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*The Vice-Chancellor's Engaged Research Initiative*

*Assessing the regional economic impacts of flood  
interruption to transport corridors  
in Rockhampton*

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## **EXECUTIVE SUMMARY**

This study examined the economic costs of transport corridor closures at Rockhampton, Central Queensland, as a consequence of peak flooding in the Fitzroy River during January 2011. The floods in central Queensland caused a large number of direct economic impacts, including lost coal production, lost agricultural production, damaged infrastructure and the emergency response and avoidance costs. However, the floods also caused a variety of indirect costs, as those impacts and the interruption to business activities rippled through the local and state economy. A particular subset of the indirect impacts that are assessed in this report are the costs stemming from the closure of the transport corridors at Rockhampton, largely isolating the city from supplies and separating north Queensland from southern Queensland.

These indirect economic costs were assessed in two main ways. The first was to assess the amount of economic slowdown in the regional economy over the period when the road and airport was closed. This drew on data from 138 local businesses surveyed at the end of the flood period, and a further 6 in-depth interviews with business leaders six months later. While not all businesses were affected, many had substantial reductions in their trade and activities, while others reported having staff away unable to get to work, lack of access to supplies, some water in their premises, or closing their business as a precaution against the flood getting higher.

To estimate the impacts of the road closure on the economy, the estimated downturn in business conditions (18.6% decline) is extrapolated to the Gross Regional Product (GRP) at Factor Cost (industry factor income) of the Rockhampton region (Table 4.1) for the period of the road and airport closures (averaged to 18 days). This generates an expected reduction in total production in the Rockhampton economy over that period of \$35 million, or about 0.77% of gross regional product over a year.

The second method for assessing the costs of road and airport closure was to apply the ‘travel cost savings’ approach, where the regional transport figures for the period during which the Bruce Highway remained closed. This methodology is already by used Austroads (1997, 2003, 2011) to assess the costs and benefits of transport options in Australia. In this case study for central Queensland, available travel value estimates from Austroads (1997, 2003, 2011) have been extrapolated to both passenger and freight vehicle movements. Data prepared from this methodology showed that the estimated costs for the closure of the Bruce Highway road using the Austroads approach were:

- \$3.34 Million per day from the loss of through traffic, with many of these losses expected to be directed to north Queensland.
- \$0.59 million per day for the loss of the through traffic to the Capricorn Coast (mostly losses to the Rockhampton economy), and
- \$1.42 million per day for the closure of southern and western access to local traffic (mostly losses to the Rockhampton economy).

Total costs from the loss of road transport at Rockhampton are estimated to be approximately \$5.41 million per day.

Furthermore, economic data for the flood-related closure of the Rockhampton Airport indicated that the costs to the Rockhampton and state economy were approximately \$730,000 per day. These costs reflect both lost travel and diverted freight opportunities. With the state highway road corridor closed for two weeks and the regional airport remaining shut for three weeks, the total direct costs of the transport closures to the Queensland economy can be assessed at \$66.74 million for the road closure, and \$15.34 Million for the airport closure. Approximately \$47.5 million were due to the road closure limiting access between southern and northern Queensland, while the remainder were impacts to Rockhampton because of the local losses to road and airport transport.

These losses are sensitive to the assumptions about the lost travel time involved. The time factors (72, 24 and 8 hours) are based on approximate estimates of trip delays for the different groups. If only actual missed travel time is considered (instead of time delays), then estimates will be reduced by about a factor of three. This would reduce the cost estimates for the road closure to approximately \$1.8 million per day. However, the time delay approach gives values that are more consistent with the first valuation technique.

Under the economic slowdown approach, the impact on the Rockhampton economy over a two week period was assessed as a reduction in GRP approximately \$35 million. Under the value of travel time approach, the cost of missing trips to the Rockhampton economy was assessed at \$34.58 million (\$19.24 million for road delays and \$15.34 for the airport closure). Some caution has to be attached to these estimates, as the GRP and travel time approaches measure slightly different economic concepts. However, the consistency of results suggests that the impacts of the transport corridor closures at Rockhampton in January 2011 cost the Rockhampton economy approximately \$35 million, and the wider Queensland economy a further \$45.7 million, for a total of \$80.7 million.

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## ABBREVIATIONS

CGE	Computable General Equilibrium
CQU	CQUniversity Australia
CTEDL	Capricorn Tourism and Economic Development Limited (now Capricorn Enterprise)
DIP	(Queensland) Department of Infrastructure and Planning
DTMR	(Queensland) Department of Transport and Main Roads
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GRP	Gross Regional Product
GSP	Gross State Product
ICA	Insurance Council of Australia
I-O	Input-output model
LGA	Local Government Area
QLD	Queensland
RRC	Rockhampton Regional Council
SD	Statistical Division

## **1. INTRODUCTION**

Assessing the economic costs of natural disasters is an important because it can

- inform the need to allocate funds for repairs and to meet immediate economic and social consequences,
- be used to help to predict the wider impacts on communities and economic frameworks, and
- assist in designing infrastructure and policy settings that reduce the risks from future events.

Estimating the cost of natural disasters is complex, and no one assessment method is universally accepted (Pelling et al. 2002). Initially, the costs of many natural disasters are calculated solely on the basis of direct losses, usually repair and replacement costs, with values often estimated from the reported costs of insurance repairs. However, the total costs are much greater than this when the wider economic and social impacts in a region are considered (Pelling et al. 2002).

Whilst there is no universally accepted method for measuring these costs, most formal studies (e.g. PWC 2011, IBIS World 2011) have divided costs into direct and indirect costs, with a focus on

- assessing the direct costs of repairing and replacing damaged assets and infrastructure,
- assessing the value of lost production in primary industries, and
- assessing the impacts on overall economic performance through slowdowns in growth, typically measured as changes in Gross Domestic Product (national level), Gross State Product or Gross Regional Product.

The combination of floods and cyclones which affected Queensland in the summer of 2010-11 provides a case study example of a series of natural disasters with substantial economic consequences. The flooding in December and January, followed by Cyclone Yasi in February, is estimated to have affected 70% of Queensland and around 60% of the state population (PWC 2011). Several lives were lost, and there were large personal and social impacts in many communities. In economic terms, the natural disasters reduced Gross State Product (GSP) for Queensland by around 2.25%, or \$6 billion, for the 2010-11 year (Queensland Government 2011c). There was significant damage to infrastructure and housing, with more than 50,000 homes damaged in the state, as well as major interruptions to coal production and exports and losses in agricultural production. To the end of June 2011, the estimated insured losses due to the Queensland floods was \$2.55 billion, with a further \$1.05 billion in claims for damage suffered from Cyclone Yasi (ICA 2011).

The Queensland Government predicts that the combined cost of rebuilding public assets and providing support to the community will cost government around \$6.8 billion (Queensland Government 2011c).

While estimates of total impacts are useful in guiding macroeconomic and policy settings, more detailed information about impacts at a sub-regional level is typically required to help evaluate current policy settings and infrastructure, and to provide a base for evaluating any

future improvements that might be considered. However, assessing economic impacts at a sub-regional level is difficult because of the complexity of events, limited data availability and the problems in apportioning out a subset of effects and consequences to a geographic area or time period.

The focus of this study is to estimate the economic impacts of just one consequence of the 2011 floods in Queensland: the closure of transport corridors at Rockhampton, mid-way along the coast of Queensland. The floods in central Queensland generated a wide variety of costs, including damages to houses and infrastructure, losses of agricultural production, losses of mining production, delays to shipments of coal, costs of emergency services and flood responses, and interruptions to business activity and logistics. The impacts of the floods in Rockhampton on the north-south transport corridor and access to the airport was independent of a number of the other impacts, and would have only generated a smaller subset of the overall economic costs. If transport links had not been cut at Rockhampton, the regional and state economy would still have suffered substantial economic costs because lost production, damages, and operational costs, and other road closures would still have occurred.

The case study is notable in that it assesses only a small part of the total impacts of the flood and cyclone damage on the Queensland economy, where closure of transport options at Rockhampton had varying impacts on communities, businesses, employees and households. The study is also notable in that most of the impacts to be assessed were indirect impacts, where people could not access employment, goods and services, or other needs, while businesses could not access staff, suppliers or customers. The methodological challenges in defining only a small set of mostly indirect impacts from a broader set of major economic costs is the key methodological focus of the research reported here.

However, the issue of transport corridor closure at Rockhampton is very important in a policy setting because the resulting impacts could have been avoided if better infrastructure had been in place. Evidence about the economic costs of having the road and rail corridors cut at Rockhampton, and the closure of the Rockhampton airport, will be useful in evaluating the case for investing in new infrastructure in the region. For this study, economic costs have been estimated and compared using two separate approaches. The first is to estimate the downturn in the sub-regional economy, essentially providing an estimate of the changes in Regional Gross Product or factor incomes as a consequence of the natural disaster. The second is to assess costs in terms of the value of lost travel time, a standard methodology used to assess improvements in transport infrastructure.

Key research objectives of this project are to: (a) establish an appropriate methodology for assessing the economic impacts of transport and network interruptions, and (b) assess the indirect impacts on the Rockhampton Regional and Queensland economy of transport interruptions across road and air sectors as a consequence of the flooding at Rockhampton. The report is organised in the following manner. An overview of the methodology used is provided in the next section, followed by a description of the flood impacts in section 3 (more detail on the Rockhampton area is provided in Appendix 1). Cost estimates using the modelling and lost travel time approaches are provided in sections 4 and 5 respectively, and discussion about other costs and final points are made in sections 6 and 7.

## **2. ASSESSING AND MODELLING THE COSTS OF NATURAL DISASTERS**

Natural disasters are a regular occurrence in Australia. Based on data from the Insurance Council of Australia (ICA), catastrophic events in the country cost on average about \$1 billion per year nationally in insured losses (ICA 2011). However, this average can be distorted by extreme events such as the 1989 Newcastle earthquake – which alone cost \$4.2 billion. In Queensland, floods, severe storms and cyclones were identified by Gentle et al. (2001) as the most common as well as the most expensive natural disasters, costing on average over \$238 million dollars annually to 2000. However, it should be noted that these figures represent only insured losses, not total economic costs, as direct economic costs are likely to be around twice those of reported insured losses (Crompton and McAneney 2008).

Even when direct costs (i.e. damage to buildings, infrastructure and direct income losses) can be measured accurately, they do not reflect the total cost of natural disasters. A more holistic approach to assessing impacts of natural disasters takes into account not only direct damage repair costs but the further costs of reduced business turnover, and other costs such as additional logistics and transport costs (Pelling et al. 2002). The economic costs of many flow-on effects from natural disasters, such as the closure of transport corridors, are largely caused by the indirect effects of an interruption or slowdown in the economy. Assessing the costs of natural disasters therefore requires accurate methods of assessing both the direct costs and the indirect costs.

There are two broad approaches to estimating the economic costs associated with the closure of a transport corridor. The first is to model the change in economic activity in the affected regional economy, while the second is to infer the value of lost production per transport movement that has not occurred.

The economic modelling approach identifies the direct value of interruptions to businesses, customers, suppliers and employment, and then assesses the subsequent indirect and final demand effects through the use of economic modelling. These impacts are typically incorporated into modelling economic performance at the national or state levels. However the full assessment approach is typically complex to perform at a regional level and for specific influences because of the difficulties in identifying and assessing the primary impacts, and then the challenges in identifying the subsequent indirect impacts. For example, the effects of natural disasters on regional economies are complex, and it is difficult to apportion out the impacts of transport corridors being closed from other primary impacts.

The value of travel time approach can be estimated by identifying the value of travel time lost across different classes of travellers and vehicles. This is performed through the application of standard travel time values to the estimated number of vehicle and passenger movements affected by a closure of a transport corridor. The advantages of this approach are that the key variables (vehicle and passenger movements) are easier to estimate with some level of accuracy, and the methodology to value impacts is well established. However, an implicit assumption is that there are limited indirect impacts flowing through to other sectors of the economy.

These approaches are outlined in more detail in the following sub-sections.

## **2.1 Assessing an economic slowdown**

The methodology proposed by Dore and Etkin (2000) to assess the full costs of a natural disaster is to measure the distortion to normal economic growth and estimate the amount required to restore the economy such that Gross Domestic Product (GDP) (or Gross State Product (GSP) or Gross Regional Product (GRP)) is equal to that which would have occurred without the natural disaster. Using this methodology the total social loss is equal to the loss of value added plus the loss of capital and the opportunity cost of labour redirected to assist with the emergency.

Modelling the indirect effects of natural disaster costs on the wider economy has most commonly been performed using Input-output (I-O) models, Computable General Equilibrium (CGE) and econometric models, each of which has advantages and disadvantages. I-O models are linear, relatively simple to construct and are capable of estimating the full range of direct and indirect costs including integration with transport or engineering models if necessary (Okuyama 2008; Hallegatte 2008).

CGE models have an advantage over I-O models as they can be non-linear, are able to respond to price changes and can endogenously incorporate import and input substitutions (Okuyama 2008). To account for inter-regional impacts of natural disasters which specifically affect transport networks (Tsuchiya et al. 2007) expands the standard CGE model into a spatial CGE which includes a transport model covering both freight and passenger trips. However, one of the challenges with modelling the impacts of natural disasters is that most economic models are based on annual or at best quarterly periods while events such as floods occur over relatively short time frames (Okuyama 2008). CGE models also rely on the assumption of rational optimization which does not necessarily occur during periods of disaster (Okuyama 2008).

The value of recovery efforts, whether funded by governments, non-profit organisations, insurance payments or privately, provides a boost to the local economy and increases economic growth for a period (Guimaraes et al. 1992). This confounds the assessment of impacts on an economy because spending inflows from recovery efforts offset production losses. The effect is to delay and minimise the net impacts of a natural disaster on an economy by avoiding large swings in confidence and expenditure. Failure to account for offsetting recovery efforts can distort predictions from both I-O and CGE models.

## **2.2 Value of travel time lost**

An alternative approach to valuing changes in travel access is to estimate the value of changes in travel time, and to then extrapolate this across different groups of vehicles and travellers (Austroads 1997, 2003, 2011). The approach taken in Australia is typically to identify vehicle trips for private/non-business travel, business travel, commercial vehicles and freight travel. Time on public transport, commuting to and from work, and tourist/bicycle/pedestrian trips are classified as private travel. The value of private travel and business travel is assessed by Austroads (1997, 2011) as 40% and 135% of average weekly earnings in Australia (assuming a 38 hour week) respectively.

The lost travel time approach relies on the identification and classification of the number of trips that would have occurred, the estimate of travel times that would have been involved, and the application of travel time values. There is a substantial literature available on the

value of travel time savings, which has been summarised for Australian use by Austroads (2011). For passenger vehicles this involves an analysis of typical vehicle uses and costs to generate estimates of average travel costs. Here, the most important information is summarised for three particular groups of vehicle travel.

### **2.2.1 Non-business travel in passenger vehicles**

AustRoads (1997) recommended that unpaid private travel time be valued at 40% of seasonally adjusted full time average weekly earnings for Australia, assuming a 38 hour week. This equates to \$11.49/person-hour, which AustRoads (1997) recommended to be used in the valuation of private car travel for the following forms of travel:

- commuting to and from work
- recreational/tourist travel
- motor cycle travel
- bicycle travel
- pedestrian travel
- public transport waiting time
- public transit passenger travel.

### **2.2.2 Business travel in passenger vehicles**

AustRoads (1997) recommended that paid private time for non-commercial vehicles (cars and vans) be valued at 135% of full time average weekly earnings (less 7% assumed for payroll tax). On this basis, business vehicle travel can be calculated at \$36.76/person-hour.

### **2.2.3 Freight vehicles**

Austroads (2003, 2011) treats the value of driver time lost for freight vehicles in the same way as for business travel (\$36.76 per person-hour). However this does not account for the business costs in delays in load delivery. These have been estimated separately in Austroads (2011) at \$1.50 for full truck delays per pallet per hour. An A trailer carries 12 pallets and a B trailer 22 pallets.

### **2.2.4 Air Passenger Travel**

The University of Westminster conducted a comprehensive review of the costs to airlines of delays at all stages of flights (Institute of Air Transport 2000). Values were estimated for different groups of travellers based on the opportunity costs of their time and the travel delay costs. Results are summarised in Table 2.1, with adjustments to values for 2010.

**Table 2.1 Cost of airport delays**

	% travellers	\$/hour (2000 values)	\$/hour (2010 values)
<b>Low</b>			
Business	49%	\$47	\$62.28
Personal	16%	\$28	\$37.11
Tourism	35%	\$20	\$26.50
Average		\$34	\$45.06
<b>High</b>			
Business	49%	\$63	\$83.49
Personal	16%	\$33	\$43.73
Tourism	35%	\$23	\$30.48
Average		\$44	\$58.31

Source: Institute of Air Transport (2000)

### 2.2.5 Air Freight Travel

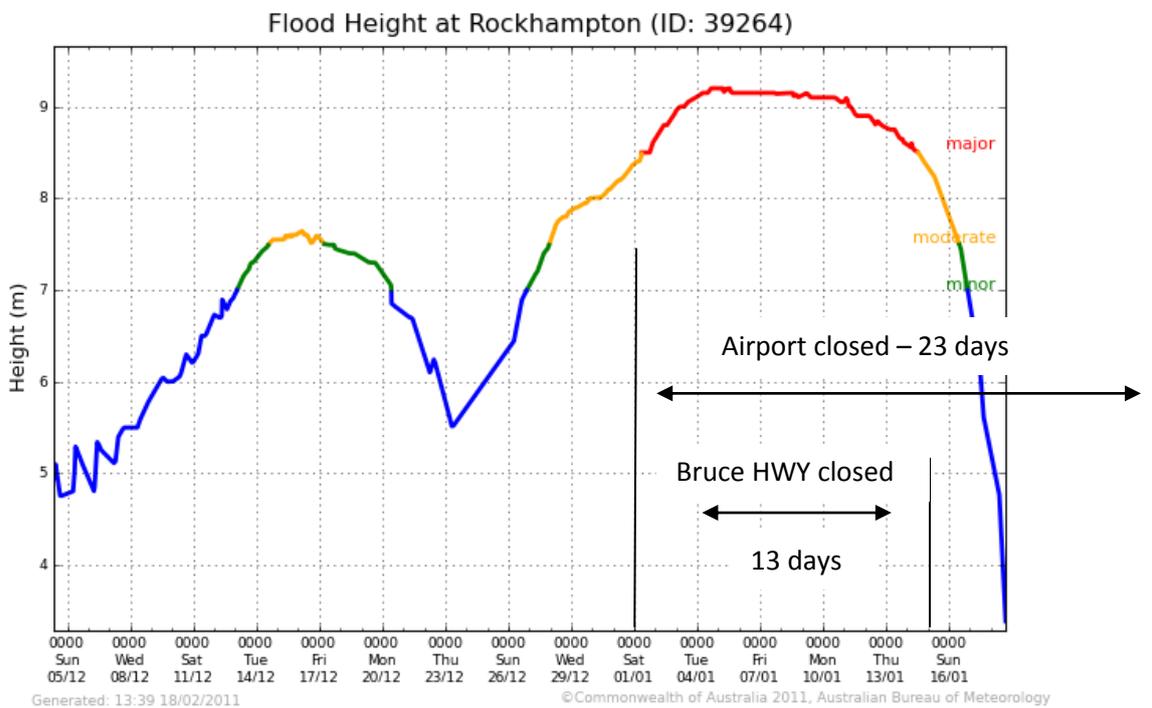
Logistics costs are most commonly estimated through stated preference estimation of the willingness to pay to reduce travel time and indirect costs through estimation of the loss of revenue or income. In a review of 27 similar studies Hu (2006) found that 23 had used stated preferences to estimate the value of travel time for freight transport. The average value of travel time found in these studies was \$23 per shipment per hour<sup>1</sup>.

<sup>1</sup> Values are in \$US 1999, which equates to approximately AUS \$32 in December 2010.

### 3. EFFECTS OF FLOODING ON ROCKHAMPTON

The 2010-11 Rockhampton flood was the fourth highest on record with over 2000 properties inundated and over 500 people requiring evacuation (Rockhampton Regional Council (RRC) 2011). The Bruce and Capricorn highways were closed between the 3<sup>rd</sup> and the 14<sup>th</sup> of January and the airport for over three weeks between the 1<sup>st</sup> and the 24<sup>th</sup> of January, which severely disrupted business trade and caused significant losses beyond the direct damage caused by the flooding.

**Figure 3.1 Flood heights at Rockhampton manual gauge for December 2010 and January 2011**



Source: Australian Bureau of Meteorology supplied by Rockhampton Regional Council

Rockhampton did not suffer the direct flood impacts that many other Queensland communities experienced. The nature of the flow in the Fitzroy catchment meant that there was ample advance warning of the upstream flood peak. Existing reports suggest that the regional emergency and management systems generally worked well to deal with the direct impacts of flood inundation on the Rockhampton community, particularly given that the appropriate planning systems had ensure that new housing and developments were built out of the flood zones (Queensland Flood Commission of Inquiry 2011). Nevertheless, Rockhampton and its neighbouring communities (Gracemere and the Capricorn Coast) experienced serious flood impacts of a different kind. For example, at its peak, the Fitzroy River inundated the intersection of the Bruce and Capricorn Highways at the southern entrance to Rockhampton, and prompted the closure of the Rockhampton airport.

This closure of both the road and air transport corridors for long periods limited access between regional businesses, suppliers, customers and employees. It also effectively split the Queensland economy into two sections, disrupting the connectivity between the southern and central/northern markets.

The closure of the major transport network that occurred in Rockhampton in January 2011 is expected to have far-reaching costs which will affect both state and regional economic performance in the short and medium term. While most attention has been focused on direct impacts such as damage to housing and infrastructure and loss of production in agriculture and mining, the indirect impacts of closures of road, rail and air access also has serious economic as well as social impacts.

### **3.1 Previous floods in Rockhampton**

Rockhampton has experienced many flooding events since records began in 1859. Prior to 2011 the most severe were in 1918, 1954 and 1991. The flooding in 1991 occurred as a result of heavy rain from Cyclone Joy which is estimated to have caused a total of \$300 million worth of damage between Ingham and Rockhampton (Baddiley 1991). In 1991 road and rail access from the north, south and west to Rockhampton was closed for 21 days and access by air blocked for 12 days. The closures caused significant problems not only in Rockhampton and surrounding areas but also to northern centres.

**Table 3.1: Previous flood heights in Rockhampton**

Year	River height (m at city gauge)	No. days above 8m
1918	10.11	26
1954	9.4	13
1991*	9.3	13
2011*	9.2	Approximately 18

\* the heights of the 1991 and 2011 floods cannot be directly compared to previous levels as the construction of the Fitzroy River barrage in 1970 changed the floodplain characteristics (Baddiley 1991; Department of Main Roads 2009)

### **3.2 2011 Flood Damage at Rockhampton**

The direct costs of the floods in Rockhampton were largely caused by impacts on roads, with some additional impacts on other infrastructure and private housing. Estimates from the Rockhampton Regional Council are that total road damage of \$56 million occurred in the shire. A further \$0.9 million in damages occurred to the Rockhampton airport. In operational terms, the counter-disaster costs of managing the flood response and highway closures at Rockhampton was approximately \$1.5 million, while the Council lost a further \$0.6 million in direct revenue because of the airport closure<sup>2</sup>.

The closure of the Bruce Highway and the airport generated a range of other indirect costs. With access to the region all but eliminated the tourism and retail sectors were severely affected. Whilst major retailers including the two main supermarket chains were able to organise supplies to be delivered by air to Mackay or by barge to Rosslyn Bay and then

<sup>2</sup> Information provided by Mr Evan Pardon, CEO of Rockhampton Regional Council.

trucked into Rockhampton this incurred significant additional costs and many smaller retailers were unable to implement similar strategies.

In addition, the Bruce Highway and the rail line are a major transport line for rural and urban centres north of Rockhampton including Mackay, Townsville and Cairns. West of Rockhampton the Capricorn Highway is a major access route to the coal-mining and agricultural areas of the Central Highlands, Bowen and Galilee Basins. These areas were also severely affected by flooding in December 2010 and January 2011 and recovery effects were hampered by restricted access from Brisbane and the coast. Positives were that sufficient warning was provided which enabled many resident and business owners to relocate stock and possessions to higher ground and importantly no loss of life or serious injuries were recorded.

### ***3.3 Impacts on Economic Sectors***

#### **3.3.1 Agriculture**

Queensland agriculture and in particular Central Queensland agriculture were particularly badly affected by the 2010-11 floods. Estimates from the Queensland Treasury are that across the state a total of \$1 billion of value was lost (Queensland Government 2011b, 2011c). This loss is primarily due to wet weather during the 2010 wheat and sugarcane harvests plus severe flood damage to cotton crops at Emerald, Theodore and on the Darling Downs. The closure of transport routes from the northern horticulture areas also created huge losses for the fresh fruit and vegetable industries with total losses estimated at \$561 million. In Central Queensland some fresh product was able to be shifted via barge but up to 1000 hectares of pineapples was ploughed in at full loss.

#### **3.3.2 Mining**

Mining is the largest sector by gross value of production in the Fitzroy Statistical Division and it is also the sector to have suffered the highest losses as a result of the floods. Estimates are that between \$2 and \$2.5 billion dollars worth of coal was not exported between December 2010 and March 2011 as a direct result of floods (Queensland Government 2011b, 2011c). In addition many coal mines suffered inundation or water damage to coal pits, access roads and machinery. The majority of rail lines in Central Queensland were also affected with the Blackwater lines closed for over four weeks. Mining employees were unable to access their work sites for up to several weeks due to road closures and many employees also suffered the direct impacts of inundation to homes.

#### **3.3.3 Transport**

The transport sector is estimated to have suffered losses of over \$460 million (IBIS World 2011). The trucking industry suffered the greatest losses with over \$200 million in additional costs, delays and lost revenue. In Rockhampton one trucking company alone has estimated losses of up to \$3 million (Bryant 2011).

**Table 3.2 Transport sector losses in Queensland**

	Lost revenue (\$M)
<b>Overall</b>	<b>467.4</b>
Road	213.6
Rail	26
Ports	37.4
International shipping	5

Source: IBIS World (2011)

### 3.3.4 Tourism (Accommodation and Food Services)

Tourism was one of the worst affected business sectors in Central Queensland by the indirect impacts of transport closures, with occupancy rates down 50% for December and 70% for January. Given that some businesses receive up to a quarter of their annual revenue over the Christmas/New Year period this will have significant effects in the long run. Total revenue losses over this 10 day period for the Rockhampton, Capricorn Coast and Central Highlands have been estimated at almost \$3 million. The Callaghan Park racecourse in Rockhampton alone suffered a loss of \$100,000 from the cancellation of one race day.

Up to 1200 full time equivalent (FTE) staff are estimated to have been out of work during the flood period. Many of these staff work under contract or casual employment arrangements thus are not entitled to holiday pay. As a direct result of the floods all Qantas and Virgin Blue flights were cancelled between the 1<sup>st</sup> and the 24<sup>th</sup> of January. Tiger Airways cancelled all flights until the 29<sup>th</sup> of March. All Queensland Rail Sunlander and Tilt Train services were also cancelled.

These impacts were further compounded by the impression given in the media that many areas that had not in fact been impacted were also not open for business. Extensive flooding in other areas of Queensland, New South Wales and Victoria are also expected to have reduced visitor numbers from those areas as residents recovered.

Access restrictions also had a negative impact on areas north of Rockhampton including Mackay, the Whitsundays, Townsville and Cairns. These areas reported almost complete cancellation of drive and rail tourism plus significant reductions in State Government and business travel. Total losses for Queensland are estimated at \$300 million in 2010-11 (Queensland Government 2011b).

### 3.3.5 Retail

Retail is one of the largest employers in Central Queensland and was severely affected not only as a direct result of flood damage to premises and stock but also due to transport restrictions which limited access for staff, product and customers. The impacts were experienced during the summer school holiday period which is a traditionally a period of increased revenue. PriceWaterhouseCoopers estimated that up to a quarter of all Queensland businesses suffered major disruptions or full closure as a result of the floods with most of these operating at below flood levels for at least a month.

## **4. ASSESSING THE IMPACTS WITH AN ECONOMIC MODELLING APPROACH**

The closure of the transport corridors at Rockhampton had substantial impacts on many local businesses in the area. This occurred because (a) customers from outside of Rockhampton could not access businesses there, (b) businesses could not trade with customers and other businesses, particular those on the coal fields to the west, (c) businesses could not access supplies from the south, and (d) many employees were not able to access their workplace.

The economy of the Fitzroy Statistical Division and the Rockhampton LGA within it represent about 7% and 2% respectively of the Queensland economy. The regional economy is a complex structure of different economic sectors that interact with each other, export goods and services, import goods and services, and provide outputs for consumers in the region. Initial demands for goods and services are generated by primary industries such as agriculture, mining and tourism, and by the large population base. Satisfying these demands requires a variety of industry sectors, many of which purchase services and supplies from each other to produce final goods and services. Transport is an essential input to all sectors of the economy, and forms a substantial sector in its own right.

The structure of the regional economy can be depicted in a number of ways. One common approach is to show how the different sectors contribute to the overall level of production in a region. The size of the local economy can also be compared to the broader Fitzroy Statistical Division (SD) and to the Queensland economy (Table 4.1).

In the economic modelling approach, the estimates of an economic slowdown can be generated by identifying the average change in economic performance across sectors from the loss of transport access, and extrapolating this as a percentage of regional economic activity. The regional economic activity is summarised as the GRP for the Rockhampton area (Table 4.1).

Two approaches were adopted to estimate the level of slowdown in the regional economy during the flood period. The first was a survey of local businesses conducted by the regional economic development organisation towards the end of the flood period, while the second was a series of interviews with key business representatives six months later. These data collection exercises and the results are summarised in the following sub-sections.

**Table 4.1 Gross Regional Product by Industry at the Queensland, SD and LGA level**

	Rockhampton	Fitzroy SD	Queensland	Rockhampton employment
	<b>Level (\$m) 2008/09</b>	<b>Level (\$m) 2008/09</b>	<b>Level (\$m) 2007/08</b>	
Agriculture, forestry & fishing	62.6	260.1	4,739	1,220
Mining	171.0	6,033.5	18,423	1,301
Manufacturing	384.3	1,005.1	19,174	2,780
Electricity, gas, water & waste services	172.8	318.7	4,218	1,145
Construction	272.0	733.9	18,086	3,778
Wholesale trade	170.0	303.8	10,125	1,544
Retail trade	353.8	645.5	12,712	5,144
Accommodation & food services	170.8	318.1	6,835	3,274
Transport, postal & warehousing	525.8	1,074.6	14,343	2,623
Information media & telecommunications	66.1	99.8	4,792	457
Financial & insurance services	116.4	188.5	14,154	890
Rental, hiring & real estate services	120.0	235.8	7,715	758
Professional, scientific & technical services	111.8	246.1	11,107	1,466
Administrative & support services	70.9	151.1	4,949	1,013
Public administration & safety	281.4	462.1	11,943	2,947
Education & training	227.3	377.7	8,758	4,441
Health care & social assistance	353.5	534.0	12,894	5,019
Arts & recreation services	36.1	54.7	1,446	365
Other services	140.1	260.0	4,561	1,802
Inadequately described/Not stated	41.8	99.1		
<i>Total Industry Factor Income</i>	<i>3,848.5</i>	<i>13,402.0</i>	<i>190,974</i>	
<i>Total Employment</i>				<i>41,567</i>
Ownership of dwellings	355.4	1,237.7	16,461	
<b>GRP at Factor Cost / Total Factor Income (\$m)</b>	<b>4,204.0</b>	<b>14,639.7</b>	<b>207,435</b>	
Taxes less subsidies on production and imports	296.9	1,034.0	16,015	
Statistical discrepancy (I)	86.8	302.1	0	
<b>Gross Regional Product (\$m)</b>	<b>4,587.6</b>	<b>15,975.8</b>	<b>223,450</b>	

Note: GRP models reported in Rolfe (2011)

#### **4.1 Survey of local businesses**

A survey of 138 local businesses conducted by Capricorn Enterprise during the flood period in January 2011 identified that 27.5% did not think they were affected by the flood, while the remainder were. Key reasons for not being affected were that January was a slow time, or a period when they were normally closed. In contrast, many of the businesses that identified as being affected indicated that they were incurring substantial costs. Some businesses, particularly in the accommodation sector, lost 90-100% of their business over the period. Others reported having staff away unable to get to work, lack of access to supplies, some water in their premises, or closing their business as a precaution against the flood getting higher.

Accommodation businesses, particularly those servicing the tourism market, appeared to be the most affected. Average vacancy rates were reported at 28%, down on an estimated 83% at the same time the previous year. Some of the larger businesses had lost more than \$100,000 in trade, while higher losses in revenue were reported from businesses in other sectors such as transport. Across 45 businesses that gave an indication of the proportional downturn in business conditions, 60% indicated that there was no major effect on their business turnover. The average downturn in business turnover across all businesses was 22% (18% when tourism businesses were excluded).

#### ***4.2 Interviews with key business representatives***

In surveys carried out six months after the January 2011 flood event, businesses in the Rockhampton region reported significant losses caused by transport corridor closures. Six businesses were surveyed by telephone, representing the retail, tourism, freight and services sectors. Estimates of lost sales during the floods, due exclusively to closures of transport corridors as opposed to other effects of flooding, varied up to \$2.8 million in lost sales; \$1.8 million in lost revenue; \$500,000 in lost profit; and 86% of lost business (results listed are for three of the businesses that were surveyed). A major regional shopping centre recorded a loss of 15.7% for January 2011 compared to the same time period during 2010, attributable to the transport closures. Some retailers reportedly experienced continuing supply shortages for up to three months following the floods.

For smaller, family owned businesses, lost sales were not as high as for larger companies, but were potentially equally detrimental when considered to scale. For businesses in the tourism sector the floods coincided with the peak season for visitations, that is the Christmas / New Year period and January school holidays. The timing of the floods over the holiday season is also likely to have had an effect on retailers who lost both local trade and that of visiting travellers. All the businesses surveyed reported that most or all trade was unable to be recouped after the floods had passed, although one retail centre reported higher than normal trading during over Easter, the next major holiday period. While January losses were not fully recouped, the increased Easter trade may have been linked to the inability of consumers from outside of Rockhampton to enter the city during the January holiday period.

Those businesses with staff who were unable to get to work covered the loss without hiring additional staff. One business reported putting 50% of staff on holidays for the duration of floods, while another retained staff who were able to get to work, but carried out alternative duties during that time (e.g. refitting, maintenance tasks). Many specialty retail stores reportedly had to close during the floods due to staffing issues, and most retail stores experienced reduced trading hours. Lost staff due to transport closures were explained by both localised flood effects (e.g. staff who worked in Gracemere were unable to get to work in Rockhampton), and more widespread effects (e.g. staff who travelled south for holidays were unable to return home). Staff movements were also affected, with housing issues experienced by new staff travelling to the region to begin work in early 2011.

In all cases, lost trade was accounted for by customers being unable to access the business and an inability to have supplies delivered to the business. For some retailers the necessity to access alternative transport routes to source supplies was an additional business cost. One business also commented on increased costs to their customers of the floods, for example through the need to utilise alternative transport routes to the west to get in and out of

Rockhampton. A business in the tourism sector considered that the perception that Queensland was still flood-affected persisted and impacted on sales until as late as mid-2011. In addition to the effects of road, rail and air closures, one business surveyed cited flood damage to property to the value of \$400,000, and another reported that \$60,000 worth of infrastructure had to be replaced. Some local retailers had stock in warehouses in southern Queensland that was damaged by the flooding in that region.

### ***4.3 Assessing the downturn across the regional area***

The downturn in business conditions occurred over the first two weeks in January when road access to the south and west was cut. The interviews with key business people in Rockhampton identified that business conditions did not pick up directly after the floods abated and roads opened, indicating that the loss in business activity was permanent. This is consistent with the broader Queensland economy.

To estimate the impacts of the road closure on the economy, the estimated downturn in business conditions (18.6% decline) is extrapolated to the Gross Regional Product at Factor Cost (industry factor income) of the Rockhampton region (Table 4.1) for the period of the road and airport closures (averaged to 18 days). This generates an expected reduction in total production in the Rockhampton economy over that period of \$35 million, or about 0.77% of gross regional product over a year.

## **5. ASSESSING THE IMPACTS WITH VALUE OF TRAVEL TIME APPROACH**

### ***5.1 Identification***

The Central Queensland region suffered substantial economic and social impacts from the 2010-2011 flood events, with losses to property, infrastructure, crops and livestock, and substantial impacts on the production and transport of coal from mines in the Bowen Basin. The loss of export earnings from coal had the largest economic impact at both the regional and state level.

The interruptions to transport services at Rockhampton with the closure of the road network to the west and south for two weeks, and the airport for three weeks, generated a subset of direct impacts on the Rockhampton and state economy. The most important of these impacts can be summarised as follows:

- Workforce interruptions
- Employees to the west not able to access Rockhampton
- Employees in Rockhampton and Capricorn Coast not able to access the west and south
- Employees elsewhere not able to move north-south through Rockhampton
- Customer interruptions
- Customers to the west and south not able to access by road
- Customers and tourists not able to access by air
- Service users to the west and south not able to access
- Supplier interruptions
- Business suppliers in Rockhampton not able to service outside businesses
- Businesses in Rockhampton not able to source supplies
- Businesses in north Queensland experienced substantial interruptions to supply lines
- Business and contractor interruptions
- Businesses, professionals and service users not able to travel by air
- Businesses and contractors not able to travel to Gladstone and Bowen Basin.

### ***5.2 Assessment of road closure impacts on transport movements***

Information about the size of the transport flows have been summarized in AECOM (2010) and CTEDL (2010). Average daily traffic flows on the main highways into Rockhampton are in Table 5.1 (CTEDL 2010).

**Table 5.1 Average annual daily traffic counts on key highways around Rockhampton, 2009**

Highway and location	Average annual daily traffic (all directions)
Bruce Highway (south of Rockhampton, 1 km north of Scrubby Creek)	7,476
Bruce Highway (north of Rockhampton, 150 m north of Terra Nova Drive)	7,372
Capricorn Highway, 3 km west of Gracemere	4,790
Emu Park Road, old shire council boundary	4,872
Yeppoon Road, Iron Pot Creek road	10,180

Source: CTEDL (2010: 50)

The Capricorn Highway to the west has the highest proportion of heavy vehicles (20.8%), followed by the Bruce Highway to the south (17.4%) and the Bruce Highway to the north (14.6%). In contrast, the highways to the coast service mainly passenger traffic, with heavy vehicles only contributing 8.6% of traffic on the Emu Park road and 6.2% on the Yeppoon Road (CTEDL 2010).

Data from the Department of Transport and Main Roads identifies that the average daily volume of traffic on the Bruce Highway to the south (at Widgee) in the first two weeks of January 2010 was 4,952 light vehicles and 987 heavy vehicles. Comparison to the traffic count at Scrubby Creek (Table 5.1) indicates that approximately 1,500 vehicles are using the Mt Morgan road each day.

AECOM (2010) estimate daily volumes of through traffic in Rockhampton (passing through in less than two hours) as:

- North-south Bruce Highway = 550 vehicles
- South-north Bruce Highway = 430 vehicles
- West-north Capricorn to Bruce Highway = 290 vehicles
- North-west Bruce to Capricorn Highway = 180 vehicles.

A similar analysis has been performed to identify the traffic travelling through Rockhampton on the Yeppoon road (passing through in less than two hours). The volumes are estimated as:

- East-west Yeppoon Road to Capricorn Highway = 195 vehicles
- East-south Yeppoon Road to southern Bruce Highway = 205 vehicles
- West-east Capricorn Highway to Yeppoon Road = 160 vehicles
- South-west Bruce Highway to Yeppoon Road = 330 vehicles.

This analysis identifies that the ‘through’ traffic from the south and west that is subject to loss of highway access in times of flood is approximately 2,340 vehicles. Of this, 72.37% of the north-south through traffic is estimated to be passenger vehicles and the remainder are freight vehicles. This is only a proportion of traffic in Rockhampton, as there is substantial other traffic that accesses the city from the south and west.

The volume of traffic flows that could be affected by road closures to the south and west of Rockhampton have been assessed for both passenger and freight vehicles in three separate groups. The first are vehicles travelling through Rockhampton, either on the Bruce Highway, or from the Capricorn to the Bruce Highway to the north (it is assumed that access between

the Capricorn Highway and the Bruce Highway to the south remained open). As this group of vehicles only transit through Rockhampton, it can be assumed that the impacts will occur elsewhere in the Queensland economy.

In the second group are the restrictions on vehicle movements to and from the Capricorn Coast, either from the Bruce Highway to the south or the Capricorn Highway to the west. In this case it has been assumed that the impacts will be to the local economy because the Capricorn Coast is within the jurisdiction of Rockhampton Regional Council. In the third group are the restrictions on access from Rockhampton to the south (particularly Gladstone and Mt Morgan) and west (particularly Gracemere). Estimates of daily vehicle movements and the proportion of heavy vehicles have been sourced from AECOM (2010), CTEDL (2010) and the Queensland Department of Transport and Main Roads.

**Table 5.2 Estimates of vehicle movements affected by flood road closure**

	Total vehicles	% heavy vehicles	Passenger vehicles	Heavy vehicles
<b>Group 1: Through traffic, non-Rockhampton economy</b>				
North-south Bruce Highway	550	27.6	398	152
South-north Bruce Highway	430	27.6	311	119
West-north Capricorn to Bruce Hwy	290	20.4	231	59
North-west Bruce to Capricorn Hwy	180	14.6	154	26
Sub-total	1450		1094	356
<b>Group 2: Through traffic, Rockhampton economy</b>				
East-west Yeppoon Rd to Capricorn Hwy	195	6.2	183	12
East-south Yeppoon Rd to Bruce Hwy	205	6.2	193	13
West-east Capricorn Hwy to Yeppoon Rd	160	6.2	150	10
South-west Bruce Hwy to Yeppoon Rd	330	16.9	274	56
Sub-total	890		800	91
<b>Group 3: Local Traffic, Rockhampton economy</b>				
Bruce Highway south	5,961	17.4	4,924	1037
Capricorn Highway to west	3,965	20.8	3,140	825
Sub-total	9,926		8,064	1862

### **5.3 Assessment of direct losses from road closure at Rockhampton**

The estimates of impacts on vehicle movements from the road closure have been valued by applying the rates of travel time costs reported in Austroads (1997, 2003, 2011), with results summarised in Table 5.2. Key assumptions in performing the analysis are detailed as follows:

The hours of delay have been assessed as an average of 72 hours for all north-south through traffic. This allows for the fact that some traffic was able to be diverted through western Queensland, and that opportunity costs are not strictly linear over time. For the east-west traffic, the hours of delay have been assessed as an average of 24 hours for all north-south through traffic. This allows for the fact that some traffic was able to be diverted to the north (through Mackay), and that opportunity costs are not strictly linear over time. For local traffic, an average of 8 hours of delay per day has been used to reflect the fact that many people were not able to access work.

The value of travel time has been made on the basis that all freight vehicles are on business time (\$36.76/hour), and that passenger vehicles are 50% business time (\$36.76/hour) and 50% non-business time (\$11.49/hour). It is assumed that there is only one passenger per vehicle.

The value of truck time has been assessed at \$1.50 per pallet per hour, with 50% 'A' and 'B' vehicles on through trips, and 100% 'A' vehicles on local trips. It is estimated<sup>3</sup> that the profile of trucks travelling through Rockhampton is 50% singles and 50% B Doubles, with approximately 85% travelling loaded. Loaded capacity is estimated at 85% for through trips (assumes most trucks are backloaded) and 50% for local trips (assumes no backloading).

The results indicate that the cost to the state economy from the loss of through traffic is approximately \$3.34 Million per day, with many of these losses expected to be directed to north Queensland. The costs to the Rockhampton economy are approximately \$0.59 million per day for the loss of the through traffic to the Capricorn Coast, and \$1.42 million per day for the closure of southern and western access to local traffic. Total costs from the loss of road transport at Rockhampton are estimated to be approximately \$5.41 million per day.

These losses are sensitive to the assumptions about the lost travel time involved. The time factors (72, 24 and 8 hours) are based on approximate estimates of trip delays for the different groups. If only missed travel time is considered (instead of time delays), then estimates will be reduced by about a factor of three. This would reduce the cost estimates for the road closure to approximately \$1.8 million per day.

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<sup>3</sup> John Bryant, Rocky's Own Transport, personal comment.

**Table 5.3 Value of lost traffic access from flood road closure**

	Passenger vehicles	Freight vehicles
<b>Through traffic, non-Rockhampton economy</b>		
Number	1093.8	356.2
Hours of delay	72	72
Value of time lost/person/hour	\$24.13	\$36.76
Value of truck time lost per hour		\$1,560.60
Total losses per day	\$1,899,906	\$1,498,706
<b>Through traffic, Rockhampton economy</b>		
Number	799.5	90.5
Hours of delay	24	24
Value of time lost/person/hour	\$24.13	\$36.76
Value of truck time lost per hour		\$520.20
Total losses per day	\$462,888	\$126,976
<b>Local Traffic, Rockhampton economy</b>		
Number	8064.1	1861.9
Hours of delay	8	8
Value of time lost/person/hour	\$24.13	\$36.76
Value of truck time lost per hour		\$72.00
Total losses per day	\$370,624	\$407,838

#### **5.4 Assessment of airport closure on passenger and freight movements**

The Rockhampton Regional Council (2011) predicted that in 2010-11, there would be a total of 730,000 passenger movements and 283,000 landed tonnes of freight. At a daily rate, the corresponding estimates are 2,000 passengers and 775 tonnes of freight. When the net effects of return flights are considered, this can be summarised as 1,000 passengers and 775 tonnes of freight travelling each day.

#### **5.5 Assessment of direct losses from airport closure at Rockhampton**

A similar process has been used to estimate the value of travel time costs for passengers and freight that was not able to be serviced through the Rockhampton airport. The loss of travel time has been assessed at 8 hours per passenger (loss of one working day) and 5 hours per tonne of cargo (alternative time to truck south from Mackay airport). The rate of travel time has been assessed at the business hourly rate for both passengers and cargo. Results show that the daily losses from the closure of the airport are approximately \$588,048 (Table 5.4).

**Table 5.4 Daily value of lost airport access from Rockhampton Flood Closure**

	Passengers	Freight (tonnes)
Number	1000	775.3
Hours of delay	8	5
Value of time lost/person/hour	\$58	\$32
Total losses per day	\$464,000	\$124,048
Total losses over closure period (23 days)	\$10,672,000	\$2,853,104

## **6. OTHER DIRECT, INDIRECT AND STRATEGIC EFFECTS**

There are a range of other direct, indirect and strategic effects that have been generated by the floods and associated closure of the transport links at Rockhampton. These are reviewed in the following sections.

### ***6.1 Direct costs on roads, infrastructure and services***

The direct costs of the floods in Rockhampton were largely caused by impacts on roads, with some additional impacts on other infrastructure and private housing. Estimates from the Rockhampton Regional Council are that total road damage of \$56 million occurred in the shire. A further \$0.9 million in damages occurred to the Rockhampton airport. In operational terms, the counter disaster costs of managing the flood response and highway closures at Rockhampton was approximately \$1.5 million, while the Council lost a further \$0.6 million in direct revenue because of the airport closure<sup>4</sup>.

### ***6.2 Indirect costs on roads infrastructure – the increased burden on western transport links***

A key indirect impact of the closure of the Bruce Highway at Rockhampton was the increase in vehicle traffic through western roads as people tried to find alternative routes between southern and northern Queensland. This generated some damage to western roads, with a large increase in heavy vehicle movements at the same time that roads were wet and partially damaged after the rain and floods. Some estimates of the level of increased traffic and potential road damage are presented in this section.

Data on traffic movements on western roads for the first 14 days in both January 2010 and January 2011 has been provided by the Queensland Department of Transport and Main Roads. The data for 2011 matches the period where the Bruce Highway was closed at Rockhampton. The results for heavy vehicle movements are summarised in Table 6.1 and Figure 6.1, showing that movements increased by an average 3.7 times in 2011 (significant difference at the 1% level).

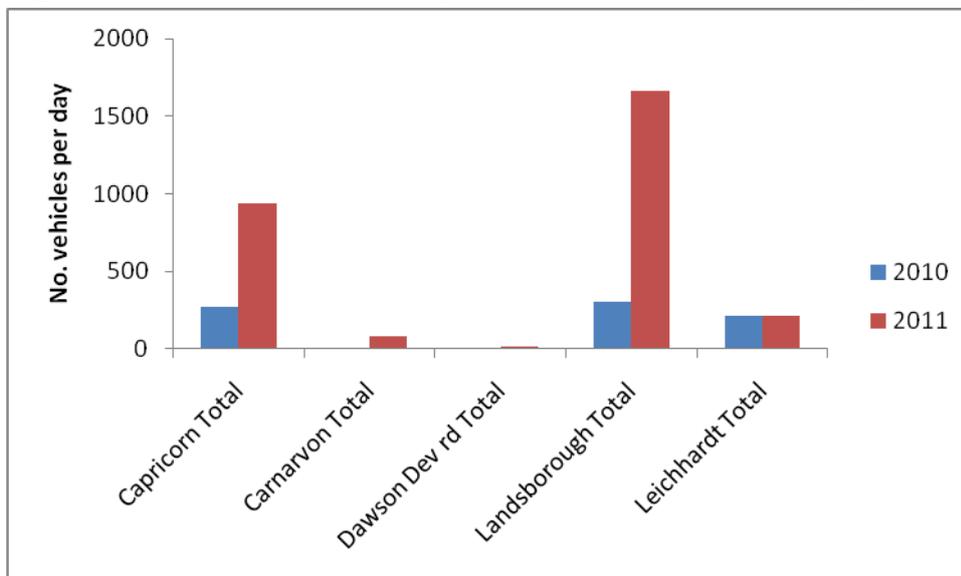
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<sup>4</sup> Information provided by Mr Evan Pardon, CEO of Rockhampton Regional Council.

**Table 6.1 Western Roads Heavy Vehicle Movements: January 2010 and 2011**

Highway	Average daily traffic volume	
	1-13 January-2010	1-13 January-2011
Capricorn	270	935
Carnarvon	0	80
Dawson Dev Road	1	10
Landsborough	304	1,665
Leichhardt	213	210
<b>Total</b>	<b>788</b>	<b>2,900</b>

**Figure 6.1 Western Roads Heavy Vehicle Movements: January 2010 and 2011**

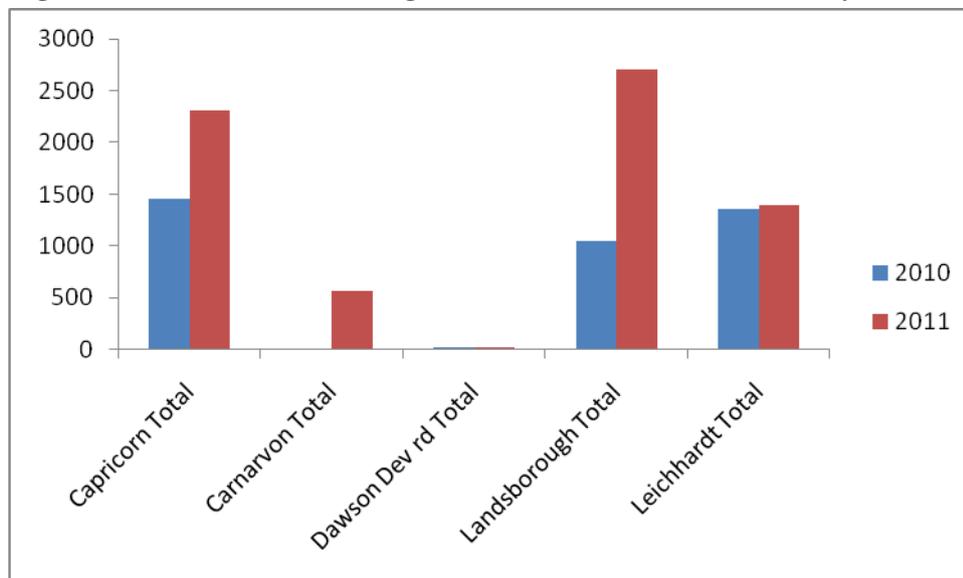


The results for light vehicle movements are summarised in Table 6.2 and Figure 6.2, showing that movements increased by an average 1.8 times in 2011 (significant difference at the 1% level). These results demonstrate that while there were increases in both classes of vehicles, the proportionally largest increase in traffic was in heavy vehicles.

**Table 6.2 Western Roads Light Vehicle Movements: January 2010 and 2011**

Highway	Average daily traffic volume	
	1-13 January-2010	1-13 January-2011
Capricorn	1,458	2,310
Carnarvon	0	564
Dawson Dev Road	18	25
Landsborough	1,053	2,708
Leichhardt	1,360	1,396
<b>Total</b>	<b>3,889</b>	<b>7,003</b>

**Figure 6.2 Western Roads Light Vehicle Movements: January 2010 and 2011**



Given the increase in road traffic that was generated by the closure of the Bruce Highway, a key question is to determine the extent of road damage. Some estimates of the estimated cost of road damage has been provided by the Queensland Government (2011c) in the budget papers. These estimates (Table 6.3) show that western Queensland suffered the most road damage in the state, accounting for slightly more than 25% of the total damage in the state. Some of this damage is expected to be a consequence of the increase in traffic (particularly heavy vehicles) at a time when roads were soft and had many damaged areas.

**Table 6.3 QLD State Budget Flood repair costs for QLD roads**

Budgeted road repair costs	\$m
Far North Queensland	\$49
Fitzroy	\$93
North Queensland	\$27
Mackay-Whitsunday	\$163
Darling Downs	\$96
Western Queensland	\$167
South-east Queensland	\$202
TOTAL	\$796

Source: Queensland Government (2011a)

### **6.4 Strategic effects**

There are several strategic issues that may also contribute to costs in the short and long term. A key cost is that the lack of transport access would have restricted abilities to service key industry sectors, particularly the coal mining sector in the Bowen Basin and the transport corridors through to Gladstone. Heavy rain and flooding caused major impacts on the coal mines and associated rail corridors, and the lack of access to Rockhampton and personnel would have hindered management and repair efforts.

A strategic issue is that the flooding at Rockhampton generated widespread publicity at both national and international levels, making people more aware of the city and the region. While there are benefits in generating awareness, there may also be offsetting negative impacts if future tourists, businesses, investors and residents perceive Rockhampton as a risky place to visit, operate, invest or reside because it is associated with flooding and lack of access.

## **7. CONCLUSIONS**

The focus of this study is on the economic costs of transport corridor closures at Rockhampton in January 2011. Two approaches have been used to assess the economic impacts of the road closures. The first is to model the proportional downturn in the regional economy, using data from surveys and interviews with local businesses to assess the proportional drop in business activity over the period. The second has been to apply the travel cost savings methodology used to assess the costs and benefits of transport options in Australia. The estimates of travel values for both passenger and freight vehicles used in the Austroads (2011) methodology has been applied in this study.

The modelling of changes to economic activity indicate that the change in economic activity over the period of transport closures in early January account for about \$35 million in lost productive activity, or about 0.77% of the regional economy. This is consistent with economic impacts at the state level. Total impacts on the local economy are likely to be larger, as it is taking some time for confidence to build again and recovery to occur.

Assessing costs through the value of lost travel time approach indicates that the cost to the state economy from the loss of through traffic is approximately \$3.34 million per day, with many of these losses expected to be directed to north Queensland. The costs to the Rockhampton economy are approximately \$0.59 million per day for the loss of the through traffic to the Capricorn Coast, and \$1.42 million per day for the closure of southern and western access to local traffic. Total costs from the loss of road transport at Rockhampton are estimated to be approximately \$4.77 million per day.

The results relating to the closure of the Rockhampton airport indicate that the cost to the Rockhampton and state economy of lost travel and diverted freight opportunities were approximately \$588,000 per day.

With the road corridor closed for two weeks and the airport for three weeks, the total direct costs to the Queensland economy can be assessed at \$66.7 million for the road closure, and \$13.5 million for the airport closure. Approximately \$47.5 million were due to the road closure limiting access between southern and northern Queensland, while the remainder were impacts to Rockhampton because of the local losses to road and airport transport.

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## **APPENDIX 1. ROCKHAMPTON REGIONAL PROFILE**

### ***A.1 Population in the Rockhampton area***

The Rockhampton Regional Council area has a population of approximately 115,000 people (Office of Economic and Statistical Research 2011). Over half the population reside in the city of Rockhampton with a further 21,000 residents living on the Capricorn Coast. The remainder of the population are spread between the towns of Gracemere, Mt Morgan, Bouldercombe and rural areas. The population grew by 13.5% (13,303 people) in the seven years between 2001 and 2008. This is slower than the growth rate of 18.7% in the Queensland population over the same period (3.62 million people in 2000-01 to 4.31 million people in 2007-08).

Projections of population growth from the Office of Economic and Statistical Research indicate that the Rockhampton LGA may have a resident population of 153,250 by 2031, with a low estimate of 142,071 people, and a high estimate of 164,745 people. These estimates indicate that the Rockhampton LGA could experience population growth of 21.5% (low projection), 27.2% (medium projection), or 32.3% (high projection) between 2008 and 2031. In comparison, the projected growth rates for Queensland are higher, with projected increases from 2006 to 2031 of 41.1% (low projection), 53.3% (medium projection) and 71.4% (high projection) respectively (DIP 2008).

### ***A.2 Population in the larger catchment area***

Rockhampton is an important business centre for the regions to the west of Rockhampton (Central Highlands LGA and Central West Statistical Division). It also services a proportion of service needs for populations to the north-west (Isaac LGA), south (Gladstone LGA), and south-west (Banana LGA). In 2011, the Rockhampton LGA has been estimated the Office of Economic and Statistical Research data to have approximately 63% of the regional population of 190,000 people in central and western Queensland, excluding Gladstone to the south and Mackay to the north.

### ***A.3 Gross Regional Product and contribution of industry sectors***

The economy of the Fitzroy Statistical Division and the Rockhampton LGA within it were about 7% and 2% respectively of the Queensland economy. The regional economy is a complex structure of different economic sectors that interact with each other, export goods and services, import goods and services, and provide outputs for consumers in the region. Initial demands for goods and services are generated by primary industries such as agriculture, mining and tourism, and by the large population base. Satisfying these demands requires a variety of industry sectors, many of which purchase services and supplies from each other to produce final goods and services. Transport is an essential input to all sectors of the economy, and forms a substantial sector in its own right.

The structure of the regional economy can be depicted in a number of ways. One common approach is to show how the different sectors contribute to the overall level of production in a region. The size of the local economy can also be compared to the broader Fitzroy Statistical Division (SD) and to the Queensland economy (Table 3.1).

**Table A.1 Gross Regional Product by Industry at the Queensland, SD and LGA level**

	Rockhampton	Fitzroy SD	Queensland	Rockhampton employment
	<b>Level (\$m) 2008/09</b>	<b>Level (\$m) 2008/09</b>	<b>Level (\$m) 2007/08</b>	
Agriculture, forestry & fishing	62.6	260.1	4,739	1,220
Mining	171.0	6,033.5	18,423	1,301
Manufacturing	384.3	1,005.1	19,174	2,780
Electricity, gas, water & waste services	172.8	318.7	4,218	1,145
Construction	272.0	733.9	18,086	3,778
Wholesale trade	170.0	303.8	10,125	1,544
Retail trade	353.8	645.5	12,712	5,144
Accommodation & food services	170.8	318.1	6,835	3,274
Transport, postal & warehousing	525.8	1,074.6	14,343	2,623
Information media & telecommunications	66.1	99.8	4,792	457
Financial & insurance services	116.4	188.5	14,154	890
Rental, hiring & real estate services	120.0	235.8	7,715	758
Professional, scientific & technical services	111.8	246.1	11,107	1,466
Administrative & support services	70.9	151.1	4,949	1,013
Public administration & safety	281.4	462.1	11,943	2,947
Education & training	227.3	377.7	8,758	4,441
Health care & social assistance	353.5	534.0	12,894	5,019
Arts & recreation services	36.1	54.7	1,446	365
Other services	140.1	260.0	4,561	1,802
Inadequately described/Not stated	41.8	99.1		
<i>Total Industry Factor Income</i>	<i>3,848.5</i>	<i>13,402.0</i>	<i>190,974</i>	
<i>Total Employment</i>				<i>41,567</i>
Ownership of dwellings	355.4	1,237.7	16,461	
<b>GRP at Factor Cost / Total Factor Income (\$m)</b>	<b>4,204.0</b>	<b>14,639.7</b>	<b>207,435</b>	
Taxes less subsidies on production and imports	296.9	1,034.0	16,015	
Statistical discrepancy (I)	86.8	302.1	0	
<b>Gross Regional Product (\$m)</b>	<b>4,587.6</b>	<b>15,975.8</b>	<b>223,450</b>	

Note: GRP models reported in Rolfe (2011)

The results demonstrate that while the Rockhampton LGA has a lower share of primary production and mining sectors, it dominates in many of the service and retail areas. The largest sector in the local economy is Transport, Postal and Warehousing, which is likely to be driven by the size of the railway sector in Rockhampton.

Another way of demonstrating the relative importance of different sectors is to identify the employment by industry (Table A.1). The summary results show that employment in Rockhampton is largely focused on commercial services and Government and social services, with a lower reliance on secondary industry (largely meatworks and minerals processing).

#### **A.4 The development of the resources sector**

The resources sector in Queensland has been growing rapidly since 2002, fuelled by international demand for minerals and energy. Rolfe et al. (2011) summarised the

contribution of the resources sector for each LGA in Queensland. Economic modelling was used to identify the direct contribution of the resources sector, as well as indirect contributions through business chain and consumption effects. The results show that the sector, which incorporates mining, gas, minerals processing and energy generation, underpins an important sector of the Rockhampton economy.

The employment effects from the resources sector for the Rockhampton LGA were estimated by Rolfe et al. (2011) as:

- Direct jobs in the resources sector: 1,465
- Indirect jobs in the business supply chain: 2,056
- Consumption jobs to service the additional population: 3,114

The results show that the resources sector underpins about 6,600 jobs in the Rockhampton economy, or approximately 12 – 16% of the employment base (depending on modelling about total employment in the region).

The high incomes paid to employees in the resources sector, and the large levels of turnover through the business chain, have an important stimulus on the local economy. Rolfe et al. (2011) estimated that there were \$190 million in direct salary payments to resource sector employees in the Rockhampton region in 2009-10. Other income through additional salaries and profits generated through the multiplier effects amounted to \$278 million. The total contribution to Gross Regional Product (including higher incomes and the effects on the business supply chain) was estimated at \$1,160 million, or approximately 26% of the regional economy. For every one job created in the region, estimated employment multipliers of about 4.5 mean that an additional 3.5 jobs are created. This compares to estimated employment multipliers in the Queensland economy from the resources sector of approximately 6.8, suggesting that for every initial job created in the state, a further 5.8 jobs are created through multiplier effects.

These results suggest that the resources sector is becoming very important in underpinning the Rockhampton economy. The influence of the resources sector is generated in a number of ways, including:

- Local employment in power generating, cement and minerals processing
- Employment and contractor base for mining in the Bowen basin and minerals processing in Gladstone
- Business supply chain base for mining in the Bowen basin and minerals processing in Gladstone
- Consumption and services base for additional population generated by the resources sector in the Fitzroy Statistical Division.

As many of these functions involve travel between the Rockhampton region and the resource areas, the interruptions to transport corridors had major impacts on the links between the Rockhampton economy and the resources sector.

### ***A.5 Sectors underpinning the local economy***

The economy of the Rockhampton region is underpinned by several key drivers. These can be summarised as follows:

- A service centre for the population at the local and regional level, particularly in terms of Commercial services and Government and social services

- A service centre for the three key primary industries of Agriculture, Mining and Tourism at the regional level
- A service centre for secondary industries of Manufacturing, Utilities and Construction, largely at the sub-regional level.

### ***A.6 Transport needs in the Rockhampton Regional Economy***

Transport is essential to every industry sector and service needs in the Rockhampton regional economy. Road is the dominant transport option for people and goods, with a mixture of road and rail being used for commodities and bulk goods. There is also increasing use of air transport, with approximately three quarters of a million passengers passing through the Rockhampton airport each year (CTEDL 2010).

Here, the most important transport flows are identified (not necessarily in order of importance):

- Transport within Rockhampton for people to access work, goods and services, and social needs
- Transport from the Capricorn Coast, Gracemere and other surrounding areas into Rockhampton for people to access work, goods and services, and social needs
- Transport from more distant southern, western and northern areas for people and businesses to access goods and services and social needs in Rockhampton
- Transport for both domestic and international tourists to access Rockhampton, the Capricorn Coast and other recreation centres in the area.
- Transport between southern Queensland and northern Queensland, with consequential services provided by the Rockhampton economy
- Transport for people and business contractors in the Rockhampton area to access work and business opportunities in the Bowen Basin and other communities to the west and north
- Transport for people and business contractors in the Rockhampton area to access work and business opportunities in Gladstone and other communities to the south
- Transport for agricultural products for sale or processing (largely cattle to the Gracemere saleyards and the abattoirs)
- Transport for minerals, energy and other raw materials for the manufacturing industry (largely magnesite being trucked from Marlborough to north Rockhampton).

Estimates of visitor numbers to the Rockhampton region have been provided by CTEDL (2010). This indicates that 73,989 international visitors and 568,228 domestic visitors came to the Rockhampton area in 2009, and stayed one or more nights. The international visitors are classified as tourists (data has been sourced from Tourism Research Australia), while 40.8% of the domestic visitors were identified as visiting for tourism or recreation purposes.

Access by road is the dominant mechanism for visitors to come to the Rockhampton region. There are also substantial numbers of people travelling by rail and air, including local residents, domestic visitors and international visitors. In 2008-09, there were 36,610 arrivals by train in Rockhampton, and approximately 364,250 arrivals by air (half of total passenger movements). When multiple individual trips are considered, the actual number of people travelling would be lower.