading the Bells Line of Road to a high standard expressway. In particular, the aim of the report is to analyse the economic impact of the proposed Bells Line Expressway on the Central NSW Regional Organisation of Councils (CENTROC) region.

Currently routes to Western NSW from Sydney, the Great Western Highway and the Bells Line of Road, are characterised by very steep grades, tight curves and limited overtaking opportunities. The nature of the roads over the mountains limits growth of both passenger and freight transport to the west. There is a distinct need for an upgrade to the Bells Line of Road as the Central West is the only region adjacent to Sydney without road access of an appropriate standard. An adequate route between the Sydney Basin and the Central West region could facilitate growth and relieve the safety and congestion issues on the Great Western Highway.

The preferred option for the upgrade is a high standard 100-110 kph four lane expressway with a gradient generally less than 7%. This type of road would be suitable for all types of vehicles including B-Doubles (SKM, 2004<sup>a</sup>). The total construction cost of the road is estimated to be between \$2 and \$3 billion with recurrent maintenance costs of 10% construction cost per annum (SKM, 2004<sup>a</sup>).

Road infrastructure investment can increase productivity, provide greater flexibility, facilitate innovation, reduce costs, improve efficiency and provide firms with a competitive advantage. This initial impact on existing businesses in the region is expected to be concentrated in those regions closest to Sydney and taper off to the west. The most significant increases in industry expansion are anticipated in manufacturing, transport and fresh market horticulture.

Tourism development as a result of the upgrade will be most marked in the areas that will become viable as day trips and short break holidays. Reduced travel time across the mountains will give the impression that western NSW is easier to get to and this will make it easier to attract domestic self-drive tourists, especially those from Sydney.

Shorter travel times between the CENTROC region and Sydney make it viable to commute or telecommute to work in Sydney, a trend evidenced in the Hunter region. It is anticipated that more people will move to the region to take advantage of affordable housing; attractiveness of the location; and accessibility to Sydney. The establishment of weekenders, later used as

retirement homes can also have a positive influence on the economic development of the region over and above household expenditure impact.

The potential for growth in the CENTROC region is considerable. The construction of the Bells Line Expressway would act as a catalyst for private investment. Improved transport infrastructure increases the attractiveness of the region and makes the region a viable location for production and distribution facilities. These effects are most likely to be concentrated in the warehousing and manufacturing industries.

In the five years from completion of the Expressway, total economic growth induced by the expressway in the region is expected to be \$268 million (4.5%) in GRP, \$122 million (3.7%) in household income and 3,062 (3.9%) full time equivalent jobs. Furthermore, accident cost savings have been estimated in this report to be around \$2.7 million per annum, with the average annual savings on vehicle operating costs and travel time determined by Sinclair Knight Merz (2004) to be \$9.9 million per annum.

The proposed Bells Line Expressway will provide the CENTROC region with substantial benefits in terms of economic growth and road safety. The noteworthy economic and community benefits that would arise as a result of the construction of the Bells Line Expressway provide support to the argument for the upgrade.

# 1 INTRODUCTION

## 1.1 Project Background

This report provides an assessment of the economic impact of upgrading the Bells Line of Road to a high standard expressway. It is the first report of a series of 3 reports, commissioned by the Bells Line Expressway Group. In particular, the aim of this report is to analyse the economic impact of the proposed Bells Line Expressway on the CENTROC region.

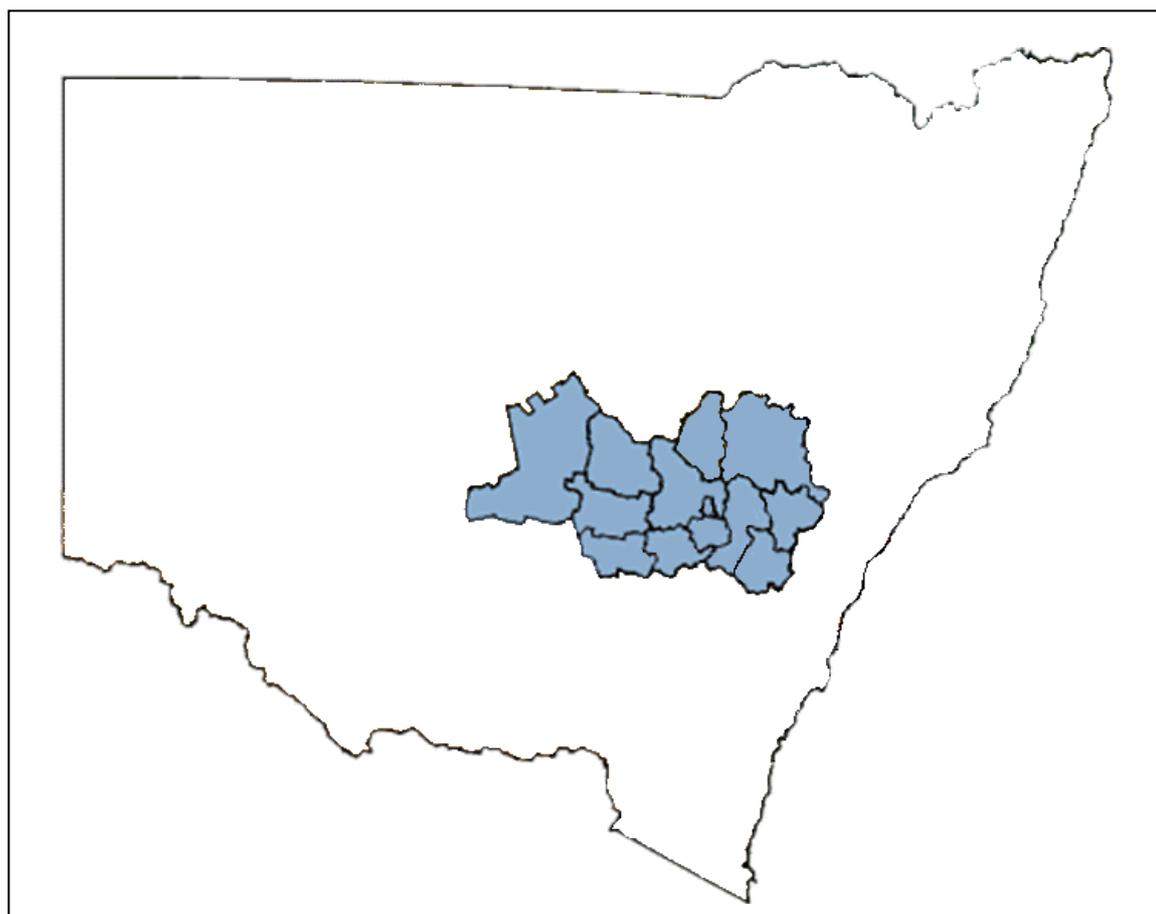
This economic impact study is in response to the *Bells Line of Road Corridor Study* prepared by Sinclair Knight Merz (SKM, 2004) which examined the feasibility of the Bells Line Expressway. Earlier studies which have also examined the Bells Line of Road include:

- RERU (1998). *A New Four Lane Expressway Between Penrith and Lithgow – An Economic Study*. Prepared for CENTROC.
- Maunsell McIntyre (2000). *Bells Line of Road Development Study* and Maunsell McIntyre (2001). *Bells Line of Road Traffic Study*. Prepared for the RTA.

## 1.2 The CENTROC Region

The CENTROC region encompasses the Local Government Areas of Bathurst Region, Blayney, Cabonne, Cowra, Forbes, Lachlan, Lithgow, Mid-Western Region, Oberon, Orange, Parkes, Rylstone, Weddin and Wellington. The region is host to a range of industries including retail, agriculture, manufacturing and mining. The total value of production in the region is around \$6.3 billion per annum with employment of around 80,000. The CENTROC region is outlined in Figure 1.2 over the page.

The CENTROC region borders the Blue Mountains just west of Sydney. Currently access to Western NSW from Sydney is limited to two routes across the Blue Mountains, the Great Western Highway and the Bells Line of Road. Both routes are characterised by very steep grades, tight curves and limited overtaking opportunities. The Bells Line of Road is currently the secondary route over the mountains with a majority of passenger and freight movements going via the Great Western Highway.

**Figure 1.2 CENTROC**

The Great Western Highway currently carries around three times the amount of traffic carried by the Bells Line of Road. Despite this, the accident rate on the Bells Line is higher than both the state average and the Great Western Highway (SKM, 2004<sup>a</sup>). The Bells Line of Road is slightly shorter than the Great Western Highway; travelling this route can significantly reduce travel time, especially for trucks. The travel times along each route are shown in Table 1.1 below.

**Table 1.1 Average Travel Times between Lithgow and the M7**

Route	Distance (km)	Travel Time (minutes)			
		Westbound		Eastbound	
		Trucks	Cars	Trucks	Cars
Bells Line of Road	81	90	65	85	70
Great Western Highway	89	100	85	95	85

Source: Sinclair Knight Merz, 2004 p. xi.

Major interstate routes including the Mid-Western and Newell Highways pass through the CENTROC region, including transport hubs in Parkes and Blayney which link NSW with a national transport network. However, access to Sydney for both passenger and freight transport is limited by the nature of the roads over the mountains.

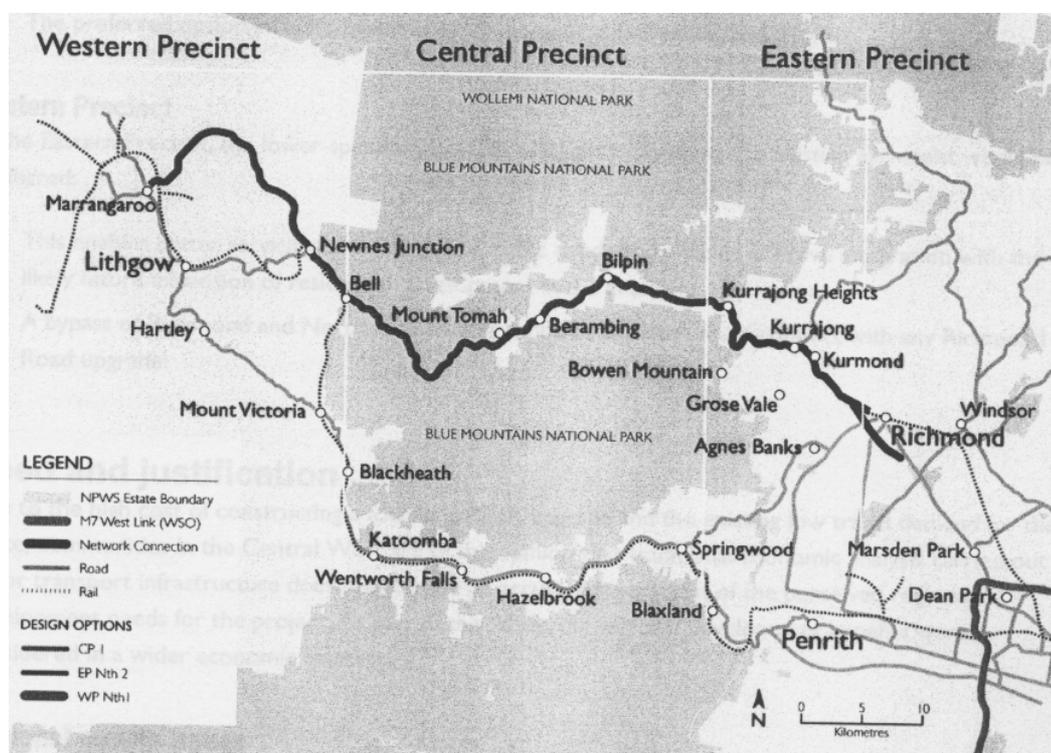
To ensure that the growth potential in Western NSW is achieved, it is necessary to improve access between the region and Sydney. The traffic demands on the Great Western Highway, caused by competing local, commuter, visitor and through traffic, limit the scope for further development of this route. Therefore, a proposal has been developed for the upgrade of the Bells Line of Road to a B-Double standard Expressway. The Expressway would extend from Lithgow to Windsor and if constructed, would reduce travel time each way by 35 minutes for cars and 20 minutes for trucks (SKM, 2004) opening up the gateway to Western NSW.

## 2 THE BELLS LINE EXPRESSWAY

The NSW Roads and Traffic Authority (RTA) and the Commonwealth Department of Transport and Regional Services (DOTARS) commissioned Sinclair Knight Merz (SKM) to undertake a study on the Bells Line of Road to identify constraints on upgrade, review and develop route options and prepare a concept design of the preferred option for the construction of the Bells Line Expressway. There is a perceived need for an upgrade to the Bells Line of Road to provide an adequate route between the Sydney Basin and the Central West region to facilitate growth and to relieve the safety issues on the Great Western Highway.

As outlined in the SKM (2004<sup>a</sup>) report, the preferred option for the construction of the Expressway is a high standard 100-110 kph four lane route with gradient generally less than 7%. The preferred option is shown in Figure 2.1 below. This type of road would be suitable for all types of vehicles including B-Doubles (SKM, 2004<sup>a</sup>). The total construction cost of the road is estimated to be between \$2 and 3 billion with recurrent maintenance costs of 10% construction cost per annum (SKM, 2004<sup>a</sup>).

**Figure 2.1 The Preferred Route for the Bells Line Expressway**



Source: SKM, 2004<sup>a</sup>

Should the Bells Line Expressway be constructed, it is estimated that traffic volumes along the route could almost triple by 2011, with continued growth exceeding current estimates by 66% to 2031 (SKM, 2004). The corresponding effect on traffic flows along the Great Western Highway could be expected to decrease between 2003 and 2011 by up to 12%, with a total increase by 2031 of only 41% (SKM, 2004). The anticipated growth in traffic over the Bells Line could account for up to a 47% increase in vehicle kilometres travelled (VKT) to 2040 (SKM, 2004). These figures indicate that the Bells Line could displace a significant proportion of traffic from the Great Western Highway.

The resulting benefits to the community for the construction of the Expressway include savings in vehicle operating costs, travel time costs and accident costs. These common tools used to measure road user benefits by the RTA were estimated in the SKM report as outlined in Table 2.1 below. The total road user benefit was estimated to be between \$682 and \$1,037 million over a 30 year period (SKM, 2004<sup>a</sup>). The distribution of savings across vehicle operating costs, travel time costs and accident costs is shown in Figure 2.2 below.

**Table 2.1 Cost Savings Associated with the Bells Line Expressway**

	Vehicle Operating Costs		Travel Time Costs		Accident Costs	
	Light Vehicle (\$/VKT)	Heavy Vehicle (\$/VKT)	Light Vehicle (\$/vehicle)	Heavy Vehicle (\$/vehicle)	Injury Accidents (number p.a.)	Tow-Away Accidents (number p.a.)
Saving	0.19	0.74	14.22	8.04	44	65

Source: Sinclair Knight Merz, 2004 pp. 29-30.

**Figure 2.2 Distribution of Road User Benefits over the Economic Life of the Road**



Source: Sinclair Knight Merz, 2004<sup>a</sup> p. 28. Note: Trend growth scenario based on annual average growth between 1% and 2%. High growth scenario based on annual average growth between 2% and 5%.

Based on these costs and savings, the SKM report (2004<sup>a</sup>) details a traditional cost-benefit analysis for investment in the Bells Line upgrade. As outlined in Table 2.2 below, this restrictive approach quantifies only road user benefits and does not take account of the GRP, household income and employment benefits that may occur in the CENTROC region as a result of the Expressway. Regional development benefits have only been quantified in terms of increased traffic flows and their impact on vehicle operating costs, travel time savings and accident cost savings. Furthermore, this regional development impact is only considered in the high growth scenario. However the SKM report (2004<sup>a</sup>) does acknowledge that although not incorporated into their analysis, the wider impacts of regional development can be included in cost-benefit analysis.

**Table 2.2 Cost-Benefit Analysis – Sinclair Knight Merz (2004<sup>a</sup>)**

	Trend Growth	High Growth
Capital Cost (7% discount rate)	2,238	2,238
Residual Value	-63	-63
Recurrent costs	249	249
<b>Total costs</b>	<b>2,424</b>	<b>2,424</b>
VOC Savings	179	264
Travel Time Savings	371	569
Accident Cost Savings	132	204
<b>Total Savings</b>	<b>682</b>	<b>1,037</b>
NPV (\$m)	-1,741	-1,387
BCR	0.3	0.4
FYRR (%)	2	2
NPV/I	-0.8	-0.6

Source: SKM (2004<sup>a</sup>) p. 28

The Sinclair Knight Merz report (2004) concludes that the Bells Line Expressway is not strictly economically viable, given that cost benefit analysis indicates a net cost to road users. However, these calculations do not take into account the regional economic benefits of increased GRP, household income and employment that may result from the construction of the Expressway. While it is acknowledged that these impacts are not a net increase, rather a transfer, it is important to recognise the significant boost to the region a high standard link between Western NSW and Sydney could provide. Also, given the pressures on Western Sydney in terms of population, infrastructure, pollution and externalities, the Expressway could provide additional benefits to Western Sydney, not measured in this report. The remainder of this report quantifies the expected regional economic benefits for the CENTROC region and when combined with the benefits outlined in the SKM (2004<sup>a</sup>) report, provides a more accurate representation of total economic benefit.

### 3 INFRASTRUCTURE INVESTMENT AND ECONOMIC GROWTH

Infrastructure investment is a fundamental prerequisite to economic growth (CEDA, 2005 p. 10). Australia's investment in road infrastructure has declined from 22% of GDP in 1960 to just over 10% in 2002 (CEDA, 2005 p. 14). This decline has resulted in increased congestion costs (projected to reach almost \$30 billion in 2015) and decreased competitiveness of Australia's trade offering (CEDA, 2005 p. 15). "*The under-investment in Australia's infrastructure over the last 20 years may come at a serious cost to future economic growth... there is little doubt that new investment in infrastructure is essential for sustained economic growth*" (CEDA, 2005 p. 18).

In the report *Australian Infrastructure Report Card*, Engineers Australia (2001) rated the country's infrastructure from A to F, where A indicated sufficient infrastructure for current and future purposes and F indicated inadequate infrastructure for current and future purposes (CEDA, 2005 p. 21). This report card showed that none of Australia's road infrastructure was sufficient, with National roads attracting a C rating, State roads C- and local roads D (CEDA, 2005 p. 21). In total, this report estimated Australia's under-investment in road infrastructure to be around \$10 billion (CEDA, 2005 p. 22). This could potentially restrict Australia's economic growth by between \$1.7 and \$3.9 billion<sup>1</sup>.

The BTRE 2003 working paper *Government Interventions in Pursuit of Regional Development: Learning from Experience* also supports the argument to increase Australia's road infrastructure investment. It details six "*fundamentals*" for regional economic development. These include:

- efficient management of the public sector and system of taxation;
- provision of efficient infrastructure;
- provision of effective education and training systems;
- operation of effective financial and labour markets;
- development of an effective regulatory and competitive framework; and stability and predictability in policy settings.

Source: BTRE, 2003 p.59-60.

Australia's current under-investment in infrastructure and the need for regional development are key issues for consideration in the proposal for the Bells Line Expressway. As evidenced in Chapter 2, the current routes between Sydney and Western NSW are not efficient and limit the growth potential of the CENTROC region. The remainder of this Chapter will explore recent research in the area of infrastructure investment and regional development.

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<sup>1</sup> Based on output elasticity of between 0.17 and 0.39 (CEDA, 2005 p. 20).

The role of infrastructure in economic development is widely researched. In general it is accepted that infrastructure improvements lead to increased productivity, reduced costs and therefore economic growth. This is particularly true of transport infrastructure where decreased transport costs and improved quality of transport services “*facilitate expansion and innovative advances in other sectors*” (Gillen and Waters, 1996). Additionally, improved accessibility to regions has been documented as important drivers in population migration and tourism development. Each of these economic impacts is discussed briefly below.

### **3.1 Transport Infrastructure and Industry Growth**

The link between the provision of transport infrastructure and economic growth is well established in the literature. “*First, public infrastructure provides the basic foundation for economic activity. Second, it generates positive spillovers; that is social benefits*” (Eberts, 1990 p. 16). Of all types of public infrastructure investment, core investment such as the construction and improvement of highways impact the most significantly on output growth and productivity (Gillen, 1996). It is widely accepted that transport infrastructure improvements can increase productivity, provide greater flexibility and facilitate innovation. Furthermore, improved road infrastructure can reduce costs, improve efficiency and provide firms with a competitive advantage (Gillen, 1996).

Reduced travel times, as a result of the Expressway, can improve productivity in the transport industry where time lost in congestion is a larger cost to transport operators than fuel (Sutton, 1999). However, the effect of this reduction in costs extends beyond the transport industry. Research has shown highway improvements to dramatically lower costs in 35 sectors of the US economy (Sutton, 1999). Estimates of cost savings have ranged from 16c per annum for each dollar initially invested (Morrison and Schwartz, 1996) and 30c per annum per dollar invested (Sutton, 1999). The majority of this cost saving is experienced in the transport, warehousing and manufacturing sectors (Sutton, 1999 and Gillen and Waters, 1996).

Additionally, a transformation of logistics performance can benefit business by providing new opportunities for expansion. Changes may be made to product mix, production techniques, business networks, location, scheduling, inventories and the scale of operations (Gillen, 1996). A number of national and international studies have examined the relationship between infrastructure investment and output, the results of which generally indicate an output increase of between 17 and 39c to each dollar invested (CEDA, 2005 p. 20).

Critical to these studies of the relationship between infrastructure and economic growth is an acknowledgement that the level of growth attainable is dependant on the regions characteristics. Eberts (1990) outlines three types of regions:

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1. *Congested Regions*: these regions are characterised by a very high concentration of population, industrial and commercial activities and public infrastructure (such as Sydney). In these regions, the cost of investment outweighs the benefits attained.
2. *Intermediate Regions*: characterised by an abundance of well trained labour, cheap power and access to raw materials. In these regions, the cost of investment in infrastructure is far outweighed by the benefits achieved.
3. *Lagging Regions*: are characterised by a low standard of living and production is dominated by small scale agriculture, stagnant or declining industries. These regions offer little attraction to investors and therefore investment in infrastructure would have little effect.

Given these definitions, the CENTROC region, an intermediate region, should receive great benefit from the construction of the proposed Expressway.

### **3.2 Transport Infrastructure and Tourism Development**

A large portion of industry growth as a result of the Expressway will be driven by the tourism market. Transport infrastructure is one of the most significant influences on the development of tourism in a region (Palhares, 2003). In particular, tourism in regional areas is heavily tied to road transport infrastructure (Gartner, 2004). In Australia, 70% of all trips are taken by car with 86% of domestic tourism to regional areas self-drive (Prideaux and Carson, 2003). In the CENTROC region, an average of 93% of domestic tourism is self-drive (Environmetrics, 2003).

The role of road transport infrastructure in the development of regional tourism is well documented in the literature, especially the case of the USA where it is claimed that the greatest boost to regional tourism came with the development of the interstate highway network (Gartner, 2004). A recent article published by Evans and Shaw (2001) highlighted the role of the Jubilee Line Extension (JLE) in London in the development of tourism in the area. Following the development of the JLE, the number of hotels within 1km more than doubled, visitation to established attractions increased by 20% and an array of new attractions were constructed (Evans and Shaw, 2001). In all, the growth rate of the area surrounding the JLE grew 24% faster than the average for London over the period studied (Evans and Shaw, 2001).

Given the worldwide growth in demand for rural tourism and the expectation that this growth will continue for some time (Gartner, 2004), the potential for tourism development in the CENTROC region is enormous. In fact, Gartner (2004) asserts that regional tourism will continue to grow due to:

- growing interest in heritage, tradition, authenticity and rurality;
- desire for short break holidays;
- positive appeal of fresh air, activity opportunities and a stress free environment;
- interest in outdoor recreation;
- solitude and relaxation in a natural place; and
- an ageing but active population.

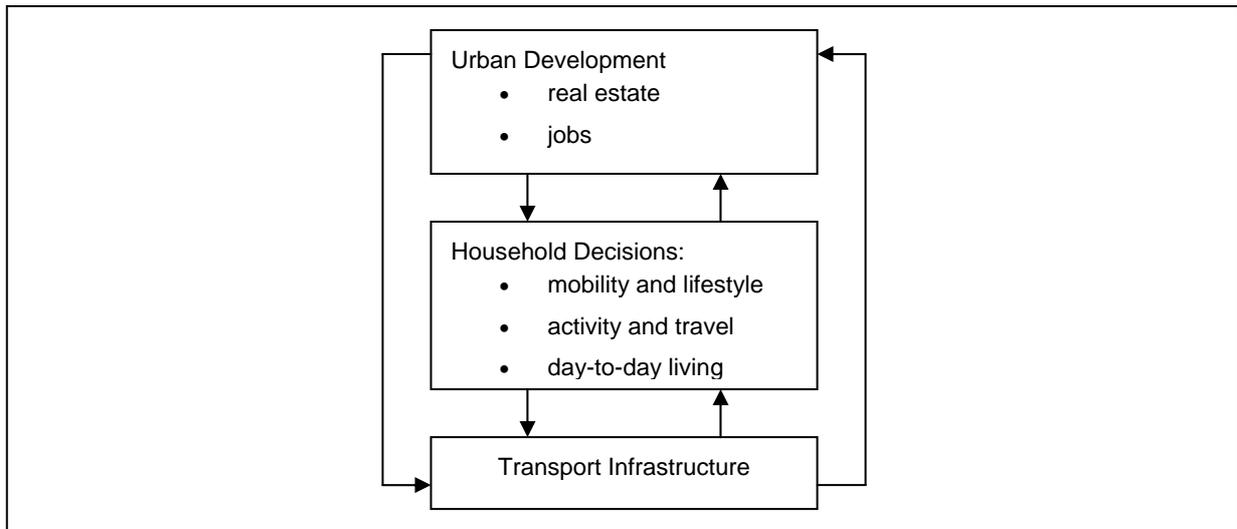
It is anticipated that the construction of the Expressway will act as a catalyst for further tourism development in the CENTROC region. This could lead to significant economic growth driven by visitor expenditure in the hospitality, retail and transport sectors.

### **3.3 Transport Infrastructure and Population Migration**

Driven by business development and increased visitation to the region, investment in infrastructure can have a substantial impact on the location decisions of households. This phenomenon is driven by the concepts of accessibility and comparative advantage. Households will more likely locate in areas with a high degree of accessibility to major centres, especially those with a comparative transportation advantage. This means that locations which have advantages not available elsewhere, such as proximity to a highway or rail network, are more highly valued than those without (Voith, 1991).

The improvement of transport infrastructure has the ability to rearrange the spatial distribution of jobs and residences (Haughwout, 2000). Households weary of city life will relocate to the fringe of the metropolitan area to enjoy an improved quality of life (Haughwout, 2000). In this way, the effect of investment in transport network systems differs from that of general infrastructure investment in that the effect is not localised, an improvement in any part of the system can benefit a whole region (Haughwout, 2000).

Beyond any incentive for increased population migration, the development of road infrastructure can act as a cyclical and ongoing stimulus to population growth and social development. Investment in the transport system drives both urban development and household location decisions, these in turn continue to affect transport infrastructure (Ben-Akiva and Bowman, 1998). This relationship is outlined in Figure 3.3 below. Increased accessibility to Sydney as a result of the Expressway will open up the CENTROC region as a viable residential location for a number of commuters and telecommuters. Improved lifestyle and ability to maintain mobility, travel and day-to-day activities will drive household decisions to relocate. This in turn will push real estate development and jobs growth in the region.

**Figure 3.3 Cyclical Flow of Effects**

Source: Ben-Akiva and Bowman, 1998 p.1132.

Eastern parts of the CENTROC region have the potential to become satellite communities. A recent study has shown that the urban fringe is expanding “*out to the Southern Highlands, Lithgow, Oberon and down to Huskisson, as city people seeking a quiet life move even further away*” (Jopson, 2002). This new geography reflects new attitudes, more flexible work arrangements, increased job diversity, a large population and the availability of cheaper housing on larger land lots (O’Connor, Stimson, and Daly, 2001). Additionally, it is anticipated that recreational day trips, short break accommodation and the establishment of holiday homes usually channelled along freeways out of metropolitan areas (O’Connor, Stimson, and Daly, 2001) will further encourage a westward population shift.

### **3.4 Transport Infrastructure and Economic Integration**

In the longer term, it is expected that improved access to Sydney from the CENTROC region will make it a viable alternative for business migration to the region. The reduction of spatial and time accessibility of firms in the CENTROC region to both resources and customers will influence production and distribution location decisions (Talley, 1996). An increase in the number and type of enterprises investing in the region will result in economic integration, driving productivity through a dense labour market, thickening of the economy and shared costs (Haughwout, 2000).

These benefits describe the “agglomeration effects” that may impact on businesses in the CENTROC region given improved accessibility to Sydney. The construction of the Expressway would provide the region with a location advantage, effectively increasing the size of the region by linking in with areas of Western Sydney and providing stimulus to new enterprises to enter the region (Gillen, 1996). Road infrastructure investment acts as a catalyst for growth, encouraging business expansion, private investment and migration of industry (Talley, 1996), creating employment opportunities in the region (Gillen, 1996). It can also attract inputs from other regions, stimulate innovation and create opportunities for improvement or wholesale change (Gillen, 1996).

The Expressway will improve business perceptions of the CENTROC regions integration with the Sydney and wider Australian economy (RERU, 1998). It is likely that improved transport access between Sydney and the region will specifically improve perceptions of the type of activities the CENTROC region is capable of supporting and increase the number and diversity of industries perceived as viable operations in the region (RERU, 1998). This type of economic growth provides a more realistic representation of the expected changes as a result of the construction of the Expressway than does growth of existing business alone.

### **3.5 Summary**

Infrastructure improvements can lead to increased productivity, reduced costs and therefore economic growth. Particularly, investment in transport infrastructure can facilitate expansion of existing business, stimulate tourism and population growth and act as a magnet for attracting investment to a region. Each of these economic impacts is quantified in this report using input-output analysis, as discussed in the following chapter.

## 4 METHODOLOGY

Following from the RERU (1998) study, the objective of this report is to quantify the regional development benefits of the construction of the Bells Line Expressway. This is done in three steps:

1. construction of the regional input-output table;
2. data collection; and
3. application of the data to the table in the form of final demand impacts.

### 4.1 Input-Output Modelling

The Western Research Institute used input-output analysis to determine the economic impact of the proposed Bells Line Expressway. Input-output modelling provides a detailed picture of the structure of the economy at a particular point in time. The input-output tables used in this report are for the CENTROC region in the 2003/04 financial year.

Input-output tables can be used to estimate the contribution of an industry to a particular country, state or region in terms of initial impact and flow-on (or multiplier) effects resulting from linkages with households and other industries. Therefore the impact of the proposed Bells Line Expressway has been provided in terms of the direct and flow-on benefits that result from a reduction in travel time to Sydney and improved road conditions. All tables were constructed using Input-Output Analysis for Practitioners version 8.1.0.9<sup>2</sup> software.

### 4.2 Table Construction

The CENTROC table was extracted from the Australian Bureau of Statistics (ABS) 1998-99 National input-output table using the Generation of Regional Input-Output Tables (GRIT) technique. The GRIT technique derives regional input-output tables from the National input-output table using location quotients and estimates of household income, employment, profit and final demand for the region being studied.

The GRIT procedure was developed by Associate Professor Guy West and Professor Rod Jensen of the University of Queensland and is the most widely used method of constructing regional input-output tables in Australia. The GRIT method is also widely used in America and Europe. A more detailed description of the CENTROC table and the construction methodology can be found in Appendix 1.

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<sup>2</sup> Input-Output Analysis for Practitioners ©2003 Centre for Economic Policy Modelling, University of Queensland. Programmed by Guy West.

### 4.3 Data Collection

The data used to identify the impact of the proposed Bells Line Expressway was obtained in a series of interviews with industry leaders and Council representatives across the CENTROC region. The interviews were structured to extract information about the short to mid-term and long-term impacts of the Expressway. Specifically, questions referred to change in costs, sales, employment, general industry structure and community. A copy of the interview outline can be viewed in Appendix 2.

#### 4.3.1 Sample

A nonprobability sampling methodology utilising the judgement sampling and snowballing techniques was employed in this study. This combination allowed for the identification of key representatives of industry and community across the CENTROC region by the WRI and local experts in each LGA. The most prominent industries in each LGA as well as those most likely to be affected by the construction of the expressway were targeted for interviews.

A total of 23 personal interviews and 19 telephone interviews were conducted across 11 key industries in the CENTROC region. The sample frame is outlined in Table 4.2 below.

**Table 4.2 Sample Characteristics**

Industry Sector	Interviews Held	Local Government Area	Percent of industry employment
Agriculture, Forestry and Fishing	2	Bathurst, Oberon	5%
Mining	2	Parkes, Lithgow	N/A
Manufacturing	10	Parkes, Cabonne, Cowra, Orange, Bathurst, Mid-Western,	19%
Wholesale	2	Wellington, Cowra	1%
Retail	4	Bathurst, Lithgow, Mid-Western, Orange	2%
Hospitality	6	Parkes, Mid-Western, Lithgow, Wellington, Orange	1%
Transport	6	Bathurst, Lithgow, Orange, Cowra, Parkes, Blayney, Mid-Western	9%
Business	4	Mid-Western, Lithgow, Orange, Bathurst	1%
Government	3	Cowra, Weddin, Parkes	N/A
Health	2	Orange, Cowra	10%
Personal	1	Blayney	1%

## 4.4 Impact Analysis

The economic impact of the proposed Bells Line Expressway has been determined by estimating the final demand impacts of changes in sales of key industries across the CENTROC region.

### 4.4.1 Final Demand Impacts

Input-output tables can be used to determine the effects of a given economic stimulus on the local economy through the use of final demand impacts. This is done by entering the direct effect of the proposed Expressway as additional final demand expenditure in the model to provide an estimate of both initial and flow-on effects that result. The economic benefits to the CENTROC region have been provided in terms of:

- **Value added** which is equal to gross output minus intermediate inputs. Value added is equivalent to the contribution to gross domestic product (GDP) at the national level, gross state product (GSP) at the state level and gross regional product (GRP) at the local level.
- **Household Income** which measures the benefit received by regional households from economic activity. Typically income includes compensation of employees, but may also include the gross mixed income of unincorporated enterprises, gross operating surplus on dwellings owned by persons, property income receivable and transfers receivable (such as social assistance benefits and non-life insurance claims).
- **Employment** which is measured as full-time equivalent employment (FTE) is a measure of the total level of staff resources used. The FTE of a full-time staff member is equal to 1.0. The FTE of a part-time worker is a fraction of this depending on the relative number of hours worked.

### 4.4.2 Use of Marginal Coefficients

The WRI applies the marginal coefficients<sup>3</sup> procedure to all impacts calculated. The use of marginal coefficients provides a more accurate representation of the flow-on effects of an economic stimulus such as the construction of the proposed Bells Line Expressway (than would be possible using a linear model). That is, the marginal coefficients model largely overcomes the overestimation of impacts that can result from using the linear approach. A more detailed description of the marginal coefficients approach can be found in Appendix 1.

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<sup>3</sup> West, G. & Gamage, A. (1997). Differential Multipliers for Tourism in Victoria. *Tourism Economics*, 3 (1), 57-68.

## 5 ECONOMIC IMPACTS

The largest impact of the construction of the expressway would be the breakdown of the “over the mountains” mindset. A majority of people living in Sydney have never been over the mountains and few consider travelling west. The construction of the expressway would help to reduce the barriers to westbound travel and could potentially result in increased population and industry growth. In particular, the CENTROC region will benefit from four types of growth as a result of the construction of the proposed Bells Line Expressway. These include an expansion of local businesses, increased tourism, increased in-migration of residents and an increase in the number and types of industries operating in the region.

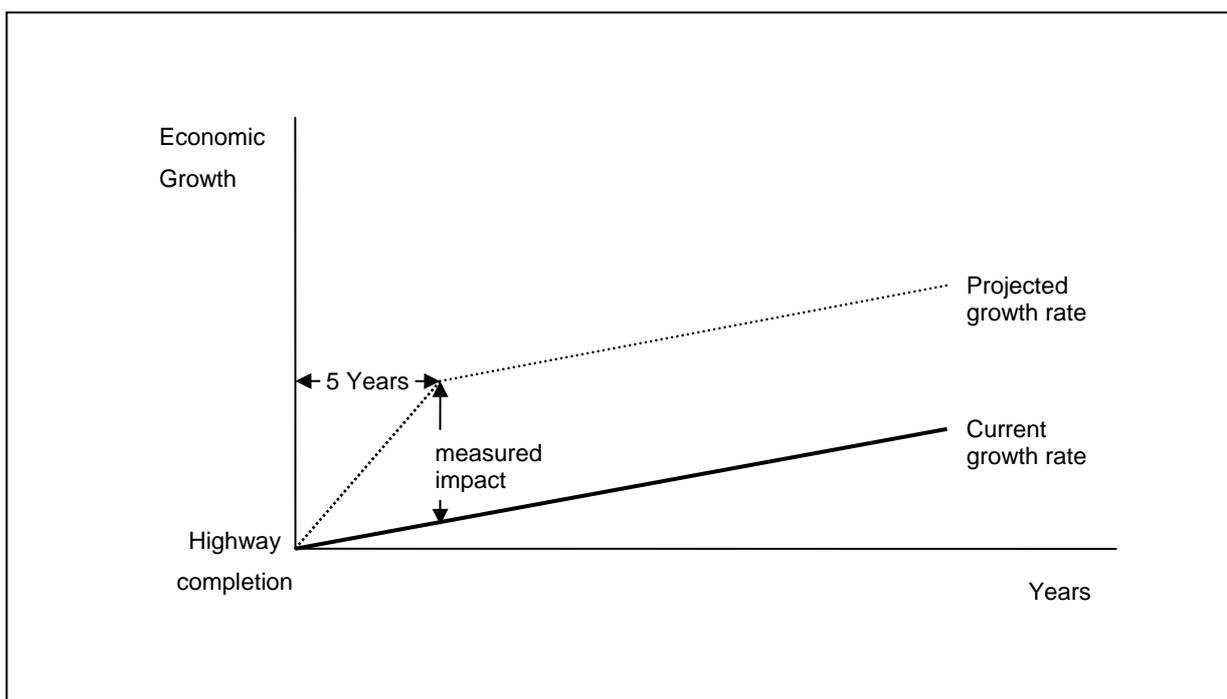
These four impacts can be described as:

1. **Industry Growth** resulting from cheaper transport costs and improved access to Sydney.
2. **Tourism Development** resulting from a reduction in mental and time distance from the region to Sydney. The breakdown of this mental barrier will make the region a more prominent and viable tourist destination, particularly in the day trip and short break markets.
3. **Population Growth** resulting from a change in perceptions of the CENTROC region due to the reduced travel time to Sydney. An increase in the number of commuters, retirees and lifestyle residents can be expected to increase the in-migration of people to the region, with the economy to benefit from increased household expenditure.
4. **Economic Integration** resulting from a shift in business perceptions of the region. The shorter travel time to Sydney allows for decentralisation of industry from the Sydney basin, with industries perceiving the CENTROC region as a viable alternative to locating in Western Sydney.

The economic benefits generated in each of these four models have been provided in terms of gross regional product, household income and employment. Due to the static nature of input-output modelling the impact of the Expressway can only be measured at one point in time. For the purpose of this report, it is assumed that it would take about five years from completion of the Expressway for the full extent of the impact to occur; therefore impacts have been calculated for the fifth year from completion of the Expressway. Note however GRP and household income are measured in 2003/04 prices.

This impact is estimated by measuring the difference in GRP, household income and employment between current growth and that induced by the Expressway. Figure 5 illustrates the impact of the Expressway as measured by final demand impact analysis. This report does not determine the shape of the induced growth up to the fifth year (linear or non-linear), nor does it include induced growth in the region after this period, although this is expected to occur.

**Figure 5 Measuring the Impact of the Expressway**



## **6 INDUSTRY GROWTH**

The impact of the proposed Bells Line Expressway on business expansion has been determined through interviews with key businesses and local government agencies across the CENTROC region. In general, the impact of the Expressway on industry is expected to be concentrated in those regions closest to Sydney and taper off to the west. In the most easterly regions such as Bathurst, Lithgow, Orange and even smaller centres like Oberon, the impact of the highway on industry growth is expected to be significant. In the short term, industry expansion is anticipated in manufacturing, transport and fresh market horticulture.

In the most westerly regions such as Lachlan and Forbes, the highway is not expected to have a large impact on business growth. Some industry expansion in niche markets such as hobby farming may be complemented by increased efficiency in other larger industries (due to time and cost savings) and the influences of increased competition, but on the whole businesses are not expected to expand significantly. The following section outlines the major changes expected as outlined by businesses across the CENTROC region.

### **6.1 Industry Growth by Sector**

#### **6.1.1 Agriculture and Forestry**

The marginal increase in sales and decrease in costs to farming enterprises as a result of the expressway are expected to be offset by an increase in the number of unproductive small acreage holdings, or “weekenders”, emerging in the region. An increase in these types of investments will effectively reduce the amount of land devoted to production such as sheep, cattle and crop farming. The forestry industry in the region (concentrated in the Oberon Shire) is already in its mature phase and is not expected to expand following the construction of the expressway.

It is expected however, that some of these smaller land holdings may be used for fresh market horticulture and fruit growing. A 10% increase in these types of enterprises across the CENTROC region has been applied to the input-output analysis, resulting in a marginal increase in the regions productivity.

### **6.1.2 Mining**

It does not appear as though the mining industry will be affected to any great extent. Sales and investment in this industry are more closely linked to the price of the mined resource and most use rail transport. The road would however allow easier access to Sydney for the transport of new equipment and reduce the restrictions on the transport of heavy machinery and supplies. No effect on the mining industry has been applied to the input-output analysis.

### **6.1.3 Manufacturing**

The CENTROC region produces a diverse range of manufactured goods. These include whitegoods, wine, packaged and fresh foods and bottled juices and water. Access to Sydney is essential to most of the large manufacturers in the CENTROC region. The Expressway is expected to increase sales for these businesses due to enhanced access to a larger number of customers in this market and improved business networking. Decreased transport costs, expected as a result of the expressway, would also make regional produce more competitive and could possibly provide inroads to national buying chains. An expansion of 3% in the manufacturing industry across the region has been applied to the economic impact analysis.

### **6.1.4 Utilities**

The general supply of town infrastructure and other utilities in the region will be dependant on population growth. It is expected that sales and investment in electricity, gas and water infrastructure will be directly proportional to population growth across the region. This impact has been measured in section 8 Population Growth.

### **6.1.5 Construction**

Any increase in population will drive an increase in the construction industry across the region. New business investment will also require construction of buildings. It is expected that the construction industry will be influenced by both population and industry growth and therefore will expand at a rate proportional to these two factors. These impacts have been measured in sections 8 Population Growth and 9 Economic Integration.

### **6.1.6 Wholesale**

Existing wholesale businesses will have an opportunity to become more efficient as trading with the Sydney market becomes easier, however no real impact on sales has been identified. Increased sales could result from improved access to Sydney, but this effect is expected to be minimal. No effect on the wholesale industry has been applied to the input-output analysis.

### **6.1.7 Retail**

The retail environment is not expected to change significantly in the short term, with the number of residents outshopping expected to be approximately equal to the number of new shoppers to the region as a result of tourism. The nature of the retail industry in the CENTROC region is expected to change, especially in the regions closer to Sydney, to accommodate day trippers and weekenders visiting the region. Seven day trading will have to become standard to service these tourist markets.

Initially, retail in Lithgow is expected to decline marginally due to increased competition from Sydney retailers due to the city's close proximity to Sydney. New customers to Lithgow related to tourism are not expected to provide any significant stimulus in the short term as the expressway will bypass Lithgow. However, it is expected that within the first five years from the completion of the Expressway, as the tourism offering in Lithgow develops, retail trade could be expected to return to its original level due to increased tourist expenditure. These impacts have been measured in sections 7 Tourism Development and 8 Population Growth.

### **6.1.8 Hospitality**

One of the largest industry impacts of the expressway will be on regional tourism. All CENTROC regions are expected to benefit to some degree as a result of the expressway making it easier for tourists to get over the mountains. The proposed expressway would make any destination in the region closer to Sydney and so could expect a westward shift in tourist travel. This impact will be most significant in those areas that will become viable as day trips and short breaks such as Oberon, Mudgee, Cowra, Blayney and the larger centres of Bathurst and Orange.

Executive travel to the region may also increase and become an important segment of the tourist market. Increased visitation in high yield markets such as the executive, conference and pampadors markets will increase average spend. The flow-on from increased tourism

expenditure will improve business, increase the number of jobs in the region and therefore attract more new residents.

For Lithgow in particular, the bypass is expected to increase the amenity and appeal of the area and increase its prominence as a tourist destination. Lithgow is the gateway to the CENTROC region and as such plays a critical role in the development of tourism in the entire region. It therefore will need to improve its offering to accommodate increased demand and promote the entire region as a tourist destination.

The reduced time travelled across the mountains and ease of the trip would breakdown the mindset of Sydney residents that life over the mountains doesn't exist. It will therefore be easier to attract tourists from Sydney and the regions products and services will have to be developed to attract niche markets from Sydney. In the long term, this could encourage increased investment in the region, including both property and business investment. These impacts are addressed in section 7 Tourism Development.

#### **6.1.9 Transport and Storage**

Transport is a time critical industry. Any reduction in time travelled along a route will impact on the costs of the business. In this case, where the construction of the expressway will allow the use of B-Doubles over the mountains, it will also allow road transport operators in the CENTROC region to offer new services to clients. Despite these changes, the proposed expressway is expected to have little effect on sales in the road transport industry. Except for the larger national networks, the real change is expected to be in improved efficiency and an increase in the number of providers. Based on businesses expectations of increased services, a 2% increase in the road transport industry has been applied for input-output analysis.

Rail is currently the most efficient means of transporting bulk goods to and from Sydney. This is not expected to change markedly, the allowance of B-Doubles over the mountains could see road become more viable as a means of transport, but the largest impact will occur in the most western areas of the CENTROC region where there is no rail link to Sydney. No effect on the rail transport industry has been applied to the input-output analysis.

Regional airlines and coach services may lose some passengers in the areas relatively close to Sydney such as Bathurst and Orange, but the effect is not expected to be large. It is not anticipated that the larger market of business flights will be affected, as air travel remains the most efficient means for these travellers. No effect on the air transport industry has been applied to the input-output analysis.

#### **6.1.10 Communication, Finance and Business Services**

Real estate will be the most affected group in the communication, finance and business services industries. In particular the number of “weekenders” in the region could be expected to increase and spread further west than current trends. The construction of the expressway would break down the “mountains barrier” that discourages this type of investment, improve access between the CENTROC region and Sydney and people will also feel safer travelling through the mountains.

It is also likely that more people will invest in property in the region as it presents a more attractive investment. Current low land prices compared to the Sydney market will attract buyers, however as demand increases so too will the price of land. While land prices are already expected to increase, the construction of the expressway could see another peak in the region within 6 years.

New investment in property and the resulting increase in population will bring increased demand for other services. In general growth in the communications, finance and business services sectors is expected to be proportional to population growth. This impact has been measured in section 8 Population Growth.

#### **6.1.11 Government Administration**

It is not expected that any increase in government administration will be observed. However, population inflow to the region expected as a result of the expressway could maintain the population level of some of the smaller centres and prevent further local government amalgamations. No effect on the government administration industry has been applied to the input-output analysis.

### **6.1.12 Education**

While growth in the provision of education is expected to be directly proportional to that of population growth, some growth may be observed in the number of students accessing educational services from Sydney. With current capacity not expected to increase, the resulting increase in educational exports is expected to be marginal. An increase of 1% in education has been applied to the input-output analysis.

### **6.1.13 Health Services**

In general, health services across the region are likely to improve although Orange is expected to remain the major provider of specialist health services in the region. This improvement is expected to arise from increased funding (due to population increase) and an improved ability to attract and retain skilled health professionals. In particular it is anticipated that allied health professionals such as occupational therapists, physiotherapists, speech therapists and dieticians will become more accessible.

Growth in general health service provision is expected to be proportional to population growth. In addition it is expected that the number of specialist day visits could increase by 2%. Given that a proportion of this expenditure will flow out of the region into Sydney, only a 1% increase in specialist services has been applied to the analysis.

### **6.1.14 Cultural and Personal Services**

Cultural, recreational, personal and other service industries are expected to grow proportionately to population growth. Some additional growth may result from increased tourist activity in the region, however this impact is addressed in section 7 Tourism Development.

## 6.2 Economic Impact of Industry Growth

Industry growth resulting from construction of the proposed Expressway is expected to be concentrated in the other agriculture; manufacturing; transport and storage; education and health industries. As outlined earlier in this chapter, these increases in production have been identified from expert interviews to be 10%, 3%, 2%, 1% and 1% respectively. The value of this increase in production has been outlined in Table 6.2 below.

**Table 6.2 Expected Growth due to Business Expansion**

Industry Sector	Growth (\$m)
Other Agriculture	13.2
Manufacturing	71.6
Transport and Storage	4.5
Education	5.3
Health	6.2
<b>Total</b>	<b>100.8</b>

In the five years from completion of the Expressway, growth of the CENTROC economy of \$82 million GRP, \$35 million household income and over 900 FTE jobs could occur due to reduced transport costs and better access to Sydney. These impacts including flow-on effects are outlined in Table 6.3 below.

**Table 6.3 Economic Impact of Industry Growth in the CENTROC Region**

CENTROC	Value Added (\$m)	Household Income (\$m)	Employment (FTE)
Impact	82	35	913
Growth	1.38%	1.09%	1.15%

These results are comparable to those of the RERU (1998) economic impact study. This earlier study estimated an increase in GRP of \$104 million, household income of \$66 million and employment of 2,345. The differences observed can be attributed to the use of marginal coefficients to gain a more accurate impact, increased productivity in the manufacturing sector reducing the employment impact and a slightly different mix of industry impacts identified during interviews.

## 7 TOURISM DEVELOPMENT

The impact of the proposed Expressway on tourism development will be most marked in the areas that will become viable as day trips and short breaks such as Oberon, Mudgee, Cowra, Blayney and the larger centres of Bathurst and Orange. However, the improved accessibility to the region from Sydney will benefit the entire region to some degree. The domestic tourism market is vital to tourism in regional NSW, especially the Sydney market, with an average of 41% of all visitors to the CENTROC region coming from Sydney

The reduced time travelled across the mountains and ease of trip would breakdown the mindset of Sydney residents that life over the mountains doesn't exist. It will therefore be easier to attract tourists from Sydney and the regions products and services will have to be developed to attract niche markets from Sydney. In the long term, this could encourage increased investment in the region.

Environmetrics has prepared detailed estimates of the expected increase in tourism in the CENTROC region as a result of the construction of the proposed Expressway. This report has been provided in Appendix 3. This report specifically examines induced trips to the region as a result of the Expressway, estimated to be around an 8% increase in current visitation (Environmetrics, 2005). This is a conservative estimate of an increase in visitation that does not take account of the increased propensity of baby boomers to live and invest in regional areas. Given the high level of trips made to the region visiting friends and relatives (18%), it is expected that the actual increase may be greater than 8%.

Two scenarios for tourism development are included in the Environmetrics report; the first examines the impact of projected tourism growth alone (8%) while the second scenario incorporates the effect of a substantial and effective tourism marketing campaign (20% growth, including the initial 8%) (Environmetrics, 2005). Industry sources indicate that while it is difficult to estimate the impact of the recently implemented Central NSW tourism campaign, the effect of the Expressway is expected to be closer to the estimate of scenario 2 (Central NSW Tourism, 2005).

The forecasts for tourism development are provided below. Table 7.1 outlines current tourism trends in the CENTROC region. Table 7.2 outlines the net impact under scenario 1 and Table 7.3 outlines the net impact on tourism in the region of scenario 2. As outlined in these tables, scenario 1 represents a 13% increase in tourism output across the region and scenario 2 represents a 33% increase in output.

**Table 7.1 Current Tourism Trends in the CENTROC region**

Local Government Area	Overnight visitors ('000s)	Daytrips ('000s)	Total visitors ('000s)	Total nights/days ('000s)	Total spend (\$m)
Orange, Blayney, Cabonne, Wellington	134	135	268	495	62.9
Bathurst, Evans	95	188	283	444	56.4
Lithgow, Oberon	162	56	218	494	62.7
Mudgee, Rylstone	134	55	189	416	52.8
Parkes, Forbes, Lachlan	66	25	90	202	25.7
Cowra, Weddin	51	8	59	145	18.4
<b>Total</b>	<b>447</b>	<b>340</b>	<b>787</b>	<b>1,547</b>	<b>196.4</b>

Note: Annual average 2001-2004.

**Table 7.2 Projected Tourism in the CENTROC region – Scenario 1**

Local Government Area	Overnight visitors ('000s)	Daytrips ('000s)	Total visitors ('000s)	Total nights/days ('000s)	Total spend (\$m)
Orange, Blayney, Cabonne, Wellington	144	145	289	535	71.3
Bathurst, Evans	175	60	236	534	71.2
Lithgow, Oberon	103	203	305	480	63.9
Mudgee, Rylstone	144	59	204	449	59.9
Parkes, Forbes, Lachlan	71	26	97	218	29.1
Cowra, Weddin	55	8	63	157	20.9
<b>Total</b>	<b>483</b>	<b>367</b>	<b>850</b>	<b>1,670</b>	<b>222.7</b>

Note: Calculation based on 8% increase over 5 years, average stay 2.7 nights and an overnight spend increase of 5% (average spend \$133 per night/day).

**Table 7.3 Projected Tourism in the CENTROC region – Scenario 2**

Local Government Area	Overnight visitors ('000s)	Daytrips ('000s)	Total visitors ('000s)	Total nights/days ('000s)	Total spend (\$m)
Orange, Blayney, Cabonne, Wellington	195	67	262	632	84.3
Bathurst, Evans	160	161	322	626	83.5
Lithgow, Oberon	114	225	339	556	74.1
Mudgee, Rylstone	161	66	227	531	70.9
Parkes, Forbes, Lachlan	79	29	108	258	34.4
Cowra, Weddin	61	9	70	186	24.9
<b>Total</b>	<b>536</b>	<b>408</b>	<b>944</b>	<b>1,963</b>	<b>261.8</b>

Note: Calculation based on 20% increase over 5 years, average stay 2.9 nights and an overnight spend increase of 5% (average spend \$133 per night/day).

## 7.1 Economic Impact of Tourism Development

The economic impact of tourism development in the CENTROC region results from increased tourist expenditure in the region. To provide an estimate of how this expenditure is likely to impact the CENTROC region, the estimated increase in visitor expenditure in the region was distributed across industry sectors according to expenditure estimates for domestic tourism in Australia from the Bureau of Tourism Research (2003). The distribution of expenditure, as applied to the input-output table, is provided in Table 7.4 below. A 15% margin was applied to retail expenditure as is commonly used in input-output analysis as an estimate of the amount of expenditure retained in the region.

**Table 7.4 Increase in Tourism Expenditure in the CENTROC Region**

Industry Sector	Scenario 1 (\$ m)	Scenario 2 (\$ m)
Transport	3.76	9.35
Retail*	1.97	4.90
Hospitality	8.03	19.97
Recreational	1.08	2.68
Education	0.30	0.74
<b>Total</b>	<b>15.14</b>	<b>37.64</b>

The impact of tourism development is likely to be concentrated in the transport, retail, hospitality, recreational and education (for the conference market) industries. In the five years from completion of the Expressway, economic growth in the region as a result of tourism development is expected to be between \$17 and \$42 million in GRP, \$8 and \$20 million in household income and 223 to 555 FTE jobs. These impacts are outlined in Table 7.5 below.

**Table 7.5 Economic Impact of Tourism Development in the CENTROC Region**

CENTROC	Value Added (\$m)	Household Income (\$m)	Employment (FTE)
<b>Scenario 1</b>			
Impact	17	8	223
Growth	0.28%	0.25%	0.28%
<b>Scenario 2</b>			
Impact	42	20	555
Growth	0.71%	0.62%	0.70%

Tourism development impacts estimated in this report are quite different to those of the RERU (1998) economic impact study. The use of detailed industry data to determine the expected level of tourism development is expected to have resulted in a far more accurate assessment of tourism development impact as a result of the Expressway.

## 8 POPULATION GROWTH

The CENTROC region has an estimated population of almost 200,000 currently growing at about 0.7% per annum. Population growth is expected to slow by 2031 across the entire region to 0.3% per annum (DIPNR, 2004). While the larger centres and their surrounding areas are expected to show positive growth to 2031, the population in smaller centres and those further west is expected to decline.

Projected population growth in the region is mainly attributed to rural residential development, lifestyle migration from Sydney and industry expansion in the intensive agriculture and wine sectors (DIPNR, 2004). The population in a number of centres is expected to remain fairly stable to 2031, with some in decline. These decline areas are generally beyond commuting distance to Bathurst and Orange, the population decrease is associated with natural decline and out-migration of younger residents (DIPNR, 2004). Table 8.1 below outlines the annual projected population growth for each Local Government Area in the CENTROC region.

**Table 8.1 Population growth projections**

Local Government Area	Projected Population Growth (%)
Bathurst Regional	0.9
Blayney	0.3
Cabonne	0.1
Cowra	0.1
Forbes	-0.6
Lachlan	-0.7
Lithgow	0.0
Oberon	-0.1
Orange	0.6
Mid-Western	0.5
Parkes	-0.1
Weddin	-0.8
Wellington	-0.2
Total CENTROC	0.3

Note: The former Evans Shire has been amalgamated into the Bathurst and Oberon Shires. In the above table however, the entire Evans Shire has been combined with Bathurst into the Bathurst Regional figure. Also, the Mid-Western LGA represents the former Mudgee and Rylstone LGA's. Source: DIPNR, NSW Statistical Local Area Population Projections 2001-2031 (2004).

It is anticipated that the construction of the proposed expressway could lead to increased migration into the CENTROC region, particularly Lithgow and surrounding areas. A majority of this migration is expected to be diverted from that currently entering the Western and outer Northern parts of Sydney. These areas of Sydney are currently growing at around 1.6% per annum and are expected to slow to population growth of 1% per annum to 2031. Any proportion of this growth migrating to the CENTROC region rather than the western parts of Sydney, would provide a significant boost to population in the region.

As outlined in the literature, transport infrastructure improvements can rearrange the spatial distribution of population as households move to the fringes of metropolitan areas seeking improved quality of life. Therefore, a new expressway across the Bells Line should attract new residents to the region as shorter travel times make it viable to commute to work in Sydney. In addition, more people will be prepared to relocate to the CENTROC region if their access to services, cultural and other activities in Sydney is enhanced.

This effect was observed in the Hunter region in the first year after the completion of the initial stage of the F3 Freeway, where population growth remained steady despite a projected slowing of 0.5% (DIPNR, 2004). Similarly, this type of growth could be expected in the easternmost centres of the CENTROC region such as Lithgow, Oberon, Bathurst, Blayney, and Orange and could potentially stretch out to Mudgee, Cowra and Wellington.

In line with the RERU (1998) study, it has been assumed that 5% of the growth in Western and outer Northern Sydney could be diverted to the CENTROC region in the five years following the completion of the Expressway. Population growth in Western and outer Northern Sydney has been analysed over the period 1998 to 2003 to determine the level of population growth that could be expected as a result of the Expressway. As shown in Table 8.2 over the page, the construction of the Expressway could result in an increase in population of 7,389 in the CENTROC region.

**Table 8.2 Population growth in Western and Outer Northern Sydney**

	1998 Population	2003 Population	Increase	Growth (%)
St George-Sutherland	419,723	438,244	18,521	1.1
Fairfield-Liverpool	326,465	354,111	27,646	2.1
Outer South Western Sydney	222,993	239,883	16,890	1.8
Central Western Sydney	286,299	300,674	14,375	1.2
Outer Western Sydney	307,859	319,403	11,544	0.9
Blacktown	249,296	273,267	23,971	2.3
Central Northern Sydney	384,409	419,227	34,818	2.2
<b>Total</b>	<b>2,199,042</b>	<b>2,346,812</b>	<b>147,770</b>	<b>1.6</b>

5% Total

7389

Source: ABS (2004). Regional Population Growth, Australia – companion data: Table 2a. Estimated Resident Population, Statistical Local Areas, New South Wales. Cat. 3218.0.55.001.

From interviews conducted with business and local government across the CENTROC region, it is expected that Lithgow and some of the most eastern parts of the region may become dormitory suburbs for Sydney workers. However, other areas further west such as Bathurst, Orange and Mudgee are not likely to follow a similar path due to a lack of public transport available into Sydney for commuters. In these regions, it is expected that there may be an increase in the number of telecommuters, as has been the case in the Hunter region (National Economics, 2001). These people choose to live in lifestyle areas, commute to Sydney for work one or two times per week and work from home for the remainder.

The trends witnessed in the Hunter, Illawarra and Western Sydney in the past could occur in the CENTROC region given the construction of the proposed Bells Line Expressway. Increased population growth resulting from affordable housing; attractiveness of the location; accessibility to Sydney; and establishment of weekenders, later used as retirement homes can have positive influence on the economic development of the region over and above household expenditure impact, including:

- diversification of the economy;
- increased business opportunity;
- expansion of the skills base; and
- an improvement in educational attainment.

Source: National Economics (2001).

In-migration of residents is expected to be most significant in two groups: baby boomers and families. Baby boomer investment in the region by those looking for a “tree change” rather than the “sea change” is already established (Chapman Consulting Services, 2005). Further increases in the baby boomer population could be expected as the Expressway makes the region a more accessible and viable alternative. These people seek a sense of community which towns like Mudgee, Oberon, Blayney, Orange and Cowra can provide.

Families are also increasingly opting for a “tree change”, looking for a more pleasant environment in which to raise their children than that offered in the city. These people are lured out of Sydney “*by the promise of cheaper mortgages, wide open spaces and the quiet life*” (Jopson, 2002). Recent studies have shown that the urban fringe is already extending out to “*the Southern Highlands, Lithgow, Oberon and down to Huskisson, as city people seeking a quiet life move even further away*” (Jopson, 2002). The construction of the Bells Line Expressway could only be expected to enhance this trend.

Increases in population would bring a corresponding increase in industry investment to service growing demand. Such increased investment in the region, the ability to gain employment and an increased diversity of the region’s entertainment offering could also lead to increased retention of skilled workers and younger residents. Improved accessibility to Sydney is also expected to positively impact on retention.

## **8.1 Economic Impact of Population Migration**

The potential impact of a diversion of population growth from Sydney to the CENTROC region is dependant on the distribution and composition of new residents. Given that a majority of new residents are expected to be early retirees and dual income households, the relative increase in household expenditure in the region is expected to be quite high. However, to provide a conservative estimate of the in-migration impact of the proposed Expressway, the average level of household expenditure in NSW has been used to determine the increase in expenditure due to a net increase of 2,842 households<sup>4</sup>.

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<sup>4</sup> Given an estimated population increase of 7,389, the average number of persons per household in NSW (2.6) was applied to determine the approximate number of households this population increase would induce (2,842).

The economic impact of increased population migration to the CENTROC region results from the new residents spending money in the region. Therefore the impact of in-migration is likely to be concentrated in the retail, finance and business services industries. The distribution of expected additional household expenditure as a result of population growth is outlined in Table 8.3 below. In line with input-output convention, a margin of 15% was applied to the total increase in retail expenditure (\$62.7 million) to include in the impact only that proportion that could reasonably be expected to remain in the CENTROC region.

**Table 8.3 Additional Household Expenditure**

Industry Sector	Growth (\$m)
Utilities	3.4
Retail	9.4
Transport and Storage	1.1
Communications	3.1
Finance	12.5
Business Services	8.4
Government	1.6
Education	2.0
Health	2.5
Recreational Services	3.3
Personal Services	2.0
<b>Total</b>	<b>49.3</b>

Based on ABS 1998-99 Household Expenditure Survey Category 6535.0

In the five years from completion of the Expressway, economic growth in the region as a result of population growth is expected to amount to \$54 million in GRP, \$29 million in household income and almost 650 FTE jobs. These impacts are outlined in Table 8.4 below.

**Table 8.4 Economic Impact of Population Migration on the CENTROC Region**

CENTROC	Value Added (\$m)	Household Income (\$m)	Employment (FTE)
Impact	54	29	649
Growth	0.91%	0.88%	0.82%

This conclusion, based on literature and experience in the Hunter region, outlines the benefit of population growth to the CENTROC region. However, this benefit is an expenditure transfer from Western Sydney and does not constitute growth in the overall State or National economy. Given population growth pressure in Western Sydney in terms of congestion, pollution and stressed infrastructure, population diversion to the CENTROC region would also have a positive effect in Western Sydney.

## 9 ECONOMIC INTEGRATION

In general, it is expected that the construction of the expressway would increase the attractiveness of the region to business investors, resulting in an increased diversity of product and strengthening of the economy. In addition to the impacts of business expansion and population growth, the scope for expansion of the number and range of businesses in the CENTROC region is considerable. Given the strengths of the region, improved accessibility to Sydney is likely to encourage increased investment in a range of small to medium businesses, with a significant shift towards warehousing and manufacturing enterprises.

In the five years from completion of the Expressway, it is expected that a modest level of economic integration occurs. Still, the impacts of this growth are significant and as the perceptions of Western NSW in the business community (particularly that of Sydney) improve further economic integration and growth is expected as the decentralisation of industry becomes increasingly viable. The following discussion outlines the major economic changes expected to result from increased integration with the Sydney market as discussed in interviews.

### 9.1 Industry Development by Sector

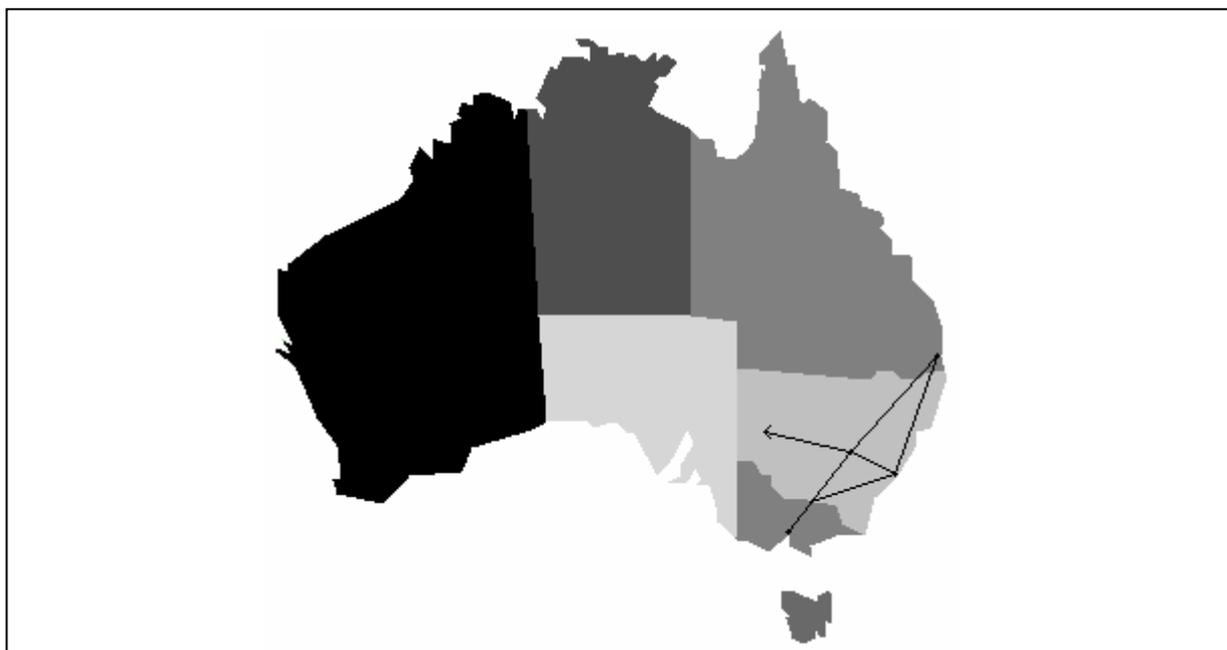
#### 9.1.1 Transport and Storage

An upgrade of the Bells Line of Road to B-Double standard, would provide transport operators in the CENTROC region with a route to Sydney docks as efficient as that from Western Sydney. Should the Expressway be constructed, local industry operators estimate that the cost of transport from the CENTROC region to Sydney docks would approximately equal that of Western Sydney. However, industrial and warehousing rents in the CENTROC region range from \$75-\$85/m<sup>2</sup> compared to \$120-\$125/m<sup>2</sup> in Western Sydney. Moreover the cost of housing employees is much cheaper in CENTROC than in Western Sydney. For example a house in Kellyville costs \$600,000 while a similar house in Lithgow costs \$280,000. Therefore the Expressway could deliver a significant cost advantage for warehousing in the CENTROC region.

This could open up significant opportunities for the CENTROC region to become a national transport hub, allowing easy access to all major cities. The effect that the Expressway could have on national transport corridors is shown in Figure 9.1 over the page. In particular, Parkes could become a viable location for transport and warehousing operations, therefore reducing freight traffic along Australia's East coast between Melbourne and Brisbane. With

uninhibited access to the West of the country, logistics operations in Parkes could grow exponentially.

**Figure 9.1 National Transport Corridors**



The Expressway would provide the region with the opportunity to accommodate large warehousing facilities, like those currently located in Western Sydney, with transport links right across Australia. The transport and storage industry is expected to grow across the entire region through the relocation of large distribution centres from Western Sydney to areas such as Parkes and Blayney, which have established reputations in the national distribution grid. Therefore an increase of 10% in transport services and storage has been applied to the input-output analysis.

### **9.1.2 Manufacturing**

In a trend similar to that of Wollongong, manufacturing of value added products in the CENTROC region could be expected to develop after the construction of the proposed Expressway. Examples include manufacture of value added wood products and semi-processed fresh foods. Manufacturers could take advantage of transport efficiencies to develop a range of value added products close to the source of inputs.

Business relocation to the region would become more attractive following the construction of the proposed Expressway, as access to Sydney is improved and the warehousing/logistics industry is expanded. One interview participant noted that it is currently more viable to get products from Sydney to Brisbane than it is to move products from Sydney to Mudgee.

Therefore an additional impact of the Expressway may be the clustering of suppliers to established heavy industry as lower wage rates, set-up costs, land costs and cost of living makes regional investment attractive to operations currently located in Sydney. A growth of 5% in the manufacturing industry has been applied to the input-output analysis.

## 9.2 Economic Impact of Economic Integration

Economic integration as a result of the construction of the proposed Expressway is expected to initially be concentrated in the manufacturing and transport and storage sectors. As outlined earlier in this chapter, these increases in production have been identified from expert interviews to be 5% and 10% respectively. The value of this increase in production has been outlined in Table 9.2 below.

**Table 9.2 Expected Growth due to Business Expansion**

Industry Sector	Growth (\$m)
Manufacturing	119.3
Transport and Storage	8.9
<b>Total</b>	<b>128.2</b>

In the five years from completion of the Expressway, expansion of the CENTROC economy of \$90 million GRP, \$38 million household income and almost 950 FTE jobs could occur due to growth in the number and types of businesses operating in the region. These impacts are outlined in Table 9.3 below.

**Table 9.3 Economic Impact of Economic Integration on the CENTROC Region**

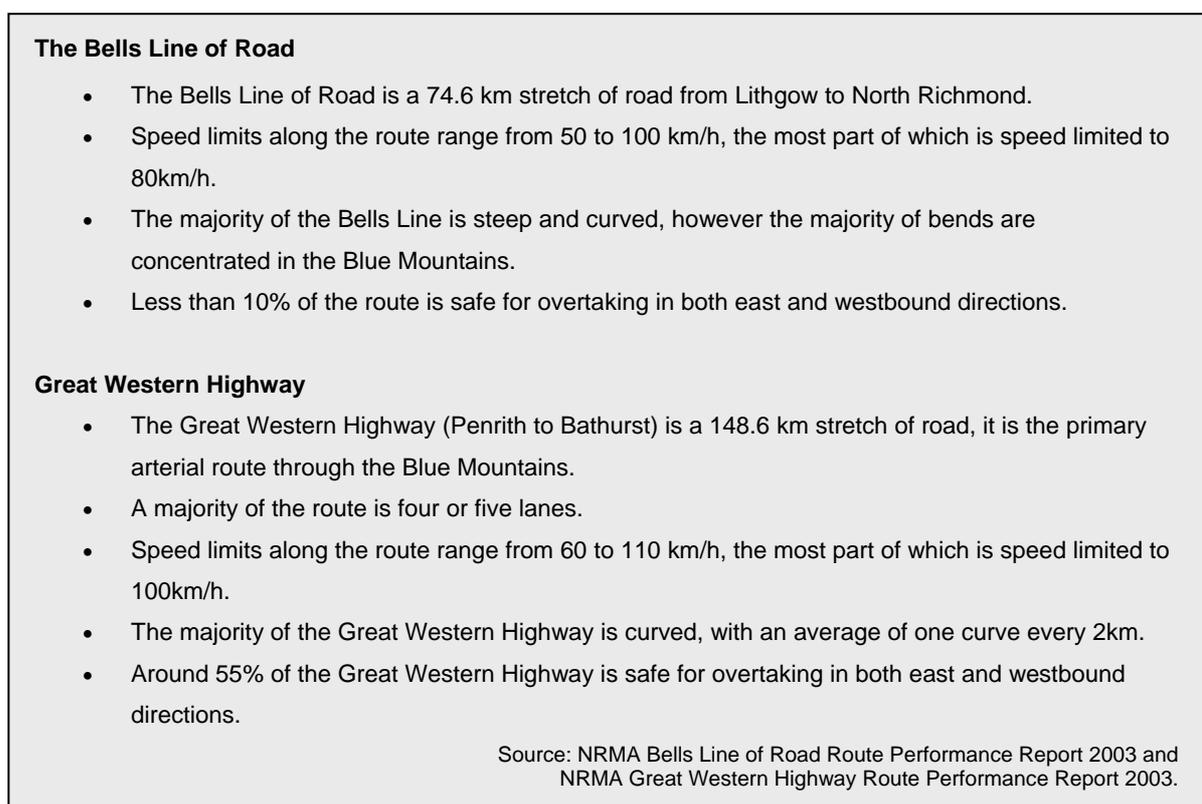
CENTROC	Value Added (\$m)	Household Income (\$m)	Employment (FTE)
Impact	90	38	945
Growth	1.52%	1.15%	1.19%

These results are comparable to those of the RERU (1998) economic impact study. This earlier study estimated an increase in GRP of \$80.5 million, household income of \$49.4 million and employment of 2,078. The differences observed can be attributed to the use of marginal coefficients to gain a more accurate impact, increased productivity in the manufacturing sector reducing employment impact and a different mix of industry impacts identified during interviews.

## 10 IMPACT ON ROAD SAFETY

Not only would the construction of the proposed Bells Line Expressway have a significant economic impact, it would also improve road safety along this route. Interviews conducted with business and community representatives in the CENTROC region highlighted a noticeable level of concern over road safety along the Bells Line of Road and the Great Western Highway. The general consensus among participants was that the Expressway would provide a much safer route than that which currently exists due to decreasing fatigue by reducing travel time; reduced congestion; and a reduction in the number and acuteness of bends. Those in the transport industry in particular noted that the construction of an Expressway across the Bells Line would dramatically reduce the probability of accidents.

**Figure 10.1 Current links between the CENTROC region and Sydney**



## 10.1 Comparison Data

In comparison with NSW freeways, motorways and state highways the Bells Line of Road had the thirteenth highest number of accidents in 2003. Given the relative prominence of other routes examined, it is interesting to note the comparability of crash figures. Table 10.1 over the page shows the number and type of accidents occurring on NSW routes with the highest number of crashes.

**Table 10.1 NSW Routes with Highest Number of Crashes**

	Fatal Crash	Injury Crash	Non-Casualty Crash	Total
Pacific Highway	58	833	1,215	2,106
Princes Highway	22	556	831	1,409
Great Western Highway	10	534	788	1,332
Hume Highway	12	520	800	1,332
Cumberland Highway	3	295	431	729
F3 Freeway	4	162	333	499
New England Highway	8	185	204	397
Newell Highway	5	100	104	209
Mitchell Highway	5	73	100	178
Bruxner Highway	4	80	67	151
Oxley Highway	3	74	57	134
Southern Freeway	1	47	65	113
Bells Line of Road	1	53	50	104
State Highway 23	0	30	69	99
Sturt Highway	4	43	38	85

Source: NRMA Route Performance Report Bells Line of Road 2003 and RTA Road Traffic Crashes in New South Wales 2003.

While the number of crashes provides some indication of road safety, accident rates based on traffic volume and road length can be used to allow a more accurate comparison of routes (per 100 Million Vehicle Kilometres Travelled - 100MVKT). The NRMA regularly conducts route audits which take account of crash, fatality and casualty rates as a measure of route performance. Comparative accident rates for a number of routes across NSW are outlined in Table 10.2 over the page.

**Table 10.2 2000-2002 Accident Rates NSW Major Routes per 100MVKT**

	Crashes	Casualties
Bells Line of Road	65.5	39.0
Great Western Highway	51.3	30.8
Pacific Highway	26.9	19.2
Princes Highway	37	23.5
Hume Highway	18.31	10.92
Sturt Highway	17.9	14.4
Mitchell Highway	21.7	13.5
Mid-Western Highway	18.7	11.5
F3 Freeway	23.9	10.8

Source: NRMA Route Performance Reports and website.

Between 2000 and 2002, the Bells Line of Road had the highest rate of crashes and casualties per 100MVKT of all roads examined. Comparatively, the Bells Line has a significantly higher rate of all types of accidents- fatal, injury and non-casualty. The Great Western Highway, the only other route between the CENTROC region and Sydney, has the second highest crash rate. The construction of the Expressway could potentially significantly reduce the number of traffic accidents along the Bells Line by improving road surface, dividing east and westbound traffic with safety barriers, providing safe opportunities to overtake and reducing fatigue, all of which are significant factors in road accidents (NRMA, 2005).

## 10.2 The Cost of Road Accidents on the Bells Line

Any reduction in road safety risk along the Bells Line of Road is beneficial to the community. While defining the extent of the benefit can be difficult, the NRMA and RTA frequently use a generic cost for each crash type to determine the economic cost of each incident. The most recent estimate of crash costs can be found in the RTA's Economic Analysis Manual, version 2 (1999) which outlines cost estimates for the year 2000. These are outlined in Table 10.3 below.

**Table 10.3 Generic Cost Estimates by Type of Crash**

Crash Type	Economic Cost (\$)
Fatal	1,003,500
Injury	70,000
Non-Casualty	12,600

Source: NRMA (2003).

Using these estimates, the cost of road accidents on the Bells Line can be determined. Table 10.4 below outlines the cost of accidents on the Bells Line in 2002 and the average cost per annum 1993-2002.

**Table 10.4 Cost of Accidents on the Bells Line of Road**

Crash Type	Number Crashes (2002)	Economic Cost (\$)	Average Number (1993-2002)	Average Annual Economic Cost (\$)
Fatal	1	1,003,500	2.2	2,207,700
Injury	53	3,710,000	41.9	2,933,000
Non-Casualty	50	630,000	67.0	844,200
<b>Total</b>	<b>104</b>	<b>5,343,500</b>	<b>111.1</b>	<b>5,984,900</b>

Source: NRMA (2003).

The average annual economic cost of accidents on the Bells Line of Road is approaching \$6 million. It is expected that the construction of the proposed Bells Line Expressway could significantly reduce this cost to the community by reducing the risk of accidents along the route. To provide an estimate of the potential impact of the Expressway on accident costs, it has been assumed that the expressway would see the average crash rate on the Bells Line decrease to the state average (NRMA, 2005). Table 10.5 below outlines the estimated annual reduction in the cost of accidents on the Bells Line of Road.

**Table 10.5 Annual Reduction in the Cost of Accidents on the Bells Line of Road**

Crash Type	NSW Crash Rate (100MVKT)*	Expected Number Accidents	Expected Economic Cost (\$)	Expected Cost Saving (\$)
Fatal	0.9	1	1,003,500	0
Injury	9.6	12	840,000	2,093,000
Non-Casualty	15	18	226,800	617,400
<b>Total</b>	<b>N/A</b>	<b>20</b>	<b>2,070,300</b>	<b>2,710,400</b>

\*Source: NRMA (2005).

The links between the CENTROC region and Sydney are among the most dangerous in the state. The net difference between the average annual cost of accidents on the Bells Line and the expected cost of accidents at the state average rate is significant. The expected reduction in crash rate on the Bells Line of Road could result in a 45% decrease in accident costs to the community per annum. This represents a net saving of around \$3 million annually and a return of 1% on investment. This saving is also expected to increase as traffic volumes along the route increase as estimated by Sinclair Knight Merz (2004).

## 11 CONCLUSION

Upgrading the Bells Line of Road to a B-Double standard expressway would have significant benefits for the CENTROC region. Driven by industry growth, tourism development, population migration and economic integration, it is expected that an expressway over the mountains could induce growth in GRP of 4.5% and employment of 3.9% after five years.

The impact of the Expressway on industry is expected to be concentrated in those regions closest to Sydney and taper off to the west. In the most easterly regions such as Bathurst, Lithgow, Orange and even smaller centres like Oberon, the impact of the highway on industry growth is expected to be significant. In the short term, industry expansion is anticipated in manufacturing, transport and fresh market horticulture.

Tourism development resulting from the Expressway will be most marked in the areas that will become viable as day trips and short break holidays such as Oberon, Mudgee, Cowra, Blayney and to some extent the larger centres of Bathurst and Orange. Reduced travel time across the mountains will give the impression that western NSW is readily accessible and this will make it easier to attract tourists from Sydney. In the long term, this could encourage increased investment in the region.

Related to tourism development, construction of the proposed Expressway could lead to increased migration into the CENTROC region, particularly in the eastern areas of the CENTROC region. Shorter travel times into the region make it viable to commute or telecommute to work in Sydney, as evidenced in the Hunter region. Increased population growth resulting from affordable housing; attractiveness of the location; accessibility to Sydney; and establishment of weekenders, later used as retirement homes can have positive influence on the economic development of the region over and above household expenditure impact.

Given the expected industry, tourism and population growth and the breakdown of the “over the mountains” mindset, the scope for expansion of the number and range of businesses in the CENTROC region is considerable. The construction of the Bells Line Expressway would increase the attractiveness of the region to business investors and make the region a viable location for production and distribution facilities. Given the established strengths of the region, improved accessibility to Sydney is likely to encourage increased investment in a range of small to medium businesses, with a significant shift towards warehousing and manufacturing enterprises.

In the five years from completion of the Expressway, total economic growth in the region is expected to be \$268 million in GRP, \$122 million in household income and 3,062 FTE jobs. These impacts are outlined in Table 11.1 below. The effect on GRP alone represents a 9% return on investment. While some of this benefit is transferred from Western Sydney, a westward shift of population and industry could ease pressure in Western Sydney in terms of congestion, pollution, infrastructure and externalities.

**Table 11.1 Economic Impact of the Bells Line Expressway on the CENTROC Region**

	Value Added (\$m)	Household Income (\$m)	Employment (FTE)
Industry Growth	82	35	913
Tourism Development	42	20	555
Population Migration	54	29	649
Economic Integration	90	38	945
<b>Total Impact</b>	<b>268</b>	<b>122</b>	<b>3,062</b>
<b>Total Growth</b>	<b>4.52%</b>	<b>3.73%</b>	<b>3.85%</b>

Note: Based on high growth tourism scenario 2.

The above estimate does not take into account benefits to the community in terms of vehicle operating costs, travel time costs or accident costs. Accident cost savings have been estimated in this report to be around \$2.7 million per annum. The average annual cost savings of each of these effects has also been determined by Sinclair Knight Merz (2004). Accident cost savings were estimated to be \$2.4 million per annum, with a combined total of \$12.3 million per annum for all road user benefits.

The proposed Bells Line Expressway could provide the CENTROC region with substantial road user and economic benefits. These benefits have been substantiated in other reports by Sinclair Knight Merz (2004), RERU (1998) and others. While the SKM report concludes that the cost-benefit ratio less than one indicates that the project is not an economically viable investment, this analysis largely ignores the GRP, household income and employment benefits the Expressway would bring to the region. Incorporating the GRP impact in cost-benefit analysis as shown in Table 11.2 gives a cost benefit ratio of between 1.3 and 1.5.

**Table 11.2 Cost-benefit Analysis – Including Regional Economic Impact**

	Trend Growth	High Growth
Capital Cost (7% discount rate)	2,238	2,238
Residual Value	-63	-63
Recurrent costs	249	249
<b>Total costs</b>	<b>2,424</b>	<b>2,424</b>
VOC Savings	179	264
Travel Time Savings	371	569
Accident Cost Savings	132	204
Gross Regional Product	2,192	2,418
<b>Total Savings</b>	<b>2,874</b>	<b>3,455</b>
NPV (\$m)	636	1,217
BCR	1.3	1.5
FYRR (%)	12	13
NPV/I	0.3	0.5

Note: Trend growth scenario based on tourism development scenario 1,  
high growth scenario based on tourism development scenario 2.

It is recognised that a portion of the regional economic impact will be a transfer, however in the interest of developing western NSW and easing the pressure on Western Sydney, the Bells Line Expressway is a project of significant potential.

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## APPENDIX 1: ECONOMIC IMPACT ANALYSIS

This appendix discusses the basics of economic impact analysis, including an overview of what input-output tables are, how the tables are constructed and the assumptions of the model. The appendix also describes the input-output table used in this study.

### A.1 Input-Output Tables

Input-output tables are part of the Australian national accounts. An input-output model provides a detailed picture of the structure of an economy at a particular point in time. It includes all the transactions that occur during a specific period, usually one year. The rows of an input-output table show the disposal of the output of an industry to itself and to other industries as well as final demand categories (i.e. exports and household consumption); and the columns show the origin of inputs into production, whether they are intermediate inputs (i.e. intra- and inter-industry purchases) or primary inputs (i.e. labour and capital).

One of the main attractions of input-output models is their relative ease of use and the level of detail obtained concerning the structure of the economy. The Australian Bureau of Statistics (ABS) notes the usefulness of input-output tables:

*“Input-output tables provide detailed information about the supply and disposition of commodities in the Australian economy and about the structure of, and inter-relationships between, Australian industries. Detailed data on supply and use of commodities, inter-industry flows and a range of derived data, such as input-output multipliers, are provided for economic planning and analysis, and construction of models for forecasting purposes.”* (ABS *Introduction to Input-Output Multipliers*, Cat. 5246.0)

The main use of input-output tables is economic impact analysis, where the tables are used to estimate the benefits generated by new initiatives on each and every sector of an economy. For example, if there is a change in the purchasing or sales pattern of any industry, the flow – on, or multiplier effects on upstream industries can be calculated. An input-output table is also very useful for estimating the direct and indirect contribution of final demand, as with the retail and food services expenditure of consumers.

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## A.2 Methodology of Table Construction

### Base Table Construction

The base tables were constructed from the national input-output table provided by the Australian Bureau of Statistics in the publication: *Australian National Accounts: Input-Output Tables* cat. no. 5209.0.55.001<sup>5</sup>. The national table was adjusted to represent the CENTROC using the GRIT technique. That is, location quotients derived from detailed ABS employment data for 2001 and an estimation of final demands based on the 2001 ratio of employment to population in each of the areas was used to estimate the inter-industry flows across the region. These adjustments provide base tables for the 2000-01 financial year.

### Table Inflation

Base tables were inflated from 2001 to 2003-04 using ABS data. The ABS publication *State Accounts 2003-04* was used to determine the relative increase in the intermediate quadrant, final demands and primary inputs, which were then inflated to approximately equal the ABS figures for 2003-04. Employment data for 2004 provided by the ABS<sup>6</sup> was used to determine the level of inflation in employment, this adjustment was then also applied to the tables. The application of these inflators to the tables resulted in balanced, workable tables for the CENTROC region in the 2003-04 financial year.

## A3 The GRIT Technique

The input-output tables for this project were extracted from the Australian Bureau of Statistics (ABS) 1998-99 national input-output table using the Generation of Regional Input-Output Tables (GRIT) technique. The GRIT technique is basically a hybrid method of deriving regional input-output tables from the National input-output table while at the same time allowing for the insertion of superior data at various stages in the construction of the tables.

The GRIT procedure was developed by Associate Professor Guy West and Professor Rod Jensen of the University of Queensland and is the most widely used method of constructing input-output tables in Australia. The GRIT method is also widely used in America and Europe. The system is “variable interference” in that the analyst is able to determine the extent to which they interfere with the mechanical processes by introducing primary or other superior data. The GRIT system is designed to produce regional tables that are: consistent in

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<sup>6</sup> Employment data sourced from ABS cat. no. 6291.0.55.001 Labour Force, Australia, Detailed: Table 05. Employed persons by State and Industry.

accounting terms with each other and with the national table; capable of calculations to a reasonable degree of holistic accuracy; and capable of being updated with minimum effort as new data becomes available.

The final step in the construction of the input-output tables was to balance the table using the RAS technique<sup>7</sup>. The RAS technique is a bi-proportional iterative adjustment method that modifies the base input-output matrix to fit the new sector. The table was simply adjusted proportionally to the new row and column totals and the cycle repeated until the actual row and column totals converge to the specified values. Once balanced, the consistency of the table was checked to identify any large discrepancies or obvious anomalies.

#### **A.4 Assumptions of the Input-Output Model**

The use of an input-output table in economic impact analysis requires a number of explicit assumptions. The specific assumptions are as follows:

- The inputs purchased by each sector are a function of the output of that sector. The input function is generally assumed linear and homogeneous of degree one, which implies constant returns to scale and no substitution between inputs. The technology is also assumed constant.
- Each commodity (or group of commodities) is supplied by a single industry or sector of production. This implies that there is only one method used to produce each commodity and that each sector has only a single primary output. In other words, there are no joint products.
- The total effect of several types of production is the sum of the separate effects. This rules out external economies and diseconomies and is known simply as the additivity assumption.
- The system is in equilibrium at given prices.
- In the static input-output model, there are no capacity constraints so that the supply of each good is perfectly elastic. Each industry can supply whatever quantity is demanded of it and there are no capital restrictions.

In terms of applied input – output analysis, the focus of these assumptions comes down primarily to the linearity property. The assumption of a linear relationship between the input coefficients and output unrealistically implies that supply is infinitely elastic. This limitation generally leads to an overestimation of the multiplier effects generated by any initial change in expenditure. The overestimation of impacts can occur in the short run, when a firm has

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<sup>7</sup> The RAS technique is explained in Appendix A of the ABS *Input-Output Tables 1996-97* publication (Cat. 5209.0).

excess capacity and in the long run if a firm is experiencing increasing returns to scale. In both cases an increase in output can occur that is less than proportional to the necessary increase in inputs, and the linear coefficients assumption is violated.

Transfer and expenditure switching is the second major problem that arises when using input-output tables, as economic impacts tend to be overstated. The Bureau of Industry Economics (1984: page 3) argues that expenditure transfers occur when expenditure on a particular good or service is transferred from one location to another<sup>8</sup>. Expenditure switching, on the other hand, is when expenditure is switched from one good or service to another. When such transfers of expenditure occur within the region under investigation then the economic impact can be overstated to the extent of that transfer.

## A.5 The Marginal Coefficients Model

One of the main limitations of input-output tables is the assumption of linear coefficients. To address this problem this study uses the marginal coefficients model. This model attempts to overcome the limitations of traditional input-output analysis by removing the assumption of linear coefficients for the household sector. Marginal income coefficients are used for the household sector to provide a more accurate estimate of the multiplier effects (closer to those of a computable general equilibrium model). Following West and Gamage (1997) the linear coefficients assumption between other intermediate sectors of the input-output table has been maintained, but the relationships between the primary factors are non-linear.

The marginal coefficients model therefore provides a non-linear relationship between household income and household consumption. This is done by using a generalised least squares regression to estimate a logarithmic equation for household income elasticities. The marginal coefficients, estimated from time series data at the sectoral level, replace the average income coefficients of households. Information for the state of Queensland was used for estimating the marginal coefficients used in this study, as specific data for New South Wales is not available. This should still result in a more accurate estimate of the economic impact than would be possible with traditional input-output analysis.

It should be noted that the marginal coefficients model effectively discounts the initial effect of an impacting agent (i.e. increased export demand) according to the household income elasticity of the relevant sector. This also causes a reduction in the flow-on effects of the impacting agent and the total economic impact of that agent. Therefore, the estimated

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<sup>8</sup> Bureau of Industry Economics (1984). *Tourist Expenditure in Australia*. Research Report 16, AGPS.

multipliers for the marginal coefficients model would typically be higher than those for a traditional input-output model, even though the total economic impact in value terms (and jobs) is lower in the marginal coefficients model. Extreme care is therefore required when using multipliers derived from a marginal coefficients model, as it is less valid to separate its results into initial and flow-on effects.

To address this issue the multipliers in this report are calculated on the basis of the total economic impact estimated using the marginal coefficients model divided by the initial impact that would have applied to a traditional input-output model. This procedure allows the estimation of multipliers using the marginal coefficients model that are comparable to those of a traditional input-output model. Multipliers estimated using this method should be lower than traditional multipliers. However, these multipliers give a more accurate estimate of the economic impact of a change in final demand.

## APPENDIX 2: INTERVIEW OUTLINE

### Bells Line Expressway – Interview

Business Name: \_\_\_\_\_

Business Type: \_\_\_\_\_

Town: \_\_\_\_\_

Number Employed: \_\_\_\_\_

Annual Turnover: \_\_\_\_\_

Products: \_\_\_\_\_

If a four lane expressway was constructed from Windsor to Lithgow (via the Bells Line of Road) which cut travel time from Lithgow to Windsor by a significant amount (around 40minutes), please indicate on a scale from 1 = strongly agree to 5 = strongly disagree how strongly you agree with the following statements:

	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
The expressway would bring new customers to the Lachlan Region from Sydney	1	2	3	4	5
The expressway would bring new customers to the Lachlan Region from the Central West	1	2	3	4	5
My business/industry would be able to develop new products	1	2	3	4	5
Costs to my business/industry would be lowered, e.g. transport costs	1	2	3	4	5
Improved access to Sydney would increase competition	1	2	3	4	5
The expressway would increase competition within the Central West	1	2	3	4	5
The expressway would allow my business/industry to access new markets	1	2	3	4	5
The expressway would improve access to skilled workers in my business/industry	1	2	3	4	5
The expressway would improve access to industry and other training for myself and my employees	1	2	3	4	5
The expressway would lead to improved business networking	1	2	3	4	5
The expressway would lead to increased market intelligence	1	2	3	4	5
New residents/weekenders moving to the region would affect my business/industry	1	2	3	4	5



Do you perceive any constraints or conflicts in the Lachlan Region to the changes you have identified?

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What is your impression of the effect that the new expressway could have on road safety?

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## **APPENDIX 3: ENVIRONMETRICS TOURISM REPORT**

### **REPORT**

# **Bells Line Of Road development: Estimate of increased tourism flow to Centroc Region**

Prepared for

**Western Research Institute**

by

**Environmetrics**

**September 2005**

Client contact: Tom Murphy

Environmetrics contact: Pete Wilson

Ref: 2169



### Information we used for the estimate

- National Visitor Survey 1998-2004: overnight domestic leisure and holiday trips and spend by Sydneysiders to domestic destinations
- Road Traffic Authority: Average Daily traffic figures for M4 and Bells Line Of Road 1980 to 2002 (the most up to date data)
- Explorer Country Tourism (ECT) visitor research 2002-2003 conducted by Environmetrics
- LeisureScope: Environmetrics six-monthly study of Sydneysiders leisure habits
- The following papers and articles:
  - 'Before and after Sydney's M4 Motorway: did it make the city more sustainable?', Michelle E Zeibots, 2003, University Of Technology, Institute For Sustainable Futures
  - 'Traffic Congestion and Tourism Displacement in the NH Route 1A/B Corridor: Does Sampling method matter?', Joshua Wisersma, resource Economic, University of New Hampshire, 2003
  - 'New roads, new traffic, bigger roads, bigger problems', Brisbane Institute, 2002
  - 'A650 Bingley Relief Road', Highways Agency, 2004
  - 'Traffic Impact Study – A6 Rushden & Higham Ferrers Bypass', Highways Agency, 2003
  - "A500 Basford Hough Shavington Bypass – Traffic Impact Study, Highways Agency, 2003

### Some initial assumptions

- The estimate involves the likely increase in tourism from the Sydney market only.
- That Sydney holiday and leisure visitors to the Centroc region travel by car (ECT data indicates it is around 90%)
- The increase in speed limits and time saving proposed for the new road are accurate
- General traffic flow trends along the current M4 and BLOR (which encompass all vehicles, not just tourists) are reflective of the tourist vehicle traffic.
- The estimate of any growth in tourist traffic along the new road must factor in the likely reassignment of traffic from the M4 and the effect of the new Western Orbital Road (Westlink M7).

## **A note to the reader**

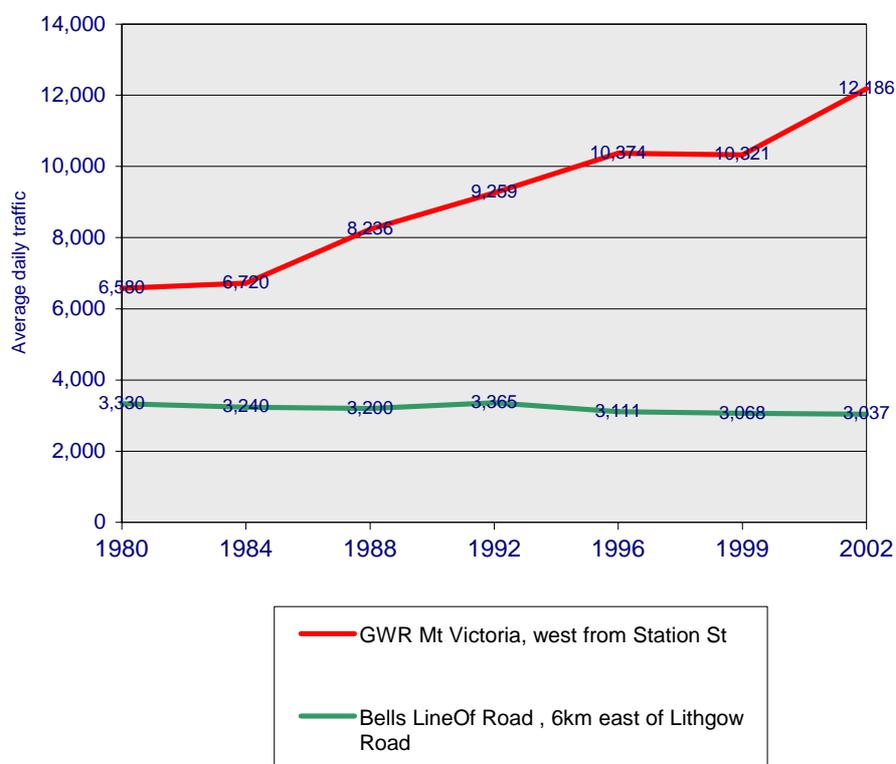
In preparing this report we have presented and interpreted information that we believed relevant for completing the agreed task in a professional manner. It is important you understand that while we have sought to ensure the accuracy of all the information incorporated into this report, data derived from surveys are estimates and should be regarded as such. Where we have made assumptions as a part of interpreting the data incorporated in this report, we have sought to make those assumptions clear. Similarly, we have sought to make clear where we are expressing our professional opinion rather than reporting empirical data. Please ensure that you take these assumptions into account when using our report as the basis for your decision-making. We are more than happy to discuss the analysis and recommendations with you and would be willing to incorporate any of your own knowledge and observations into the report.

## CURRENT TRAFFIC FLOWS

To understand the current vehicular flow from Sydney into the Centroc region we need to look at traffic flows through the two major routes into the region.

- The Great Western Highway (GWH) travelling west at Mt Victoria (assuming that most of these cars will end up in Lithgow and beyond)
- The western most point of the BLOR where traffic flow can be measured (assuming that most of these cars will end up in Lithgow and beyond)

The most recent average daily traffic figures for these two points are shown below.

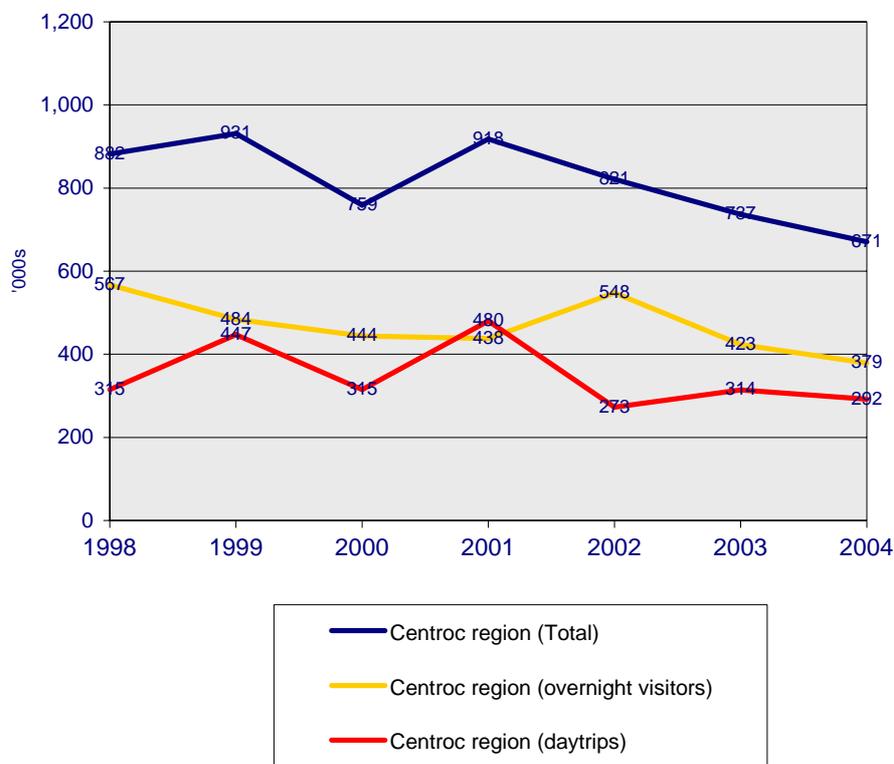


Source: RTA Traffic Volume data

The traffic flow along the BLOR has remained relatively constant for over 20 years, while the Great Western Highway traffic at Mt. Victoria has almost doubled over this time. The current ratio is for every vehicle along the BLOR 4 cars travel along the GWR at Mt Victoria.

## CURRENT TOURISM FLOWS (SYDNEY MARKET)

The number of holiday and leisure overnight trips (in thousands) made by Sydneysiders to the Centroc LGAs are shown below.



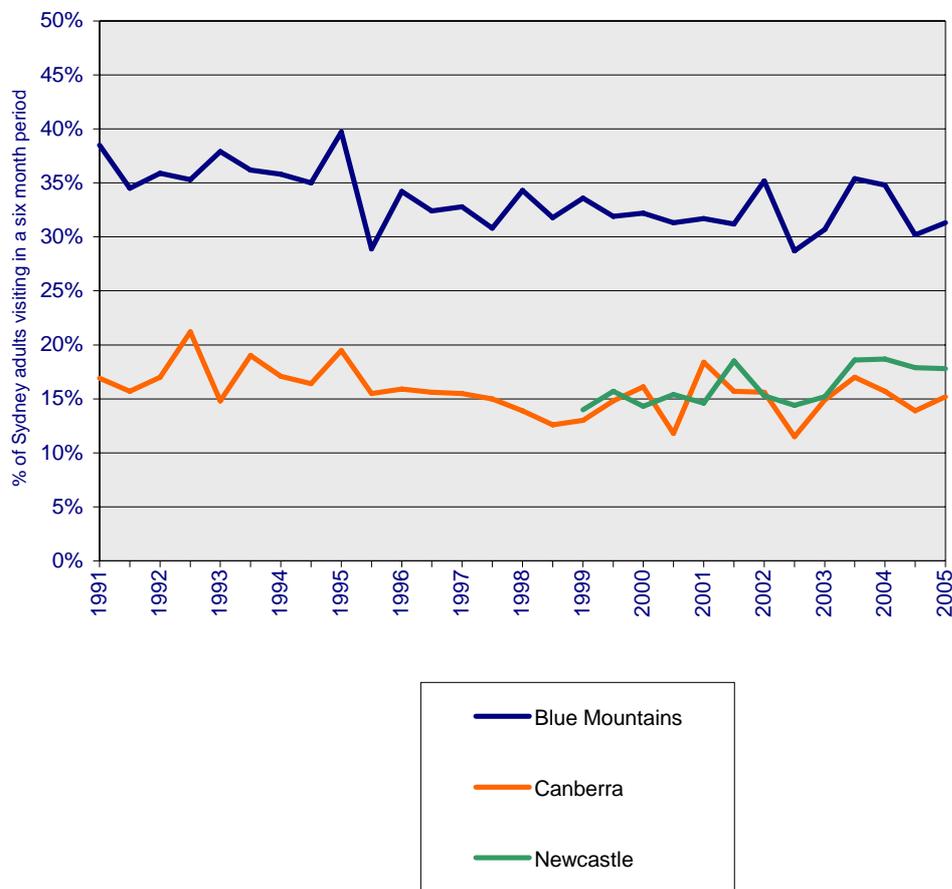
Source: National Visitor Survey<sup>9</sup>

Tourist flows into the Centroc region by the Sydney market is reflective of total domestic travel. The last 5 years has seen a 14% decrease in overnight trips, daytrips and a similar decrease in total visitor nights by the total Sydney market to all domestic destinations.

Since 2001 the number of overnight trips and daytrips to the Centroc region has decreased by 27%. While the validity of NVS data cannot be assured for visitor nights, the ECT 2002/2003 research indicates that Sydneysiders stay 2.7 nights on average in the region and it is likely that this figure has remained constant (or decreased) since 2002.

<sup>9</sup> The visitation results have been derived from the aggregation of overnight and daytrip visits to the Centroc LGAs. There are two important things to note. 1) That for many of the LGAs the results have been derived from small sample bases and therefore must be treated with some caution. 2) The overnight and day trip figures are *net* totals of trips to all LGAs. That is, they look at the discrete number of people who visited any LGA in the Centroc region. Obviously, some of these people will have visited more than one LGA in the region, but to best appreciate the size of the Centroc region Sydney market we have not counted these people twice.

This finding is also consistent with LeisureScope data that has been measuring Sydney leisure visitation to a number of nearby getaway destinations including the Blue Mountains, Canberra and Newcastle (visitation figures shown below).



Source: LeisureScope

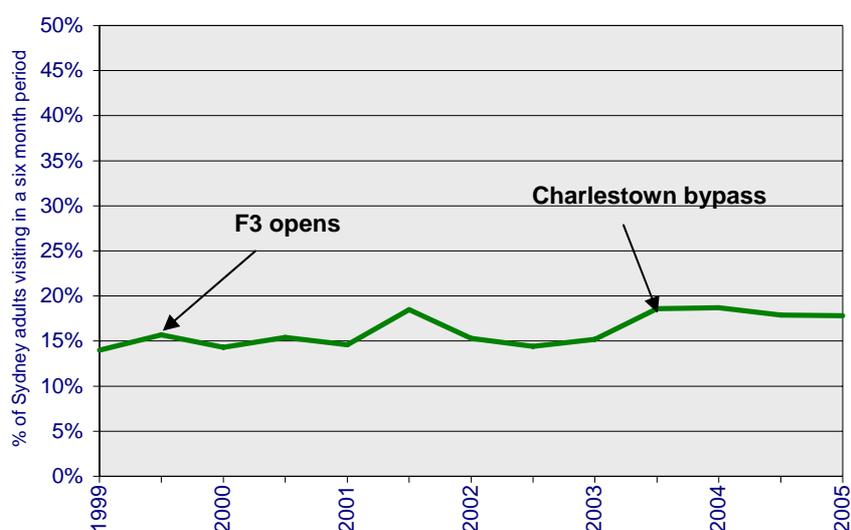
In the above examples, Sydney visitation has been decreasing over the last 15 years. It should also be noted that during this time the major routes to each destination have had a variety of upgrades, improvements and extensions (notably the M4 and M5, improvements to the Hume Highway Federal Highway, the F3 and Pacific Highway). These developments have had little lasting impact on the Sydney tourist market, with the exception of Newcastle where visitation has increased - a spike in visitation in 2001 (F3 completion) and a sustained increase in 2003 (opening of Charlestown bypass). It should also be noted however, that the Newcastle region has implemented an extensive and successful tourist marketing campaign and tourism product development program over the last few years. This demonstrates that road improvements alone are unlikely to result in long lasting increases in tourism.

Similarly, it has proved difficult to grow domestic tourism markets over the last 10 years for a number of reasons:

- A shift towards a more 'time-poor' society.
- An increase in the range and number of tourist destinations and experiences on offer (both domestically and internationally).
- People usually have a fixed number of 'holiday visits' they will make in a given year. Rather than increasing the number of these visits, tourist destinations have to 'steal' a visit from another destination. It has become more difficult to grow the domestic tourism pie.
- A shift towards home-based leisure and entertainment.
- In Sydney with the housing boom over the last few years, an increase in the percentage of the household budget spent on mortgages.

### Case study: Newcastle

The growth in Newcastle tourism from the Sydney market can be summarised below.



In the last 6 years the Newcastle tourist market from Sydney has grown around 30% (from around 15% of Sydneysiders every six months to around 19% every six months). During this time two significant road improvements have occurred reducing the travel time from Sydney to Newcastle between 20 and 30 minutes. Further, as mentioned previously, these improvements have been accompanied by a significant tourism marketing campaign and program of tourist product development.

It should also be noted that increases in tourism have not been overnight. Apart from a spike in tourism in 2001 (possibly the result of a post Olympics boom as well as the new F3), the current tourism levels have taken place over 5 years.

## MEASURING TRAFFIC INCREASES

A paper on the effect on the M4 to Sydney's traffic ('before and after Sydney's M4 Motorway: did it make the city more sustainable? Michelle E Zeibots, 2003, University Of Technology, Institute For Sustainable Futures') gives some useful explanations on how road traffic can be increased due to new roads.

Type of increase	Definition	Relevance to tourism growth in Centroc region
<b>Traffic reassignment</b>	Traffic that shifts from other routes to the new route. In this instance no additional trips are being made, but the route choice changes because the same trip can be made in a shorter period of time	In the BLOR case, traffic reassignment represents the traffic that would have previously used the M4/GWR but may now travel on the new BLOR because of increased travel times.  However, given these reassigned trips <i>don't</i> represent new trips to the region (i.e. growth) they are not relevant to our estimates. It is assumed that these travellers would visit the region anyway, but are just travelling a different route.
<b>Mode shifting</b>	Traffic that shifts from one mode to another, e.g. from rail to road	Given the assumption that Sydney tourists mostly drive to the Centroc region (and that leisure train travel from Sydney to Lithgow and beyond is relatively small), it is not relevant to our calculations
<b>Business as usual</b>	This represents traffic increases that are mostly the result of external factors (i.e. the increase would have happened anyway). Factors such as population and commercial growth in the nearby region (or the city as a whole) can lead to this growth	As the chart on page 4 shows there has been little Business As Usual growth along the BLOR for the last 20 years (it seems the M4/GWR has been absorbing this growth). However, given the growing population in the NW of Sydney it is likely this type of growth will become more pronounced along the new BLOR over time.
<b>Induced trips (traffic redistribution)</b>	Refers to cases where commuters decide to access more distant destinations because these can be reached within shorter time periods. No additional trips are made, but new origin and destination combinations result, where the distance between the two is increased so that distance travelled increases	Relevant to Centroc growth, although not for total market growth for the region, but for redistribution of tourists to destinations further a field within the Centroc (e.g. previously may have travelled to Bathurst, but because of new road may now decide to travel to Orange).
<b>Induced trips (new or repeat)</b>	Where people undertake new trips because the network speed has been increased. These trips may be new or an increase in repeat trips	The greatest contributor to increased tourism growth

The M4 study estimates that induced traffic due to M4 upgrades resulted in a 4% increase in traffic flow. Similarly, another 4% resulted from Business As Usual growth. We will use these figures for our estimates.

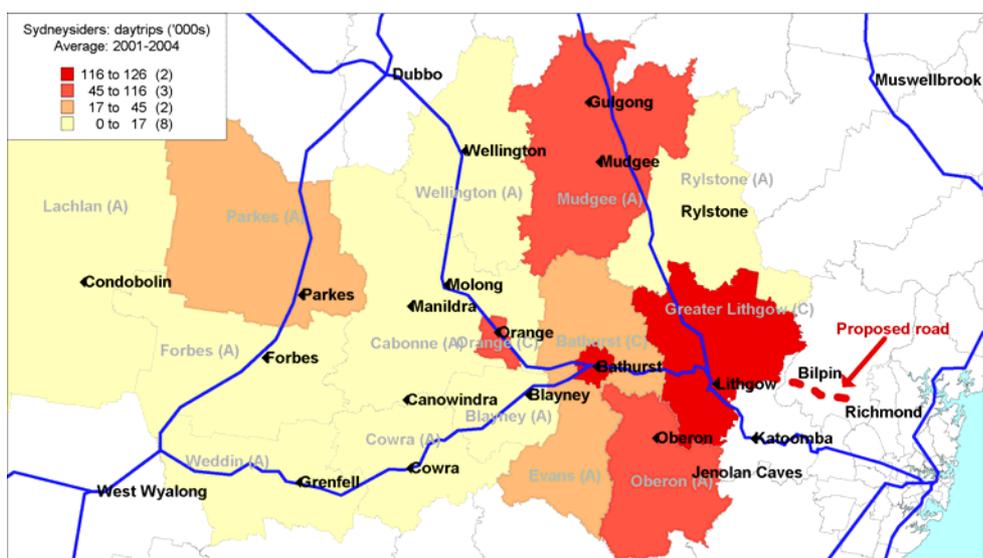
## Calculating increased tourist traffic

The following maps show the current visitation patterns to the Centroc region by the Sydney market – overnight trips and day trips. Given some of the small sample sizes involved, an average figure from 2001 to 2004 has been used.

### Overnight trips



### Daytrips



## Clusters of Centroc LGAs

Given some of the small sample sizes involved in the data and the tourist nodes that occur in the region (e.g. Mudgee, Orange, and Bathurst), we will cluster the Centroc LGAs as follows.

<b>Average 2001-2004</b>	<b>Overnight trips (‘000s)</b>	<b>Daytrips (‘000s)</b>	<b>Total visitors (‘000s)</b>
Lithgow, Oberon	95	188	<b>283</b>
Bathurst, Evans	134	135	<b>268</b>
Orange, Blayney, Cabonne, Wellington	162	56	<b>218</b>
Mudgee, Rylstone	134	55	<b>189</b>
Parkes, Forbes, Lachlan	66	25	<b>90</b>
Cowra, Weddin	51	8	<b>59</b>
<b>Total net</b>	<b>447</b>	<b>340</b>	<b>787</b>

## Assumptions in the calculations

To arrive at realistic forecasts we have assumed the following:

- Changes in tourism levels are unlikely to take place immediately. We have allowed for a 5 year period of growth
- Two different scenarios have been used – one based on just the road development and no other changes to tourism product or marketing (8% growth in total trips and nights), the second incorporating the effects of a substantial and effective tourism marketing campaign for the region (8%+12%=20% growth in total trips and nights).
- The 8% figure has resulted from the addition of the 4% likely induced traffic and 4% likely Business As usual growth.
- The 20% figure is based on a conservative estimate derived from the tourism growth seen in Newcastle.
- Given we don't have enough information to establish what might happen on a sub-regional level we assume the tourism growth rates affect each sub-region or LGA similarly (e.g. 8% or 20% across the board). This means those places with relatively higher visitation for say, daytrips (e.g. Lithgow), will see their place as a daytrip destination further consolidated. While those destinations that will benefit from increased traffic redistribution (e.g. people being able to travel further to places such as Cowra) will also be ascribed a realistic growth in tourism numbers.
- We will assume that the average number of nights staying in the region (amongst overnight visitors) will remain at 2.7 for the 8% increase, but will increase to 2.9 for the 20% increase. As stated previously, the number of nights Sydneysiders stay away

during domestic holidays has been falling over the last few years. It is therefore unlikely that this figure will increase greatly in the Centroc region, even with a concerted marketing effort. Further, the ECT research indicates that the Central West region is mostly seen as a 'weekend destination' for most of the Sydney market. We predict that most of the growth will therefore result from new markets and/or repeat visits from existing markets. However there may be some incremental growth in the length of stay if a substantial marketing strategy occurs, which the 2.9 figure allows for. Similarly, given the above assumptions, the average nights per stay figure has been applied consistently across all Centroc LGAs (while it may be likely that some LGAs or clusters may benefit more than others in terms of length of stay, it is unlikely to be much greater than the average of 2.9 and unlikely to have a substantial effect on the overall tourism revenue to the region).

- Latest NVS data on tourist expenditure comes from 2003. Figures are only available for total spend by all visitors to the Explorer Country/Central NSW region. It was not possible to extract Sydney only data for the Centroc Region. The average per night/day spend for the Explorer Country/Central NSW region was \$127. This figure is consistent with other regions and seems a realistic estimate of average spend by Sydney visitors to the Centroc region (factoring in overnight and daytrip visitors). We will use this \$127 figure in our forecasts and assume that over the 5 year forecast they will increase by 5% in line with CPI rather than an expected absolute increase in visitor spending (average spend in 5 years: \$133). As with most other domestic tourism measures, average spend has remained relatively stable over the last few years (for example, in Explorer Country there was 1% increase from 2002 to 2003).

## FORECASTS

With the above assumptions the current and forecasted figures can be calculated as follows. All figures represent annual data.

The net totals shown once again represent the discreet visitor/visits/ spend across the whole region. These totals are less than the gross total obtained if figures for each cluster were added together. The gross totals would double count visitors and their spend and are likely to over represent the tourist flow and resulting revenue. We therefore feel that the net totals are a more realistic estimate of tourist flow and spend.

### The current situation

<b>2001-2004 average</b>	<b>Overnight visitors ('000s)</b>	<b>Average nights</b>	<b>Daytrips ('000s)</b>	<b>Total visitors ('000s)</b>	<b>Total nights/days ('000s)</b>	<b>Average spend per night/day</b>	<b>Total spend (\$m)</b>
Bathurst, Evans	134	2.7	135	268	<b>495</b>	\$127	<b>\$62.9</b>
Lithgow, Oberon	95	2.7	188	283	<b>444</b>	\$127	<b>\$56.4</b>
Orange, Blayney, Cabonne, Wellington	162	2.7	56	218	<b>494</b>	\$127	<b>\$62.7</b>
Mudgee, Rylstone	134	2.7	55	189	<b>416</b>	\$127	<b>\$52.8</b>
Cowra, Weddin	51	2.7	8	59	<b>145</b>	\$127	<b>\$18.4</b>
Parkes, Forbes, Lachlan	66	2.7	25	90	<b>202</b>	\$127	<b>\$25.7</b>
<b>Total net</b>	<b>447</b>	<b>2.7</b>	<b>340</b>	<b>787</b>	<b>1,547</b>	<b>\$127</b>	<b>\$196.4</b>

### Scenario 1: New BLOR road development and no other changes to tourism product or marketing

8% increase over 5 years, avg night 2.7, overnight spend increase 5%	Overnight visitors ('000s)	Average nights	Daytrips ('000s)	Total visitors ('000s)	Total nights/days ('000s)	Average spend per night/day	Total spend (\$m)
Bathurst, Evans	144	2.7	145	289	535	\$133	\$71.3
Orange, Blayney, Cabonne, Wellington	175	2.7	60	236	534	\$133	\$71.2
Lithgow, Oberon	103	2.7	203	305	480	\$133	\$63.9
Mudgee, Rylstone	144	2.7	59	204	449	\$133	\$59.9
Parkes, Forbes, Lachlan	71	2.7	26	97	218	\$133	\$29.1
Cowra, Weddin	55	2.7	8	63	157	\$133	\$20.9
<b>Total net</b>	<b>483</b>	<b>2.7</b>	<b>367</b>	<b>850</b>	<b>1,670</b>	<b>\$133</b>	<b>\$222.7</b>

The above forecast results in 8% growth in visitor numbers and spend over 5 years

### Scenario 2: New BLOR road development substantial and effective tourism marketing campaign for the region

20% increase over 5 years, avg night 2.9, overnight spend increase 5%	Overnight visitors ('000s)	Average nights	Daytrips ('000s)	Total visitors ('000s)	Total nights/days ('000s)	Average spend per night/day	Total spend (\$m)
Orange, Blayney, Cabonne, Wellington	195	2.9	67	262	632	\$133	\$84.3
Bathurst, Evan	160	2.9	161	322	626	\$133	\$83.5
Lithgow, Oberon	114	2.9	225	339	556	\$133	\$74.1
Mudgee, Rylstone	161	2.9	66	227	531	\$133	\$70.9
Parkes, Forbes, Lachlan	79	2.9	29	108	258	\$133	\$34.4
Cowra, Weddin	61	2.9	9	70	186	\$133	\$24.9
<b>Total net</b>	<b>536</b>	<b>2.9</b>	<b>408</b>	<b>944</b>	<b>1,963</b>	<b>\$133</b>	<b>\$261.8</b>

The above forecast results in 33% growth in visitor numbers and spend over 5 years

## Forecast summary

	Total nights/days ('000s)			Total spend (\$m)		
	Current	Scenario 1	Scenario 2	Current	Scenario 1	Scenario 2
Orange, Blayney, Cabonne, Wellington	494	534	632	\$62.7	\$71.2	\$84.3
Bathurst, Evans	495	535	626	\$62.9	\$71.3	\$83.5
Lithgow, Oberon	444	480	556	\$56.4	\$63.9	\$74.1
Mudgee, Rylstone	416	449	531	\$52.8	\$59.9	\$70.9
Parkes, Forbes, Lachlan	202	218	258	\$25.7	\$29.1	\$34.4
Cowra, Weddin	145	157	186	\$18.4	\$20.9	\$24.9
<b>Total net</b>	<b>1,547</b>	<b>1,670</b>	<b>1,963</b>	<b>\$196.4</b>	<b>\$222.7</b>	<b>\$261.8</b>

## THE WESTERN RESEARCH INSTITUTE

The WRI is a non-profit economic, business and social research organisation located on the Bathurst campus of Charles Sturt University. The WRI holds a wealth of knowledge on employment, business development and investment issues affecting regional Australia. It has worked with Commonwealth, State and Local Governments and industry groups on numerous investment and development programs in regional areas. The WRI has strong credentials in business and commercial market consulting and applied economic modelling including input-output analysis, shift-share, agribusiness and regional socio-economic surveys and analysis.

### The Research Team

#### **Tom Murphy - Chief Executive Officer** BEc. (Hons I) MSc. (Econ) Lancaster

Tom Murphy holds the degrees of Bachelor of Economics from the University of New England and Master of Science (Economics) from the University of Lancaster. He is currently Chief Executive Officer of the WRI. Mr Murphy has previously held academic positions as senior lecturer in Economics and Director of the Regional Economics Research Unit in the Faculty of Commerce, Charles Sturt University, Bathurst and positions at the University of New England and Macquarie University. He has also held the positions of Economic Analyst with the Office of National Assessments in Canberra, with responsibility for the ASEAN economies and Senior Consultant with KPMG Peat Marwick Management Consultants.

#### **Luciana Mazzotti – Senior Research Officer** BBus (Marketing) CSU

Luciana has a background in marketing and adds a new dimension to the WRI team. With her strong analytical capabilities and economic modelling skills, Luciana manages a range of WRI projects. Her excellent written communication skills are demonstrated by the clear and simple language that characterises WRI research reports. Luciana has experience in the retail, hospitality and advertising industries and brings a diverse range of skills to the WRI.

#### **Kathy Sloan – Research Consultant** BAppSc (AppGeog) Canberra, GDip InfoSys CSU

Kathy provides statistical analysis in WRI projects and is an experienced researcher in both the private and public sectors. Her strengths in information communication technology ensure WRI work is enhanced through the usage of current computer applications. Her recent experience in private consultancy and the Planning and Audit Division of CSU provides a strong background in project management and quality assurance.