Transport and the Economy

Prepared for
East West Transport Link Team

Final Report

March 2008

For information on this document, please contact:

Anthony Ockwell and Lars Rognlien

Suite 8, 88-96 Bunda Street, Canberra ACT 2601 Australia
TEL +61 02 6230 4077; FAX: +61 02 6262 9993
Email: anthony@meyrick.com.au
Mobile: 0418 438 783

Meyrick Reference: 11183

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EXECUTIVE SUMMARY

Transport occupies a central role in the Australian economy. It connects employees with places of work, people with leisure activities, resources with centres of production, and products with markets and consumers. In this way transport is an enabler of economic and social activity and supporting economic growth and development. In 2004–05 alone, the transport distribution and logistics (TDL) sector in Victoria was estimated to have contributed about $21 billion to Gross State Product (GSP), or 8.9% of GSP (ABS 2005). The TDL sector employs about 238,000 people, or 6% of total employment in Victoria.

This sector is supported by a number of key transport infrastructure elements which operate as international 'economic gateways'. These economic gateways include the Victorian ports of Melbourne, Geelong, Hastings and Portland and Melbourne's International Airport at Tullamarine. The economic value of the ports to Victoria has been estimated at $3 billion per annum and the airport at over half a billion dollars per annum (see Appendix 1).

There is a direct correlation between growth in income, as measured by GSP, and growth in the demand for passenger and freight transport. Population is another key driver in the demand for transport services. In its State budget for 2007–08, the Victorian Department of Treasury and Finance (Victorian Government 2007) forecast growth in GSP at an average of 3% per annum for the period 2007–08 to 2010–11, and employment growth at an average of 1.25% a year. Further, Victoria's population is forecast to increase from 4.8 million in 2001 to 6.2 million in June 2031 and 6.6 million in 2051. The majority of this increase in population is expected to occur in Melbourne, increasing the population of Melbourne from 3.4 million in 2001 to 4.5 million in 2031. Together, these factors will continue to drive an increase in the demand for transport, which will place greater pressure on the supply and management of transport infrastructure.

The passenger task for Melbourne doubled over the period from 27 billion passenger-kilometres in 1977 to 54 billion passenger-kilometres in 2004, and is forecast to increase by a further 33% from 2005 to 2020 (BTRE 2007). Until recently, public transport accounted for about 8% of the share of the passenger task (BTRE 2007), although the ABS 2006 Journey to Work data have indicated growing public transport demand over the past year or so (ABS 2007). Some of this increase may be attributable to higher petrol prices. Similarly, the road freight task for Melbourne increased from 2.83 billion tonne-kilometres in 1977 to 10.58 billion tonne-kilometres in 2004, and is forecast to increase by 54% from 11 billion tonne-kilometres in 2005 to 16.92 billion tonne-kilometres in 2020. This represents an average annual growth rate of about 3% (BTRE 2007).

This forecast increase in the demand for passenger and freight transport in Melbourne reflects a vibrant and strong economy, with the broader economic and political fundamentals in place that are conducive to continued investment and growth. This presents a challenge for policy makers in managing the demand for transport in a way that enables, rather than constrains growth. Since transport demand derives from economic growth, which in itself is driven primarily by income and population, an ongoing concern is the appropriate level of investment in transport infrastructure required for transport to play the role of enabler in an efficient and cost-effective manner. At the same time, balance needs to be struck between the provision/management of infrastructure and other Government objectives, such as safety, environment, security, accessibility and the amenity of our cities. The question that then emerges is the extent to which the supply of transport infrastructure lags the demand for transport services and therefore acts as a constraint to economic growth.

Transport can only ever help enable growth that is driven by other factors. The UK Eddington Study (Eddington 2006) summarised additional conditions for transport to have an impact on an economy's performance:

- Economic conditions: There needs to be macroeconomic stability, positive externalities (agglomeration economies, labour market economies), a buoyant economy as well as availability of labour of the right skills and, where relevant, land;
- Political and institutional conditions: A broader policy environment conducive to investment, supporting legal processes, supporting policies and efficient management of existing infrastructure is required; and
- Investment conditions: There needs to be macroeconomic stability, well functioning capital markets and availability of capital, timing, structure and location of investment.

Economic Conditions

- The Australian economy has sustained a long period of economic stability, and current forecasts suggest a sustained rate of growth at around 4% (Australian Government 2007a). Inflation in Australia continues around 3% and the unemployment rate is low at 4% and forecast to rise only slightly. This would seem to support the first of Eddington's conditions.

Political and Institutional Conditions

- Australia has the lowest level of political instability in the Asia–Pacific region and the fourth lowest in the world (Australian Government 2007a). Since the late 1970s, the Australian economy has been supported by a continuing program of micro-economic reform of the financial, manufacturing and service sectors, as well as the labour market. This would appear to support the second of Eddington's conditions.

Investment conditions

- The current investment conditions are enhanced by strong economic prospects and a stable political environment. The long term economic and political stability of the Australian economy provides an economic climate conducive to both domestic and international investors. This would appear to support the third of Eddington's conditions.

This paper demonstrates that the underlying economic growth in Victoria, Australia and several of its main trading partners is strong. Long term trends also confirm the maturity and stability of the Australian economy. These trends, together with the analysis of the Australian and Victorian economies presented in Chapters 2, indicate that all three of the above conditions are met for Australia, in which case investment in transport infrastructure to improve transport efficiency should have a positive impact on economic growth (assuming no capital rationing).

The impacts of Business As Usual

The BTRE has forecast the annual cost of congestion for Melbourne to increase from $3.02 billion in 2005 to $6.12 billion in 2020 (BTRE 2007). The annual cost to business in terms of trip delay costs and variability in travel time would increase from $1.4 billion in 2005 to $2.7 billion in 2020. This does not take into account the negative multiplier effects associated with a loss of competitiveness and potential reduction in employment and subsequent flow through effects on demand. The VCEC Inquiry (VCEC 2006) valued the current cost of congestion to the Melbourne economy at between $1.3–2.6 billion per annum. This would suggest that, based on the three conditions for infrastructure investment in transport to have an impact on the Victorian economy, the likely cost of congestion to business and the Victorian economy in the longer term would warrant intervention. However, the type and scale of that intervention would depend on the expected benefits to result from such investment.

The impacts of interventions

In order to estimate the likely benefits arising from interventions to improve transport efficiency, it is necessary to consider a number of impacts:

- Direct impacts on users of the infrastructure such as road users, users of public transport, providers and financiers of initiatives, and the externalities on society, such as emissions and noise;
- Indirect impacts on the economy arising from a reduction in transport costs and its transmission into business costs, competitiveness and employment; and
- Wider economic impacts associated with:
  - improved access to broader and more skilled labour resources for businesses
  - benefits deriving from agglomeration economies from a reduction in the physical separation of suppliers as in the case of the motor vehicle manufacturing industry.

This is not to suggest that intervention to improve transport efficiency is a pre-requisite for economic growth and development of the Victorian economy. However, there are two important considerations that are relevant to the argument to support intervention:

- With the prospect of congestion costs for Melbourne doubling over the next 15 years, a 'do-nothing' scenario is hardly tenable in terms of the resulting costs to business and the loss of amenity to society with their consequent second round impacts on the economy and the liveability and attractiveness of Melbourne as a place of work and residence. The latter also impacts on business through its access to a skilled labour force. The opportunity cost would suggest that a level of investment would be justifiable to avoid some of those costs (ie., there is an economically efficient level of investment recognising that some degree of congestion is appropriate).
- Transport plays an important facilitating role in bringing together the various resources, production and leisure activities of society. In this sense it is an enabler of economic activity, including social interaction. Transport has the capacity to reduce the physical separation of those activities that support economic growth and development. There is an economic case for intervention to address constraints where the benefits at least equal the cost. This is consistent with the Eddington view that it is important to look for evidence where transport demand is nearing or exceeding supply.

Structure of the Report

This report is structured around the issue of examining the role of transport in the Victorian economy. In Chapter 2, the economic setting for Australia and Victoria is presented with a view to exploring the forecast economic growth and the implication this may have for the transport sector.

Chapter 3 attempts to build on international experience to determine the generation of economic development benefits that can derive from investment in transport infrastructure. There is strong evidence to suggest that such investment has significant multiplier impacts associated with microeconomic relationships between perceived distance and productivity, such as agglomeration economies. Furthermore, there is consensus amongst transport professionals and academics that transport improvements can, in certain circumstances, also deliver growth on a higher level – by unlocking barriers to underlying economic growth. Chapter 4 builds on the discussion in Chapter 3 and develops a framework for estimating the wider economic benefits from investment in transport infrastructure.

Appendix 1 presents an analysis of the transport distribution and logistics sector and its role in the Victorian economy. This includes expenditure by firms on transport, trade flows through Victorian ports, the role that these ports play in facilitating trade for the rest of Australia, and the likely implications of increasing traffic flows through Melbourne for congestion and the resulting cost to business.

Appendix 2 contains several industry case studies designed to illustrate the concept of economic journey for the resourcing, production and distribution of end products to users. It highlights the key role that transport plays in this economic process.

1. CONTEXT

Transport occupies a central role in the everyday functioning of an economy. As an economy develops, the demand for transport increases and with that growth in demand there emerges greater pressure to provide and manage infrastructure to ensure that transport services operate efficiently to support business and social activity. In linking resources with production processes and products with consumers, the capacity of transport to support those activities in a low cost and reliable way will have a bearing on the competitiveness of businesses as well as the social amenity of communities dependent on transport and their access to goods and services. The case studies that are appended to this report discuss in detail these interdependencies in the Melbourne context. The related issue that arises from this interdependency is the extent to which transport contributes to economic growth and development, or conversely the extent to which economic growth would be restrained by an inefficient or poorly functioning transport system. Similar arguments exist for governments as they tackle the trade-off associated with public expenditure across all sectors of an economy, such as education and health. Part of the complexity of the challenge is that of balancing economic efficiency and equity objectives in the delivery of services, and within any sector there is the additional issue of where the investment should be made to achieve the best value for money.

Urban transport provides an important cross section of these issues in terms of meeting expectations of all elements of society. Transport performs a critical function in bringing together not only people for business and leisure activity and resources for production processes but also markets to sustain economic growth as well as education and health centres as the building blocks for a vibrant and amenable society. On the other hand, transport can impose some baggage on society in the form of emissions and associated health costs, safety costs arising from crashes, spatial separation of communities and loss of social amenity, and degradation of the environment.

The purpose of this paper is to explore these issues and the role that transport occupies in a developed economy such as Australia and the functioning of a major city like Melbourne.

1.1 The Role of Transport in the Economy

The physical separation of different economic functions such as primary and secondary production, business and leisure activities, marketing and consumption is a fundamental aspect of a society. Consumers are widely dispersed from producers and in most industry sectors production is separated from where resources originate. Observation suggests that separation has increased over the last 200 years; many industries have become global in scale in terms of both sources of inputs and markets, leisure has become a major and fast growing activity, manufacturing is no longer concentrated around resources or ports, and cities have become massive and highly productive concentrations of service business activity.

The economy would be more productive if separation did not exist, as the costs of overcoming separation would be avoided. Transport is how separation is addressed – it is a cost that companies and individuals have to bear. However, there are also benefits from separation: tourism is one example. Another consideration is that many people choose to live out of the town or city and commute. This choice suggests that these people prefer the attractions of a less densely developed area and the associated costs of commuting, to living in a city. Better and cheaper transport has enabled people to enjoy the benefits of separation, while enabling businesses to drive down the costs of being separated from markets and resources.

The efficiency of transport has therefore made possible the growth derived from international trade, competition and globalisation, enabling the world economy to exploit different comparative advantages in different countries and regions and the migrations of skills that have sustained growth in many developed economies. Transport allows a producer to have access to a set of specialised inputs sourced from across the globe. For example, some inputs for a locally produced Aurion car are sourced from both local suppliers whilst others are air and sea freighted from production centres such as Japan. Transport has also allowed people to have much greater choice of where they live and work, and serves important social functions, including access to family and friends, educational institutions, work and leisure activities.

Whilst transport is the purveyor of many social and economic benefits, there is increasing concern over the generation of externalities by transport and its negative contribution to the environment through increased emissions and noise, and second round impacts on health and climate change. In addition, increasing levels of urban congestion are detracting from the social amenity of our major cities and reducing the ease of access to facilities. Despite significant reductions in the numbers of fatalities since 1970, the cost of road crashes continues to represent a substantial social and financial burden on society.

Over the past decade, the Australian economy has sustained a high rate of economic growth, attributable in part to the continuing strong demand for exports generated by the Australian resources sector. This has placed increased pressure on Australia's transport infrastructure to deliver resources, products and services efficiently and at low cost to maintain our international competitiveness and economic growth. The multiplier effects of that growth are significant to all sectors of the economy, and have contributed to the current record low levels of unemployment not seen since the early 1970s.

This scenario raises the duality of the challenge that faces transport over the coming decades. First, transport is a derived demand, meaning that it arises to meet the needs of consumers of transport services. Growth in the demand for transport services is directly related to growth in income and population[1]. Second, lack of investment in transport infrastructure can lead to a dampening of economic growth through increased costs to transport dependent industries as a result of increasing levels of congestion, i.e., industries are unable to exploit fully the economies of separation. In addition, inefficient connections to ports and terminals for freight, and for passenger movements for all travel also contribute broader costs to society in the form of increased externalities.

This report attempts to map the role of transport in the economy, and in doing so seeks to address both sides of this transport equation. On the one hand, an efficiently functioning transport system can support economic growth and generate second-round positive impacts for the economy by providing better access to resources and markets. On the other hand, where the rate of economic growth outstrips the capacity of transport to respond efficiently, then this could dampen economic well-being through higher costs to industry and society such as increased congestion and reduced liveability of our urban environment.

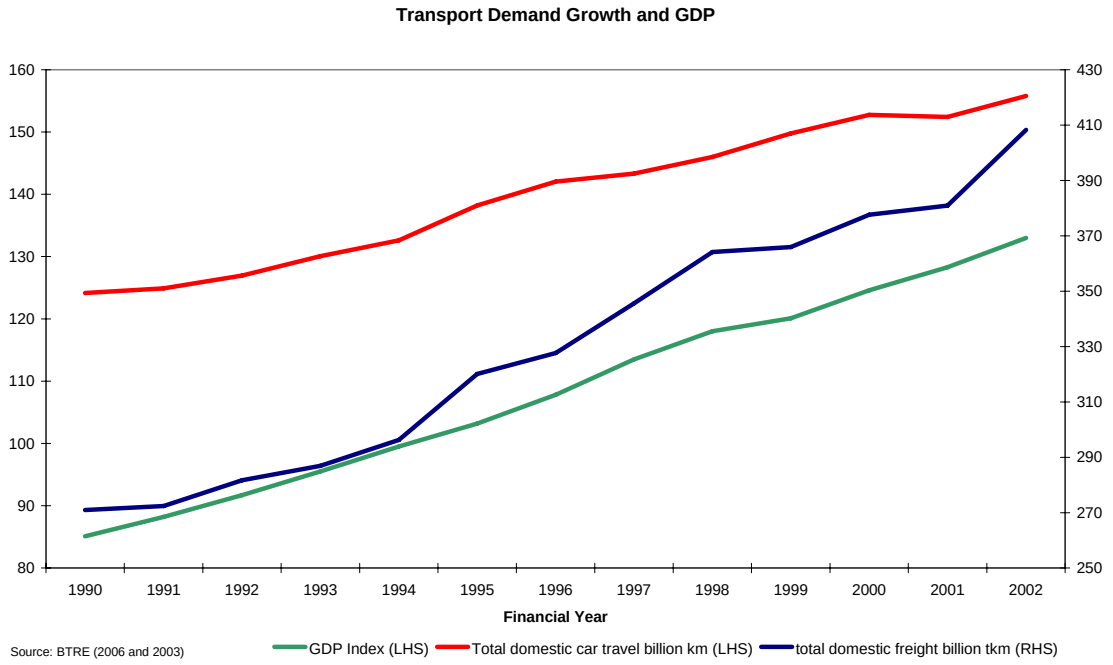
[1] Gross Domestic Product and Gross State Product measure real growth adjusted for inflation at national (GDP) or regional (GSP) levels. Gross domestic product (or, for regions, gross state product) represents the sum total in any period of economic output of selected goods and services traded on the monetary market. It is output produced in Australia and includes all new consumer goods and services, including public goods and services. GDP and GSP do not include costs to the environment of economic development, unless these costs are specifically captured or internalised in transactions or charges.

1.2 Growth in Transport Demand

Whilst step changes in transport efficiency can have an instrumental impact on economic growth, economic growth itself drives the demand for transport services. As income grows, society consumes more, and most products consumed need some degree of transport as an input. As an economy becomes wealthier, there is a tendency to spend more on transport, whether it is in terms of longer commutes to work, more holidays further away or an increase in the demand for consumer goods or services. Further, the specialisation of economic activity to take advantage of lower production costs through economies of scale has resulted in an increase in the transport component of manufactured products. For example, the UK Department for Environment Food and Rural Affairs (DEFRA 2007) concluded that "…'food miles' [i.e., the transportation of food and drink by the food industry from 'supplier to shelf'] are significant and growing. They accounted for 30 billion vehicle kilometres in 2002, of which 82% occurred in the UK and the vast majority of these were by road … [Further] 'food miles' are a significant source of CO2 emissions." In addition, globalisation has also increased the demand for transport, with semi-finished products being transported from production centre to production centre as part of an international assembly plant, such as the case with car manufacturing processes (European Conference of Ministers for Transport (ECMT) 2000).

Figure 1 illustrates the trend in transport demand and Gross Domestic Product (GDP) growth for Australia. There is a direct correlation between growth in the demand for freight and passenger transport with growth in income (BTRE 2007). The other key driver for transport demand is population growth. This supports the first of the two propositions above: transport is a derived demand, and follows the growth in demand for goods and services, which itself is largely driven by the growth in population and income.

FIGURE 1: TRANSPORT DEMAND GROWTH AND GDP GROWTH IN AUSTRALIA



Source: BTRE (2006 and 2003)

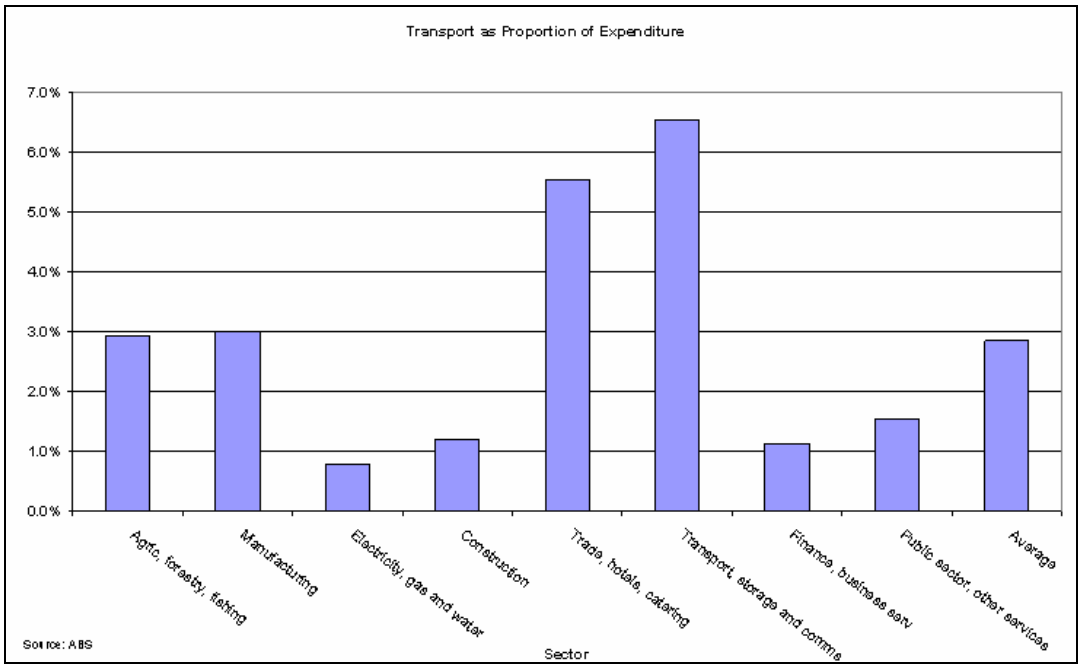
1.3 Contribution of Transport to Economic Activities

The transport sector provides a number of services to an economy. First and foremost, transport is an input to productive activity. It enables firms to import raw materials and intermediate goods to use in their production processes, and deliver their outputs to markets. For example, without transport as an input, the milk which Murray Goulburn relies on to make butter and other products could not move from farm to their Leongatha or other production centres. Nor could these finished products reach the final consumers in Melbourne or in international markets (as detailed in the case study attached to this report in Appendix 2). Transport as an input to productive activity is particularly important for certain sectors such as food manufacturing and processing, the production of minerals and wholesale trade. A high quality transport network enables low cost and reliable access to inputs and to markets.

Second, firms also rely on the efficient transport of people. Typically service sector firms rely on face to face interaction for sales activity and often also as a part of delivery of their services. The increasing importance of the service sector to the Victorian economy is discussed in Chapter 2. Again, an efficient and reliable transport network allows firms to reach a larger market at a lower cost.

The importance of transport services for the activities of various sectors can be measured by looking at expenditure on transport as a proportion of their turnover. Figure 2 below shows this share for nine sectors of the Victorian economy.

FIGURE 2: VICTORIA – TRANSPORT AS A PROPORTION OF FIRMS' EXPENDITURE



1.4 The Importance of International Access

A significant share of transport demand from some firms is to gain access to international markets. Transport services are therefore particularly important for firms that trade goods and services internationally. Analyses of many business activities almost invariably find that access to international transport hubs is an important factor in their location decisions (Vickerman and Monnet 2001). The significance of such access for Melbourne and Victoria can be seen in the Toyota, Murray Goulburn and SPC case studies appended to this report and is illustrated by the volume of international trade that goes through Victorian ports, which is equivalent to approximately 30% of Gross State Product (GSP) for Victoria. In 2003–04, the Port of Melbourne handled 26.8% by value of Australia's international maritime trade (BTRE 2005) which was equivalent to 23.4% of Victoria's GSP. The vast majority of goods imported through the port of Melbourne remain in Victoria (from Port of Melbourne Corporation data).

There are a number of key transport infrastructure elements that operate as international 'economic gateways'. These economic gateways include the Victorian ports of Melbourne, Geelong, Hastings and Portland and Melbourne's International Airport at Tullamarine. The economic value of the ports to Victoria has been estimated at $3 billion per annum and the airport at over $0.5 billion per annum (see Appendix 1).

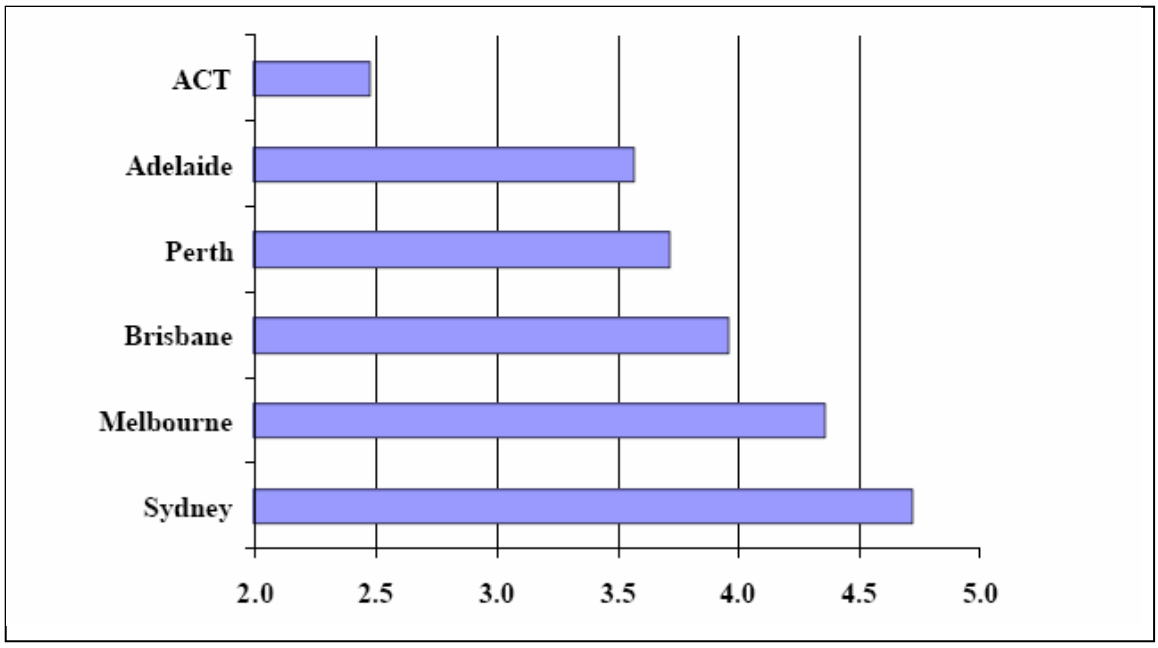
Whilst all sectors of the economy are dependant on these international gateways for import and exports of inputs and final goods as well as for human resources, there are some sectors more reliant than others. Examples of high dependence on international gateways include the automotive and processed food industries and the retail sector. Case studies of economic journeys that occur in these sectors and their dependence on international gateways are discussed in the case studies in Appendix 2 to this report.

1.5 Access to Labour

Ensuring firms have access to labour markets is a very important, but often overlooked, role that transport plays. Although commuting by itself does not benefit the economy, providing firms with access to the skills they need does. Often access to the key production inputs can go a long way to explaining why some companies choose to locate in large cities (e.g., car manufacturing with access to suppliers of components), while other types of activities cluster around smaller towns (eg., fruit processing plants in regions of fruit production). Although they might differ in their specific needs, most firms will consider access to labour to be a crucial factor to their activities.

Typically large cities draw labour from a vast area. Figure 3 shows average commuting times per week across a number of Australian cities for 2002. While some of the reason for the longer commutes in Melbourne and Sydney is the higher level of congestion in those cities, the main explanation is that workers in large cities are prepared to spend a longer time commuting than people living in non metropolitan centres. People have better access to a wider range of employment opportunities, and jobs in big cities tend to be higher paid than similar jobs elsewhere, which encourages workers to commute further and compensates them for their longer journeys (Laird et al 2006).

FIGURE 3: WEEKLY COMMUTING TIMES FOR CAPITAL CITIES IN AUSTRALIA (HOURS PER WEEK) FOR 2002



Source: Household Income and Labour Dynamics in Australia Survey 2002.

1.6 Transport Needs to be Efficient

Providing a transport network linking cities with ports, workers and other cities will ensure that the economy is functioning. But the picture painted so far is only a part of the story.

Naturally, it is not just about having the links in place. A network that is 'top notch' at one point in time may become totally inadequate only a decade later. For example, growth in traffic leads to congestion, which imposes real costs on firms and can slow down economic growth.

Some of these costs are borne directly by firms. For example, the BTRE (2007) estimated the avoidable cost of congestion for Australian cities at $9.4 billion in 2005 and forecast to increase to $20.4 billion by 2020[2]. For Melbourne, the BTRE estimated the cost of congestion at $3.02 billion per annum in 2005, and forecast to increase to $6.12 billion by 2020. Of this cost of congestion, business travel time costs accounted for $1.4 billion (trip delay plus variability in travel time) in 2005, and are forecast to increase to $2.7 billion by 2020. This equates to nearly $750 in lost output per Melbourne citizen per year. A parallel inquiry by the Victorian Competition and Efficiency Commission (VCEC 2006) valued the current cost of congestion more conservatively at between $1.3–2.6 billion per annum. This figure is forecast to double within 15 years in the absence of appropriate infrastructure and non-infrastructure interventions.

A constrained transport network has other economic costs too. As history has shown, easier and cheaper transport leads to economic efficiencies by allowing cities and countries to specialise in different activities and thereby enjoy economies of scale. A well integrated economy means more efficient access to resources and distribution of goods, which can strengthen the competition between firms offering similar products or services both domestically and internationally. Without efficient transport linkages between factor inputs, production centres and markets, costs will increase with subsequent adverse multiplier effects across the economy.

There is also growing evidence that supporting the growth of cities leads to economic efficiencies (Aschauer 1989). A growing city attracts more skilled workers and this is important to many firms. The theory of agglomeration suggests that labour access is important beyond enabling access to enough workers with the right skills. Being able to select between a large number of suitable workers brings benefits in its own right. Filling vacancies is quicker and it is easier to find workers with the exact set of skills that match firms' needs (Graham 2006).

However, transport costs can also act as a barrier to labour supply by limiting how far people are willing to commute. Although thought to be less important generally, recent UK evidence suggests it can be significant in certain circumstances — particularly in large cities. For example the Crossrail project, an East–West rail link connecting main terminals at either end of London, derived 40% of the nearly $50 billion (Net Present Value) economic impact from reducing this labour supply barrier (UK Department for Transport (DfT) 2005).

[2] The BTRE has defined the avoidable cost of congestion as a measure of the cost of "doing nothing" about congestion or the amount by which total costs of congestion could be reduced if traffic flows were reduced through economically justifiable interventions.

1.7 The Economic Journey

The case studies appended in Appendix 2 to this report indicate the economic journey of various goods from point of origin to final destination and track how these goods move into and out of Melbourne. These case studies provide actual Melbourne examples of the points made earlier in this chapter of the importance of transport to the economy and discuss the economic journeys made. These economic journeys incorporate not only the movement of goods (and their production and distribution by-products) but also the movement of people to, from and often during work.

2. ECONOMIC SETTING FOR AUSTRALIA AND VICTORIA

2.1 Domestic Market Performance

The Australian Treasury in its Budget Statement for 2007–08 forecast real GDP growth at 3.75% for 2007–08, up from 2.5% for 2006–07 (Australian Government 2007a). This forecast rate of 3.75% has been revised up by the Australian Treasury to 4.25% (Victorian Department of Treasury and Finance (DFT) 2007). For the period 1996–2006, the average annual rate of growth in GDP in Australia was 3.6% per annum, and the Australian economy is forecast to sustain a rate of around 4% GDP growth per annum through to 2009. The Intergenerational Report 2 (Australian Government 2007b) provides long term projections for the Australian economy, which may be summarised as:

- Australia's resident population was slightly over 20.6 million in June 2006, and is projected to rise by 38% to 28.5 million by June 2047;
- The annual growth rate in Australia's population is projected to slow gradually from 1.3% in 2006–07 to 0.4% in 2046–47;
- The population of traditional working age (15–64 years) is projected to grow by over 20% by 2047, but to fall as a proportion of the total population from 67.5% in 2006–07 to 59.5% in 2046–47;
- The labour force participation rate is projected to rise from 76.2% in 2006–07 to 78.1% in 2046–47;
- Labour productivity is assumed to grow at 1.75% per annum to 2046–47;
- Annual average real GDP growth is projected to slow to 2.4%.

For the past decade, inflation in Australia has averaged 2.5% per annum. The Reserve Bank of Australia (RBA) seeks to contain the rate of inflation to between 2–3% per annum[3]. The unemployment rate for Australia in 2007–08 is expected to increase slightly to around 5% from a level of 4% in June 2007.

These projections raise several implications:

- The projections are consistent with Australia's post WWII economic performance, and suggest a continuing strong and stable economy;
- Continued growth in income and population over the longer term is likely to sustain further strong growth in the demand for transport.

With these assumptions in mind, it is likely that the demand for transport will proceed at a level consistent with the forecast increase in GDP, which could mean an increase of 30.3% in the transport task (vehicle kilometres traveled) for Melbourne between 2005 and 2020.

[3] Partly as a result of underlying inflation increasing to around 3.5% per annum in the calendar year 2007 and the inflation headline rates (CPI Year to December 2007) rising to 3%, the RBA has raised interest rates to maintain inflation within the 2-3% band.

2.2 International Market Performance

Australia's long term growth prospects are related to world economic growth. According to the ANZ Economic Outlook for the September quarter 2007, the world economy expanded by 5.4% during 2006, which is the highest growth rate since 1973 (ANZ 2007). The ANZ has forecast that this growth will continue throughout 2007 and 2008 (see Table 1). These forecasts suggest continuing strong growth in the world economy for the period 2006–2009, particularly for China with an average annual growth rate of 10.0% over that period. In addition, real GDP growth for India is forecast at 8.5% in fiscal year 2007–08 (April–March) and 8.0% in 2008–09 (The Economist 2007).

The Victorian Department of Treasury and Finance (DTF 2007) in its half year budget update indicated that increased uncertainty in the world economy following the financial crisis in the USA has resulted in a downward revision of 2008 world economic growth from 4.9% in April to 4.75% in October. However, the DTF Budget Update concluded that, "China is again expected to grow at double-digit rates in 2007 and 2008, while India is expected to grow by more than 8 per cent each year". Together, these two economies will continue to have a significant impact on global economic growth prospects, and on the demand for raw materials from Australia.

TABLE 1: WORLD ECONOMIC FORECASTS

	2006	2007	2008	2009	Average annual growth rate
Australia	2.7	4.1	4.0	4.1	3.7
New Zealand	1.5	2.5	1.5	3.7	2.3
United States	3.3	2.2	3.0	3.2	2.9
Euro zone	2.6	2.5	2.2	2.2	2.4
Japan	2.2	2.4	1.9	2.1	2.2
China	10.7	10.5	9.8	9.0	10.0
Other East Asia	5.5	5.3	5.2	4.9	5.2
World	5.1	4.8	4.7	4.5	4.8

Source: ANZ Economic Outlook, September Quarter 2007.

2.3 Economic Forecasts for Victoria

In the State Budget each year, the Victorian Department of Treasury and Finance provides projections of key economic indicators for the next four years. These projections are revised mid-cycle in the Budget Update (Victorian Government 2007b). The Update provides revised financial estimates relative to the annual State Budget as replicated in Table 2. In the 2007–08 Victorian Government Budget Update all economic indicators were tracking well, with forecast GSP growth at between 3% to 3.75% to 2010–11, and employment growth ranging between 1.5% to 2.5% per year to 2010–11.

TABLE 2: VICTORIAN ECONOMIC PROJECTIONS

(Projections in the 2007–08 Budget, where different, are in parentheses)

	2006-07 Actual	*2007-08 Forecast*	*2008-09 Forecast*	*2009-10 Forecast*	*2010-11 Forecast*
Real gross state product	2.7	3.75 *(3.25)*	3.50 *(3.25)*	3.00	3.00
Employment	2.7	2.50 *(1.25)*	1.75 *(1.25)*	1.50 *(1.25)*	1.50 *(1.25)*
Unemployment rate [(b)]	4.8	4.50 *(5.00)*	4.50 *(5.00)*	4.50 *(5.00)*	4.50 *(5.00)*
Wage price index [(c)]	3.6	3.50	3.50	3.50	3.50
Consumer price index	2.7	2.75 *(2.50)*	2.50	2.50	2.50
Population [(d)]	1.5	1.40 *(1.20)*	1.40 *(1.20)*	1.40 *(1.20)*	1.30 *(1.20)*

Sources: Australian Bureau of Statistics; Department of Treasury and Finance

Notes:

(a) Year-average per cent change on previous year unless otherwise indicated. All economic projections are rounded to the nearest 0.25 percentage point, except population projections which are rounded to the nearest 0.1 percentage point.

(b) Year-average level, per cent.

(c) Total hourly rate excluding bonuses.

(d) June quarter, per cent change on previous June quarter.

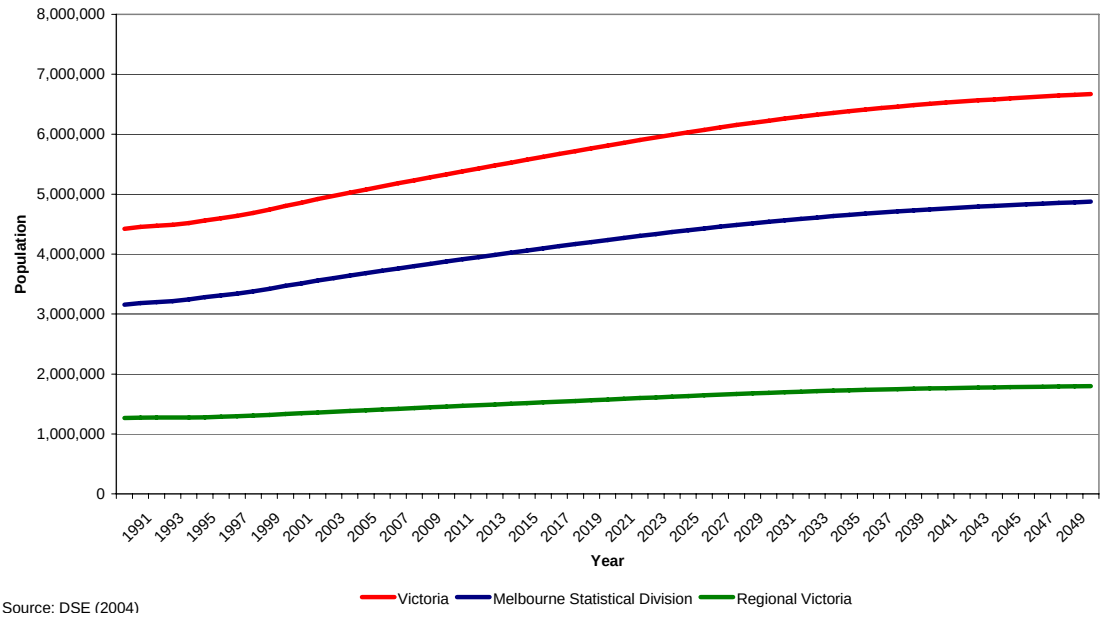
Economic and employment growth creates a number of demands on transport infrastructure as outlined in Chapter 1. More employment adds to the passenger transport task, particularly during commuter peak periods in metropolitan Melbourne. Increased income and employment will also add to the freight transport task and the key transport linkages such as the port of Melbourne, Melbourne airport and intermodal facilities such as at Dynon.

The longer the forecast period, the more uncertainty comes into any projection. There are no recent publicly available long term forecasts of these high level indicators for Victoria. In this absence, the Australian Government's projections in its recent Intergenerational Report are used (Australian Government 2007b). In this document long term projections of GDP see an average rate of 2.4% a year over the next forty years.

2.3.1 Population Base

As discussed in Chapter 1, population is one of the key drivers of demand for transport, which in turn creates the demand for infrastructure and its management.

FIGURE 4: POPULATION PROJECTIONS



Source: DSE (2004)

Victoria's population is projected to increase from 4.8 million people in June 2001 to 6.2 million people in June 2031 and 6.6 million by 2051 (Victorian Department of Sustainability and Environment (DSE) 2004, data files). The majority of this population increase will occur in the Melbourne urban area, increasing from 3.4 to 4.5 million people from 2001 to 2031.

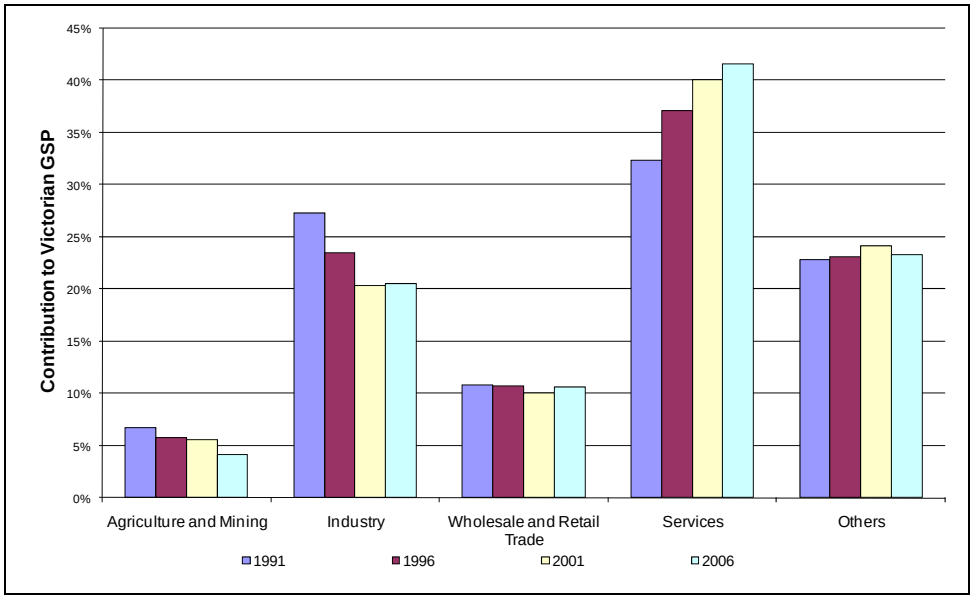
2.3.2 Industry sectors and employment

The composition of the Victorian economy and sector growth patterns also affect the demand for infrastructure across the State. Industries, such as mining, manufacturing and construction typically require more heavy freight transport.

Currently, Victorian manufacturing accounts for 30.8% of total Australian manufacturing turnover and is the second largest single employer in the State, behind retail trade.

The Victorian economy is predicted to become more service based in future[4]. This will generate increases in business related passenger travel and light commercial vehicle (LCV) traffic on the road network, particularly in urban locations. Figure 5 illustrates the increasing contribution to Victorian GSP from the services sector, from 32% in 1991 to 42% in 2006. It also shows the decreasing contribution of the industry (manufacturing, construction, energy, gas and water supply), and the agriculture and mining sectors to Victorian GSP. The wholesale and retail trade sector has remained reasonably constant in its contribution to GSP. These trends are again highlighted in Figure 6, which shows the change in employment by sector in Victoria from 1991–2006. These sector classifications are shown in Table 3.

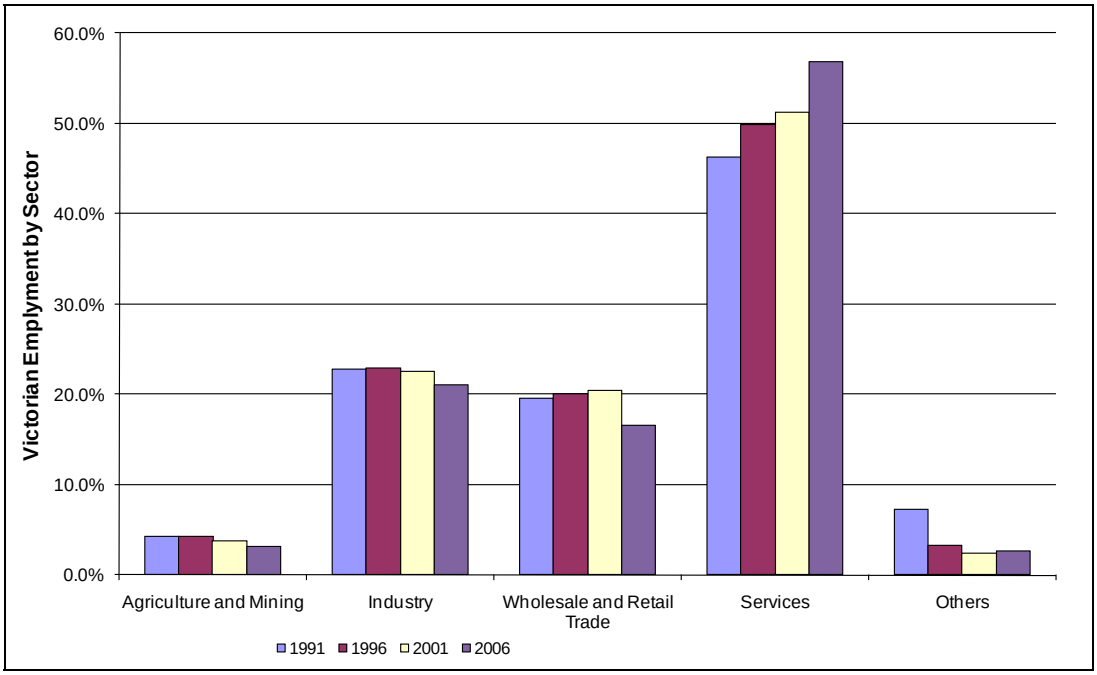
FIGURE 5: CONTRIBUTION TO VICTORIAN GSP BY SECTOR 1991–2006



Source: ABS Census 1991, 1996, 2001, 2006.

[4] The services sector accounts for the largest component of the Victorian economy and covers: accommodation, cafes and restaurants; transport and storage; communication; finance and insurance; property and business services; government administration and defence; education; health and community services; cultural and recreational services; and personal and other services.

FIGURE 6: VICTORIAN EMPLOYMENT BY SECTOR 1991–2006



Source: ABS Census 1991, 1996, 2001, 2006.

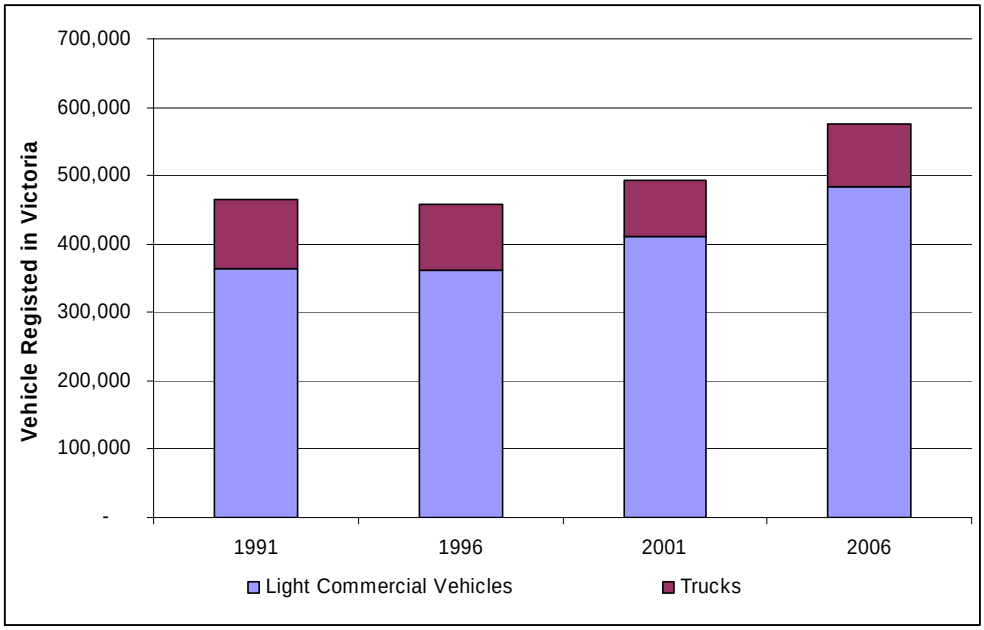
TABLE 3: INDUSTRY GROUPING FOR SECTOR CLASSIFICATION

Sector	ABS Classification
Agriculture and Mining	Agriculture, Forestry and Fishing Mining
Industry	Manufacturing Electricity, Gas and Water Supply Construction
Wholesale and Retail Trade	Wholesale Trade Retail Trade
Services	Accommodation, Cafes and Restaurants Transport and Storage Communication Services Finance and Insurance Property and Business Services Government Administration and Defence Education Health and Community Services Cultural and Recreational Services Personal and Other Services

The growth in the use of the internet and the resulting e-commerce generated is transforming the way in which the production and distribution of marketable goods are organised. E-commerce is defined as the use "…of advanced information technologies for commercial transactions and all activities deriving from those transitions, including both Business to Business (B2B) and Business to Consumer (B2C) transitions". The OECD (2001) examined the relationship between e-commerce and transport and concluded that "…e-commerce in its present form, that is based on business-delivery or home-delivery, may lead to less consolidated deliveries and thus more freight traffic". However the implications of e-commerce depend on the shippers' and firms' ability to increase efficiency by consolidating consignments and thus reducing vehicle trips. The Organisation for Economic Cooperation and Development (OECD 2001) recognised that e-commerce adds to and intensifies the existing problems of transport, that is, an inability to keep to schedules and unreliability in delivery times, particularly during peak periods of urban congestion.

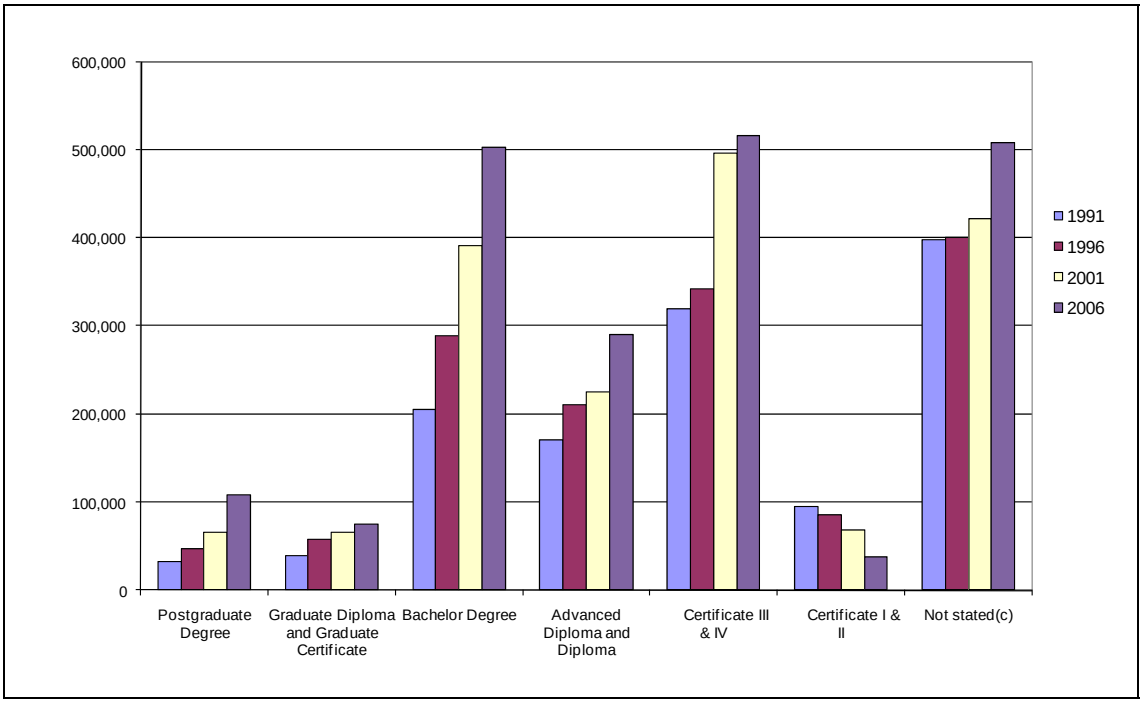
The services sector tends to generate growth in light commercial vehicle (LCV) traffic, which increases the demand for road space. Figure 7 illustrates the growth in the number of LCVs from 1991 to 2006. This reflects the growth of the services sector, which is highly dependent on transport in meeting the diverse needs of society.

FIGURE 7: NUMBER OF LCVS AND TRUCKS REGISTERED IN VICTORIA 1991–2006



Source: ABS Survey of Motor Vehicles 1991, 1996, 2001, 2006.

FIGURE 8: EDUCATIONAL QUALIFICATIONS HELD BY VICTORIANS 1991–2006



Source: ABS Census 1991, 1996, 2001, 2006.

From Figure 8, it appears that there has been steady improvement in the levels of qualifications held by Victorians over the period 1991 to 2006. This growth has been pronounced in two categories: university degrees and certificates III/IV. This could, in part, reflect the changing industry base in the Victorian economy with an increase in the demand for more highly skilled labour in the services sector and a relative decline in the demand for less skilled labour in the manufacturing sector. The highly dispersed nature of the services sector compared with the manufacturing and agricultural/mining sectors has accelerated the demand for transport, particularly given the mobility of a more highly skilled labour force.

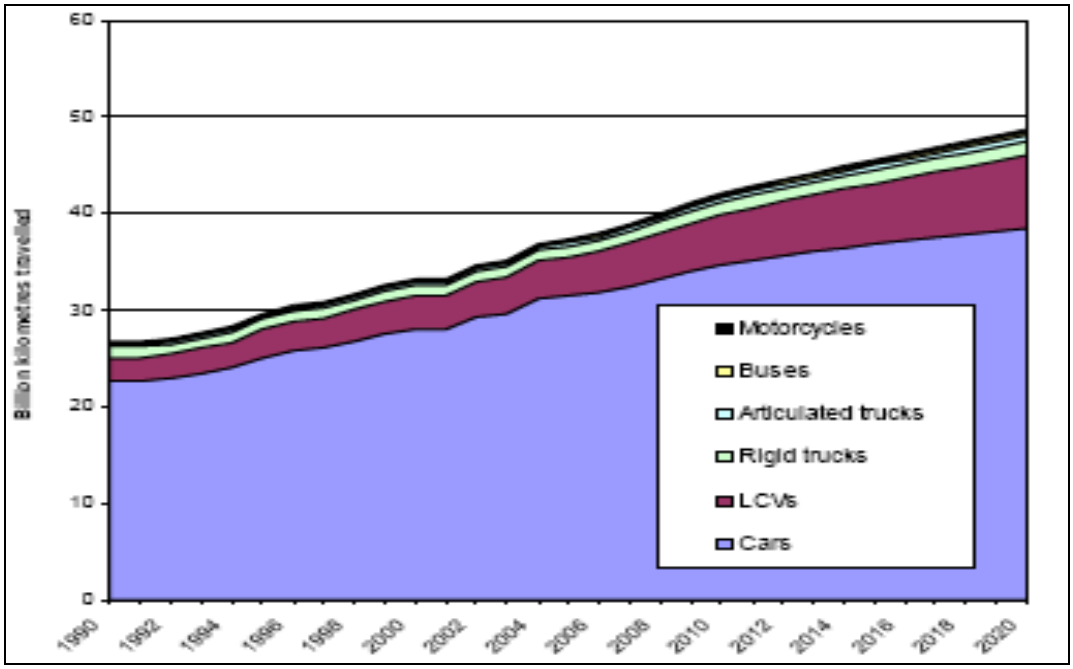
2.3.3 Passenger and freight vehicle forecasts for Melbourne[5]

For the COAG Urban Congestion Review, the BTRE (2007) derived broad forecasts of urban traffic growth for Melbourne. These estimates are provided here to indicate the forecast increase in the transport task for Melbourne, and the implications this may have for congestion costs to business and the wider economy under a 'business-as-usual' scenario.

[5] Note all Passenger and Vehicle forecasts have been taken from the most recent work by the BTRE, "Estimating Urban Traffic and Congestion Costs for Australian Cities" Working Paper 71 BTRE April 2007.

The growth in urban passenger movement in Melbourne has been characterised by an increased use of cars (see Figure 9)**,** and this is expected to continue with increases in population and income. However, the BTRE (2007) also argued that "…there is a saturating relationship between increases in annual passenger-kilometres per person and per capita income. This relationship implies that saturation in per person travel could be mostly complete by 2020. Thereafter, population increase will tend to be the primary driver of increases in travel in our cities".

FIGURE 9: PROJECTED VKT FOR MELBOURNE BY VEHICLE CATEGORY

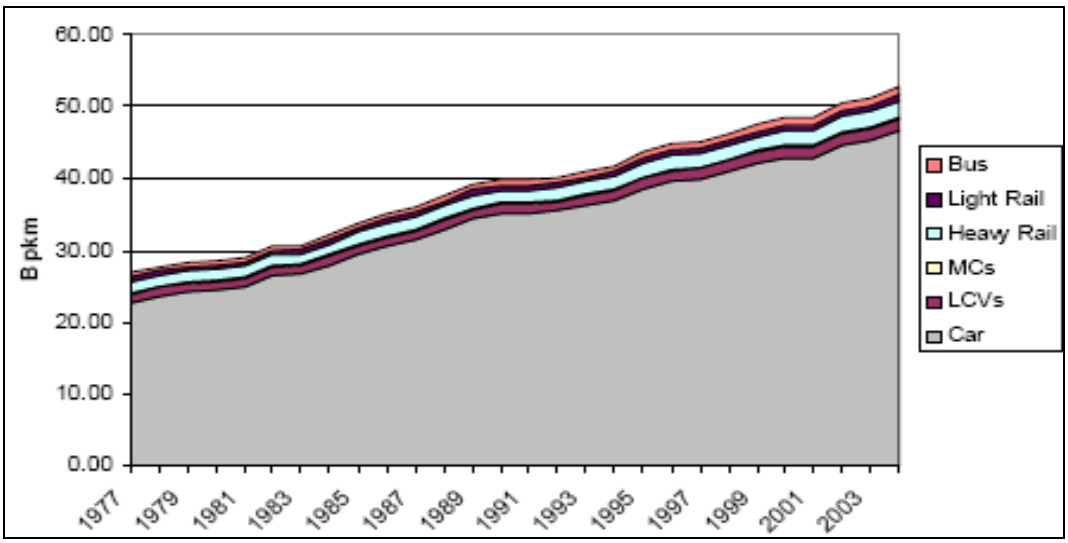


Source: BTRE 2007.

2.3.4 Urban Passenger Modal shares

As shown in Figure 10, modal shares for passenger transport have remained relatively constant for all modes since 1977 (BTRE 2007). However, since 2001, there has been an increase in the use of public transport in Melbourne, largely in response to the increase in fuel prices. According to the ABS Census results for 2006, approximately 15% of people in Melbourne used public transport for their journey to work, based on employed persons aged 15 years and over (ABS 2006). In 2001, less than 13% of people used public transport for travel to work (ABS 2003).

FIGURE 10: HISTORICAL TREND IN MELBOURNE PASSENGER TRAVEL BY MODE



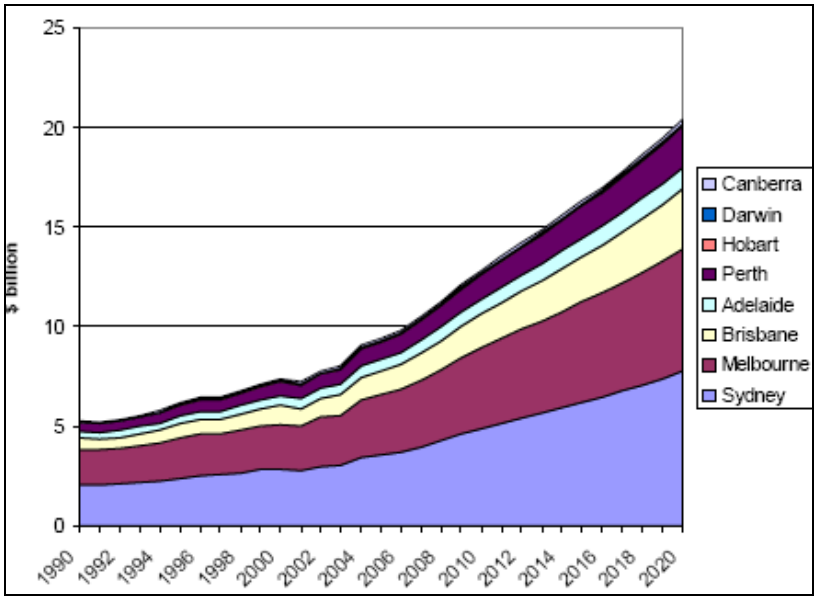
Source: BTRE 2007.

2.3.5 Forecast Congestion Costs for Melbourne — trends, impacts

As indicated in Figure 10 above, Melbourne is forecast to have significant increases traffic volumes between 2005 and 2020. This growth in traffic reflects the forecast growth in income and population for the Victorian economy over that period. However, the consequence of that forecast growth is an increase in the costs of congestion under a business-as-usual approach (BTRE 2007).

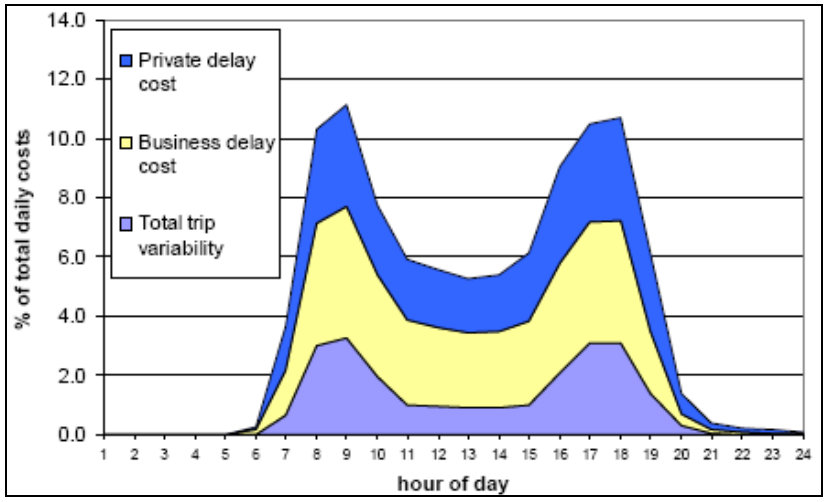
The avoidable social costs of congestion are based on the deadweight losses associated with urban congestion levels (compared with the economically optimal traffic levels). Costs include congestion related delays, trip variability, increased vehicle operating expenses and increased air pollution damages. Forecast increases in congestion costs for all Australian capital cities are shown in Figure 11. Components of the forecast increase in congestion costs are shown in Figure 12, which indicates a significant share of delay costs to business. COAG (2007) and VCEC (2007) have recognised the impact of these forecast costs to the Victorian economy and have identified a number of reforms to help contain those cost increases, which are discussed below.

FIGURE 11: PROJECTED AVOIDABLE COSTS OF CONGESTION BY CITY



Source: BTRE 2007.

FIGURE 12: THE COMPONENTS OF CONGESTION COSTS (PRIVATE VS BUSINESS TRAVEL TIME COSTS)



Source: BTRE 2007.

2.3.6 Options for Managing Congestion in Melbourne

The COAG Review of Urban Trends, Costs and Impacts (COAG 2007) concluded that any approach to tackle urban congestion in Australia should incorporate a range of infrastructure and non-infrastructure solutions. Non-infrastructure options have the capacity to increase the efficiency with which current infrastructure is used, and hence should be viewed as part of a package of measures to improve the management of urban congestion.

The COAG Review focused on non-infrastructure solutions and identified 25 action strategies, built around eight key areas, including:

1. Traffic Management – improved use of traffic management tools on a whole of corridor or network basis to improve infrastructure and transport productivity, business efficiency, reliability of system performance and community benefits through noise and emission reductions.
2. Freight, Commercial and Service Vehicle Management – growth in urban congestion will continue to have a negative impact on freight efficiency in urban areas. At the same time, the forecast increase in freight and service vehicles will add to the congestion problem. The Review raised the option of investigating possibilities to realign urban supply chains by modifying logistics practices (e.g. opening hours of warehouses and receival docks) to reduce the conflict between freight and passenger vehicles flows by extending the non-peak hours of operation for freight.
3. Passenger Travel Demand Management (Non-price) – options that target major employers to promote car-sharing, car-pooling, parking restraints, etc.
4. Public Transport – although the share of public transport is only 10% of total urban passenger travel across Australian capital cities, public transport can have a positive impact on congestion, and represents an important component of urban congestion management.
5. Integrated Transport and Land Use Planning – improve the links across transport planning, ribbon development along key corridors, and access between labour and employment markets.
6. Road Demand Management (Price) – overseas experience suggests that price based measures can help to secure the longer term benefits of infrastructure development by slowing the growth in demand. However, price based measures must be part of a broader package of measures, including public transport to facilitate modal shift away from private vehicle use.
7. Data and Monitoring – the COAG review emphasised the importance of performance measures to assess the cost-effectiveness of interventions to reduce urban congestion. To achieve this objective, models and data are key elements to assist decision-makers in choosing the best measures. These need to be supported by ex-post review to enable re-assessment of options against policy objectives.
8. Other Policy and Regulatory Issues – these include regulations in non-transport sectors that may contribute to the transport task, as well as transport related regulations.

The VCEC Inquiry into Managing Transport Congestion took a similar view. One of the key messages of the final report was that reducing congestion would require a holistic approach that tackled demand and supply sides of transport and related markets as well as the institutional arrangements within which transport decisions are made. VCEC grouped its recommended options for addressing transport congestion under 16 titles:

1. Improving efficiency – through such measures as expanded use of traffic management systems, road freight prioritisation trials and improving the operational arrangements of the rail loop system;

2. Transport infrastructure expansion – through such initiatives as selected road infrastructure focused on major bottlenecks, tram route extensions, rapid bus transit service trials and additions to the rail network;
3. Demand management – VCEC recommended a feasibility study into road use charging in Melbourne, the trial of time-of-day charging on CityLink and EastLink, as well as high occupancy toll lanes on new lanes and reduced off peak fares on public transport;
4. Freight – to target the congestion that directly impacts on the efficient movement of freight, VCEC recommended amongst other things that the road and rail corridors to the future container port at Hastings be reserved now and that there be increased focus on rail freight through project business case development for the major missing links in the rail system servicing the port of Melbourne;
5. Coordination within the Transport Portfolio – VCEC found that a unifying set of objectives for transport legislation and a review of the objectives and functions of all transport agencies would assist in addressing transport congestion;
6. Improving access to all policy options – through the establishment of an external advisory board to review and contribute to proposals for improving transport efficiency and management of congestion;
7. Enhancing the Department of Infrastructure's Project Appraisal Process – through such measures as improved annual reporting, greater availability of transport models, cost-benefit guidelines, more detailed guidance notes and post completion reviews;
8. Improving information – VCEC recommended a trial survey on the direct and indirect costs of congestion amongst other options;
9. Ensure effective project implementation – through ensuring the Department of Infrastructure's project implementation capability is matched to the level of responsibility;
10. Improving coordination between land-use and transport planning by state agencies – through legislative amendments, memoranda of understanding between the relevant agencies and guidelines between state and local government to ensure improved incorporations of transport issues into planning decisions;
11. Improving coordination between transport planning and other state government agencies – by removing the exemption that the health, environmental and education Ministers have from a requirement to comply with a Planning Scheme under the *Planning and Environment Act 1987* (Vic);
12. Improving road space management – through such options as reporting on the issues that impede agreement about clearways and the provision of greater guidance by the Department of Infrastructure on such matters as public transport priority on roads and parking on arterial roads;
13. Improving consultation between state and local government – by incorporating the quality of consultation into the state agencies' performance assessment requirements;
14. Improved long-term planning processes – through such options as clearer specifications for public transport plans in the structural planning for activity centres;

15. Making full use of the Growth Areas Authority and Integrated Planning Strategies – by reviewing the Growth Areas Authority in three years and endorsing funded implementation strategies for approved growth area plans and integrated transport strategies; and
16. Improving the contribution of buses to reducing congestion – by developing bus contracts and regulatory arrangements in list with best-practice principles (VCEC 2006).

2.3.7 Implications of Growth in Transport Demand for Melbourne

The BTRE (2006) has forecast a 3.6% annual growth rate in the national freight task (bulk and non-bulk) from 2000 to 2020 with much of the burden of this growth occurring in urban areas such as Melbourne.

Similarly, the growth in the national passenger task in terms of vehicle kilometres travelled is forecast to grow by 70% between 2000 and 2020, which will lead to a further increase in the total road task (passenger and freight) for Melbourne. There are several key issues at play in meeting this forecast growth in demand for transport services in Melbourne:

- First, there is a need to continue to improve the efficiency of transport activities through the effective provision of transport infrastructure. However, the cost of adding to the stock of infrastructure has increased greatly since 1990 following the growth in demand for construction activities from the resources sector, particularly for urban projects where the problem has been accelerated through increasing land acquisition costs and increasing costs to meet environmental requirements. The road construction and maintenance price index increased by 24% from 1993–94 to 2002–03 (BTRE 2004);
- Second, increasing demands from other sectors of the economy (eg., health and environment) have placed greater pressure on managers of transport infrastructure to extract greater productivity from the existing capital stock by using intelligent transport systems to better manage traffic flows. This issue of improving the management of transport infrastructure is increasing the focus on new non-infrastructure solutions to complement infrastructure investment to increase the efficiency with which existing and planned infrastructure is used;
- Third, in order to enhance Australia's international competitiveness, at its meeting in February 2006, COAG (Australian Government 2006) agreed on another wave of transport reform to further reduce transport costs and increase business productivity, including:
  - efficient pricing of road and rail freight infrastructure through consistent and competitively neutral pricing regimes;
  - harmonisation of and reform of rail and road regulation within five years, including productivity-enhancing reforms, improved road and rail safety regulation and performance-based standards for innovative vehicles that do less road damage;
  - strengthening and coordination of transport planning and project appraisal processes to ensure the best use of public investment by adopting Australian Transport Council endorsed national guidelines for assessing new public road and rail infrastructure projects by December 2006; and
  - reduction in current and projected urban transport congestion, within current jurisdictional responsibilities.

The sectoral based reforms could be particularly important to Melbourne with its strong manufacturing base and high volume of trade through Victorian ports. The focus on urban congestion complements the broader reform agenda by seeking to avoid productivity gains in the transport and business sectors being eroded by the forecast increase in congestion costs. This approach also reflects the arguments put forward in the national Export Infrastructure Taskforce Report, which concluded that road and rail connections to port are major issues for the Port of Melbourne (Australian Government 2005). The Victorian Freight and Logistics Council (2005) supports this view and has argued that road and rail links to Victorian ports represent a major deficiency in Australia's transport infrastructure. As the level of urban congestion increases there is growing concern that these deficiencies will become more pronounced. The VCEC Inquiry into Managing Transport Congestion further investigated this issue and prioritised the development of business cases for strategic projects to connect rail more effectively to the Port of Melbourne. The Inquiry also highlighted the importance of land transport reservations to the Port of Hastings (VCEC 2006).

The Productivity Commission (2006) has estimated that full implementation of the National Reform Agenda agreed by the Council of Australian Governments (COAG) could increase freight productivity by 5%. Further, the Commission concluded that a 1% increase in infrastructure spending could reduce the prices of transport services by 4.5%, which could increase the competitiveness of Australian businesses.

This suggests that a range of complementary measures could be considered for managing the forecast growth in transport demand for Melbourne:

- Provision of infrastructure to target congestion 'hot-spots';
- Improved management of transport infrastructure to increase efficiency of use of infrastructure;
- Consideration of both price and non-price demand measures to encourage modal shift from private cars to public transport, including use and dissemination of information to facilitate improved decision-making by users and managers of transport networks;
- Continued sectoral reform to reduce business costs and secure productivity gains.

3. TRANSPORT IMPROVEMENTS AND ECONOMIC GROWTH OF MELBOURNE

3.1 Introduction

In Chapter 1 it was established that transport is an input to productive activity. However, it is not a productive input as are labour and capital. Rather, an enhanced transport network enables other inputs to be used more efficiently, so delivering productivity gains for businesses depending on it, either directly, for business travel or freight, or indirectly, by attracting workers or customers.

At the same time, many academics hold the view that a good quality transport network can be a necessary, but not a sufficient, condition for economic development (see, for instance, Bannister and Berechman 2001). There are of course, other factors that contribute to the development of an economy, including government policy, innovation, investment, access to skilled labour and regulation. In addition, the performance of regional, national or world economies can have a significant influence on economic prosperity of a locality. If these other conditions are not favourable, their view is that transport investment alone will not have an impact on economic growth.

Apparently these two views seem to be at odds with each other. How can they be reconciled?

It is essential here to distinguish between economic growth on a micro and macro scale. On a micro level, it is undeniable that better connectivity benefits the economy by reducing costs to firms and increasing their productivity, allowing them to either reinvest their cost savings or pass them on in lower prices, higher wages or higher profits. These growth impacts are important considerations in investment appraisal, but are nevertheless incremental in magnitude. The relationships that cause these productivity gains and how they can be assessed for individual projects or policies are discussed in more detail in Chapter 4.

The macro level growth argument is different altogether. The view that transport is necessary, but not sufficient for economic growth, seeks to add caution to the view that transport is 'the solution' for a struggling economy. It also questions the view that without addressing a specific constraint on a network the economy will suffer or important industrial sectors will relocate to a different region or abroad. At the same time, the alternative view that transport is not a prime driver of economic activity merely emphasises the point that there are many factors influencing economic development and transport only plays a significant role when other requirements are met.

There are many examples of underinvestment in transport and its consequences. Dublin is often cited as an example of economic growth outstripping the local transport network (see Box 1). For around 20 years, Ireland has experienced a boom in economic activity, driven by improvements to the workforce's skills and increased foreign direct investment (FDI), without corresponding improvements in transport. Recently, with the rapid growth in the Dublin economy and the sharp increase in the demand for transport, congestion is seen as a major problem to the point where transport has emerged as a constraint on economic growth.

By way of contrast, the case of Japan is presented in Box 2. In this case substantial investment in transport infrastructure often exceeded the demand for infrastructure.

3.2 When is Transport Necessary AND Sufficient?

The case studies represent success stories of strong economic development with two different approaches to transport infrastructure provision. Whilst Japan accommodated its booming economy over nearly 50 years by making sure infrastructure was in place before supply constrained demand, Ireland achieved strong growth over several decades without corresponding investment.

Neither case study suggests transport investment is driving economic development, but rather that ensuring demand does not outstrip supply enables the economy to grow without a constraint. As we have seen in Dublin, transport constraints do not reach a point of inhibiting growth until they reach a level of severity that the barriers become nearly self-evident, such as heavy congestion and journey time variability on access to ports, urban and inter-urban links and for commuters.

As argued by the Victoria Transport Policy Institute (2003), "Only if inadequate transport is a significant limiting economic factor and transportation facility investments or subsidies are the most cost effective way to improve transportation are such policies likely to increase economic development". This places an increased focus on correctly aligning the type of intervention with the identified need that ensures an efficient outcome both in terms of the policy instrument (eg., investment in transport infrastructure) and the policy outcome (ie., a more effective transport system that lowers the cost to business and enhances economic growth).

There are four steps to establish the case for intervention:

- Establish future transport needs;
- Identify transport constraints;
- Identify other conditions required for transport to be able to impact on development; and
- Develop solutions to address transport constraints.

We expand on each of these steps in the following four subsections.

BOX 1 THE CELTIC TIGER

Ireland's is an advanced economy resulting from a surge in growth with relatively little investment in transport. It has been by far the most successful of the lower-income and peripheral economies that acceded to the European Union in the 1970s and 1980s; as a result of its economic growth since the late 1980s it has earned the title of the 'Celtic Tiger' (Crafts 2005).

A wide range of factors have contributed to the notable economic growth in Ireland, most of which focus on financial and labour market conditions. Most obviously Ireland joined the EU in 1973 and the Single Market in 1992. Ireland is effectively a regional economy where labour can flow in and out relatively freely, and at the beginning of the economic improvements it contained a reservoir of unemployed labour. Substantial income and corporate tax cuts made Ireland an attractive place to invest, with income tax rates falling by around 10% between the late-1980s and late-1990s (Barry 2004). A significant aspect of the 'Celtic Tiger' was the surge in Foreign Direct Investment (FDI), most notably from the United States, clustered in profitable industries such as Information Technology (IT), pharmaceuticals and medical/optical devices. By 2000 foreign owned firms accounted for 48% of total employment in manufacturing.

It is often noted that the remarkable acceleration in economic performance in this regional economy, which benefited from a highly elastic supply of skilled labour, out-paced infrastructure growth. This meant that the level of transport facilities effectively placed a "cap" on the level of growth which could be accommodated; in recent years the inadequacy of the transport network in Ireland has begun to render further economic growth unsustainable.

The acceleration of Irish economic performance coincided with a doubling of inflows of EU Structural Funds, which accounted for about 3% of GDP through the 1990s, yet only about one third of these funds were used for investment in infrastructure, with the remainder being allocated to human capital and to subsidies to private sector investment. In the mid-1990s Irish transport investment per head was only 61% of the EU15 average, while there were 229 km of main roads per km^2 compared with the EU15 average of 377 km (ECMT 1996). Symptoms of this underinvestment included the complete lack of high speed rail, inadequate roads for distribution and extremely limited commuter transport in all cities, as well as inadequate domestic access to Dublin's port and airport. In this context it is inconceivable that investment in public infrastructure was a key driver of the acceleration in economic growth from the late 1980s. On the contrary, a recent review noted that there had been substantial under-investment in public infrastructure, especially in the years 1980 to 1993, with the result that the economy "was unprepared for success" (Fitzgerald 2002). This is particularly noteworthy in the context of Ireland's reliance on FDI, and suggests that while foreign-owned firms were attracted by the tax regime, to some extent they have come *despite* the infrastructure.

The 'Celtic Tiger' model that was so successful from the late 1980s to the turn of the century is no longer applicable, a key reason being a tail off in employment growth now that reserves of unemployed workers have been exhausted. As a result, overall growth is projected to slow down in future. Because major investment in transport did not accompany the launch of the economy into its fast growth phase, the rapid expansion of the Irish economy has now started to run up against infrastructural constraints. It has become clear that the lack of investment in transport infrastructure has created an inhibitor to further growth.

While transport undoubtedly impacts on economic growth it is not sufficient as an individual component to actually drive economic growth; improvements to an area (or country's) transport network and/or its accessibility do not necessarily guarantee any economic improvement, and certainly do not drive economic growth. This case study indicates that only when other conditions are in place and growth has been enabled, and when transport is acting as a constraint to this process, can transport improvements themselves be expected to have more than an incremental impact on the economy they serve.

BOX 2 JAPAN

Japan has experienced prolonged periods of rapid economic growth since the early 20th century and today constitutes one of the most developed economies on the global scale. In Japan transport infrastructure investment has generally preceded the economy's requirements by almost a decade, meaning that development has continually expanded into spare capacity. Massive investment in transport (as well as power and telecommunications) from the early 1960s onwards meant that the nation was already equipped to meet the significant rise in demand that took place thereafter.

Clearly the relationship between transport infrastructure and economic growth in Japan is significantly different from that found in most other economies. There has been a traditional emphasis on investment in transport infrastructure in Japan, with supply often exceeding demand, certainly from the 1950s onwards. This is highlighted by the fact that before World War II (WWII) the level of investment in transport and power sectors was approximately equal, while in the post-war period investment in the transport sector rapidly rose to three times that in the power sector. Even in pre-war Japan development impact and induced demand as a result of transport infrastructural demand was noted; despite a surge in cargo traffic as the manufacturing industry expanded, traffic levels still lagged behind the provision available by more than 10 years (Akatsuka and Yoshida 1999).

The emphasis on transport is also evident in the fact that, chronologically, transport development came first, followed by power and then by telecommunications. In essence the transport network was put in place, and the back-bone industries upon which the latter 20th Century economic boom was built were developed afterwards – with plenty of spare capacity to absorb. While the perspective from which development of the transport network was undertaken was almost solely on supply (regardless of whether it exceeded demand), investment in power and telecommunications sectors tended to follow a "demand-driven" pattern, where the level of investment rose proportionally in response to increasing demand.

Clearly the presence of an already capable transport network aided development in other areas of the economy. The extent to which it induced this development, or enabled development that would not have happened were the transport services not already in place, is open to question. In this regard it has been acknowledged that the transport sector made a prominent contribution to economic development at both nationwide and regional levels in Japan. Particularly influential transport infrastructure includes large-scale and high-speed transport systems such as the expressway network, the Shinkansen lines, and developments in the aviation sector. The importance of transport infrastructure may also be indicated by the fact that the studies on this sector are numerous, and that its economic impacts (both qualitative and quantitative) are relatively well documented (Morisugi 1987). In addition, many of the studies on other types of infrastructure examine the role of transport as well, again suggesting its great influence on the urban and regional development (Hidano et al 1995).

In Japan the increase in transport demand was strongly associated with a rapidly growing economy that was driven largely by the expansion of the manufacturing sector, and latterly telecommunications, but the networks were largely in place to accommodate this extra demand. Clearly the two are interdependent, but in the Japanese case, more than most others, the distinction between which enabled which, is distinctly blurred. It is clear that transport development would not have been possible were the economy not already strong, but it is also highly probable that economic expansion could not have been so prolific were the transport network not already in place to facilitate this and soak up the excess demand it created.

3.2.1 Establish transport needs

The first step is to identify the current and future transport needs of the economy. As argued in Chapter 2, different industrial sectors have different requirements; from access to ports and airports, to links with other urban areas, to access to labour and customers. To identify transport needs, it is necessary to understand how the Victorian economy may develop over the foreseeable future. This analysis was presented in Chapter 2, where current trends in economic development were discussed. As indicated through that discussion, Victoria is on a strong growth path and so is the Australian economy. This is in part fuelled by growth in international demand. This will drive increased demand for all transport in Melbourne, but particularly for freight and access to ports[6]. At the same time there is a continuing restructuring of the Melbourne economy away from manufacturing and lower level services towards higher level service industries. This will also change the nature of the city and the State's transport needs. Higher level service industries are typically high density, which will help grow the employment base of Melbourne and with it the number of commuters. The expected growth of Melbourne's high level service industries will also put demands on the local road network as the amount of light commercial vehicle and business journeys by private car increases.

The manufacturing sector contributes around 15% or $33 billion to State GSP and accounts for about 15% of employment in the Victorian economy. Within the manufacturing sector, the motor vehicle industry contributes approximately 4% to State GSP or $9 billion, or over a quarter of the value of the manufacturing sector. Hence, it is a significant contributor to the State's output, employment and export earnings. It is a major market for locally sourced products and services, and hence it represents one of the largest sectors of the Victorian economy. Although the role of manufacturing as a whole is in decline, the continuing presence of key sectors such as the automotive industry will require good access throughout the supply chain, from international ports and domestic ports/terminals to local roads and manufacturing/distribution points. With the globalisation of the vehicle manufacturing sector, efficient transport logistics and distribution are an essential element to its continued growth and competitiveness.

Evidence from the transport modelling work undertaken as part of the East–West Study suggests a 47% growth in commercial vehicle journeys and 40% growth in business car journeys in Melbourne between 2006 and 2031.

3.2.2 Identify transport constraints

The second step is to determine how and where transport constraints are likely to manifest themselves. In this respect it is important to distinguish between two types of transport constraint that could reduce the potential for economic development. These are:

[6] This is reflected in the growth forecast of throughput at the Port of Melbourne presented in Chapter 4, exceeding 5% per annum.

- Absolute constraints, where there are unexploited opportunities from 'missing' links in a transport network. Historically, improvements in transport have played a great role in opening up markets and opportunities that previously did not exist. The steam ship, railroad, and flight are all examples of step changes in transport provision that have contributed to shaping the world economy.
- Marginal constraints, where the cost of movement is heightened by overcrowding on public transport, congestion on highways or other real or perceived costs such as accident risks. As a city grows and its inhabitants become wealthier, increasing demand means higher congestion and crowding. This will eventually constrain the growth in sectors that rely on the congested links, either for travel, freight or for attracting workers. The mix of activities in the city will be altered towards those that are less transport dependent. The issue here is that the supply of transport infrastructure to support transport services invariably lags behind the growth in population and income as key drivers of the demand for transport services.

The greatest potential for economic development is when new links are put in place to relieve absolute constraints. Developed economies have, however, exploited most opportunities for step-changes and few realistic and cost effective options are likely to remain. The mixed success of recent step changes is evidence of this very point; the Channel Tunnel crossing the English Channel has suffered from disappointingly low demand and its operator is now nearly bankrupt; innovative high speed trains, such as those based on magnetic levitation (maglev), although offering huge reductions in travel time, remain poor value for money due to very high costs. The Oresund Bridge between Sweden and Denmark is, perhaps, an exception. Studies have found the economic effects positive, albeit modest and limited to a regional level (Jensen-Butler 2006).

As argued by the UK Eddington Transport Study (Eddington 2006), "For developed economies, the debate should be focused on the capacity and performance of the existing network... …The relationship between transport and growth in a mature economy is [ ] likely to be an incremental one."

So the scope for transport investment to unlock economic development in a mature economy such as Melbourne is to a large extent limited to relieving future pressures on the existing network. Eddington concludes that to do this it is important to look for evidence of transport demand nearing or exceeding supply. The following analysis suggests growth in transport demand over time in Melbourne will, if unaddressed, reduce the network's performance. In a 'do nothing' world of transport investment, both the COAG Urban Congestion Review and the VCEC Inquiry into Managing Transport Congestion highlighted the economic cost to society of failing to address the increasing cost of congestion to Australian cities, including the cost to business.

The most adequate tool for identifying future demand constraints is transport models, but these must be used in conjunction with professional transport planning and policy expertise. Using an adequate transport model to represent a business-as-usual scenario, it is possible to develop an understanding of the location and severity of 'pinch points' on the network being considered by looking for links with high load factors or low speeds.

Based on performance indicators of the Melbourne transport network developed by Veitch Lister Consulting Pty Ltd (VLC), internal analysis indicates a reduction in future average travel speeds in the absence of major transport investment above and beyond Meeting Our Transport Challenges and VicRoads regular maintenance of the network. Journey speeds by personal vehicles and by tram could slow up to 5% by 2031. These results are very high-level measures of the network's performance and they most likely mask significant variation between links and high volume pinch-points. But is it possible to say something about how these general trends are likely to affect the economy? First, slower traffic means lost time. The corollary of reducing speeds is increased journey times. The lost time caused by the slowing down of traffic in Melbourne between 2006 and 2031 could impose an additional cost to the Melbourne economy of $500 million per year. The BTRE (2007) has projected an increase of 30.3% in total traffic flow (measured in VKT) for Melbourne between 2005 and 2020 under a do-nothing scenario. This increase in traffic flow for Melbourne is estimated to result in an increase in the cost of congestion from $3.02 billion in 2005 to $6.12 billion in 2020. Of this, the business vehicle delay costs of congestion (dead weight loss of travel time plus trip variability) represented around $1.33 billion in 2005 increasing to an estimated $2.70 billion in 2020. About 90% of this would derive from the arterial and freeway network.

3.2.3 Identify other conditions required for transport to be able to impact on development

So far we have outlined how to identify where transport improvements may be necessary for economic development. But how can we know whether it is sufficient? The third step is to identify whether other conditions are in place for transport to unlock economic development.

Rarely is travel itself the motive for a journey. As such, transport can only ever help enable growth that is driven by other factors. The Eddington Study (2006) summarised additional conditions for transport to have an impact on an economy's performance:

- *Economic conditions*: Macroeconomic stability, positive externalities (agglomeration economies, labour market economies), buoyant economy, availability of labour of the right skill and, where relevant, land;
- *Investment conditions:* Macroeconomic stability, well functioning capital markets and availability of capital, timing, structure and location of investment;
- *Political and institutional conditions*: A broader policy environment conducive of investment, supporting legal processes, supporting policies and efficient management of existing infrastructure.

While Eddington argued that these are important conditions to support the contribution of transport to economic growth, Bannister and Berechman (2001) have suggested that all three of these conditions must be present as enablers of economic development.

We now consider each of these conditions in the context of the Australian economy.

Economic Conditions

- The Australian economy has sustained a long period of economic stability. The Australian Treasury in its Budget Statement for 2007–08 forecast real GDP growth at 3.75% for 2007–08, up from 2.5% for 2006–07 (Australian Government 2007). For the period 1996–2006, the average annual rate of growth in GDP in Australia was 3.6% per annum, and the Australian economy is forecast to sustain a rate of around 4% per annum through to 2009. By way of comparison, for the period 1950–60, the average annual rate of growth in GDP was 4% (Australian Government 1965).
- For the past decade, inflation in Australia has averaged 2.5% per annum. The Reserve Bank of Australia seeks to contain the rate of inflation to between 2–3% per annum. The Australian Treasury has forecast the rate of inflation in Australia for 2007–08 at 2.5%, which represents an easing of the rate from 2.75% for 2006–07 (Australian Government 2007).
- The unemployment rate for Australia in 2007–08 is expected to increase slightly to around 4.5% from a level of 4% in June 2007. Interest rates have increased in the first half of 2008 in an attempt to contain increased inflation.

This would seem to support the first of Eddington's conditions that Australia has sustained a long period of economic stability.

Political and Institutional Conditions

- Australia has the lowest level of political instability in the Asia–Pacific region and the fourth lowest in the world (Australian Government 2007c). Since the late 1970s, the Australian economy has been supported by a continuing program of micro-economic reform. These reforms have improved the operation of the financial, manufacturing and service sectors, as well as the labour market. Infrastructure reform through AusLink (Australian Government 2004) has sought to deliver a strategic approach to the planning, investment in and management of Australia's transport infrastructure to meet future challenges arising from the forecast increase in the demand for transport. The Council of Australian Governments (COAG) Urban Congestion Review (COAG 2007) and the Victorian Competition and Efficiency Commission (VCEC) Inquiry (VCEC 2006) would appear to be consistent with this view in their support for management based interventions to improve the efficiency of use of existing infrastructure. Further, the existence of a forum such as COAG and the capacity of institutions such as VCEC and the Productivity Commission to provide independent advice to Government on key issues such as transport indicate that the underlying institutional framework is sound and conducive to intervention and reform of existing structures.

This would appear to support the second of Eddington's conditions. It also suggests that intervention via investment in infrastructure to improve transport efficiency could have a positive impact on the economy.

Investment conditions

- Investment is enhanced by strong economic prospects and a stable political environment. The long term economic and political stability of the Australian economy provides an economic climate conducive to both domestic and international investors. As shown above, Australia has achieved sustained economic growth since World War II. Further, as stated by the Reserve Bank of Australia (RBA):

  The domestic economic and financial environment remains supportive of financial stability; the Australian economy is continuing to grow at a strong pace, with household and business balance sheets, overall, being in good shape … Internationally very few banks of similar size have higher credit ratings [than Australian banks]. … This is consistent with the sound underlying conditions of Australian banks with problem loans remaining low by historical and international standards, and profitability having been very strong for more than a decade (RBA 2007).

This would appear to support the third of Eddington's conditions.

The underlying economic growth in Victoria, Australia and several of its main trading partners is strong. Long term trends also confirm the maturity and stability of the Australian economy. These trends, together with the analysis above, would indicate that all three of the above conditions are met for Australia, in which case investment in transport should have a positive impact on economic growth if it is targeted well at eliminating key current and future capacity constraints. The amount of growth delivered will most likely depend on the availability of workers with the right skills.

3.2.4 Develop solutions to address transport constraints

After identifying future problem areas on the network, the types of users suffering deteriorating conditions and ensuring that the other conditions for transport to affect growth are met, the fourth and last step is to identify the right solutions. The analysis undertaken here points toward a general outline of the transport improvements that Melbourne will need in the future:

- Ensuring good access to ports;
- Ensuring good access to skilled labour; and
- Ensuring good flow across the day for light freight/ delivery.

However, the Eddington Study and Bannister and Berechman both point out that the characteristics of the intervention area, as well as specific features of potential solutions, will determine their success in supporting growth. Eddington (2006) argued that the right process should be to "consider the full range of modal options using appraisal techniques and […] select those that offer the highest returns". A clear recommendation was to ensure the full range of benefits are assessed, including an extended Benefit Cost Analysis (BCA) that accounts for time and cost savings, reliability improvements and wider economic benefits (agglomeration benefits, imperfect competition and labour market impacts). Chapter 4 contains more detail about this process.

3.3 Conclusion

Increasing congestion is placing greater cost pressures on the business sector in Victoria as a result of increasing delay costs and declining reliability of the transport system. However, the available evidence suggests that unless the economic fundamentals are in place transport improvements alone are rarely by themselves sufficient for economic development. Further, rising cost pressures resulting from a congested and overcrowded network transport system alone are unlikely to spell doom for a booming economy.

However, transport improvements do deliver cost savings for businesses, which will contribute to economic growth. In many circumstances, these impacts are only incremental. In a highly competitive economy, these cost savings are passed onto workers in the form of increased wages, to land owners in the form of property rents, to owners as increased profit or to clients and customers in the form of price reductions.

Under certain circumstances transport interventions have the potential to deliver more fundamental changes, acting as a catalyst for economic development. These circumstances occur when:

- Transport needs act as an effective constraint on the economy – by conferring high costs on movements that industries depend on, in the forms of excessive journey times or journey time unreliability;
- Other conditions for growth are met, including economic, investment and policy and institutional factors.

Our research has shown that in the case of Melbourne these conditions are met.

A process for identifying the potential for improvement to Melbourne's transport network to drive an expansion of the city's economy has been outlined in this Chapter. The East–West project is now at the final key stage in this process, where it needs to identify the transport interventions that can best help solve the transport and economic constraints that may limit future growth. To provide the necessary evidence for this selection process, an evaluation of the relative merits of the short-listed options using best practice transport appraisal techniques is required.

The next Chapter extends this discussion by quantifying the contribution of each transport option to economy growth, drawing from overseas and Australian evidence and experience.

4. IDENTIFYING THE ECONOMIC IMPACTS OF TRANSPORT OPTIONS

Transport appraisal is a relatively mature discipline. For some than 30 years transport professionals have been using economic and modelling techniques to estimate the contribution of transport schemes to society.

The current UK appraisal framework is based on the UK Department for Transport's *New Approach to Transport Appraisal*, (NATA). This framework aims to capture the full set of benefits that society derives from a scheme under five objectives: the economy, environment, safety, interchange and accessibility.

The equivalent framework in Australia is the *National Guidelines for Transport System Management in Australia*. Based around the same theoretical underpinnings and aiming to measure the same impacts, the Australian and UK frameworks are, for all practical purposes, consistent. A central element of both frameworks is Benefit Cost Analysis (BCA) which compares the expected stream of project costs against the expected stream of benefits in Net Present Value (NPV) terms usually presented as the Benefit Cost Ratio (BCR). Traditionally, BCA includes estimates that are directly related to the users of the project and those immediately affected by it. For example, in the case of the latter, it does include externalities such as emissions and noise associated with the project.

The main component of the appraisal framework, and almost always the most important contributor to the Benefit Cost Ratio, is the economic assessment. Ideally this should measure what we may call final impacts, e.g. changes to real wages and consumer prices. For instance, reducing the time it takes for an accountant to reach clients will mean increased productivity as less time is 'wasted' travelling. As a result the accounting firm may increase wages, cut prices or increase its profits. Accurately tracing the direct impacts of a scheme, such as time and cost savings to users, as they work through the economy is a very complex task, particularly for a city such as Melbourne with its broad geographical spread of people, places of employment and leisure activities.

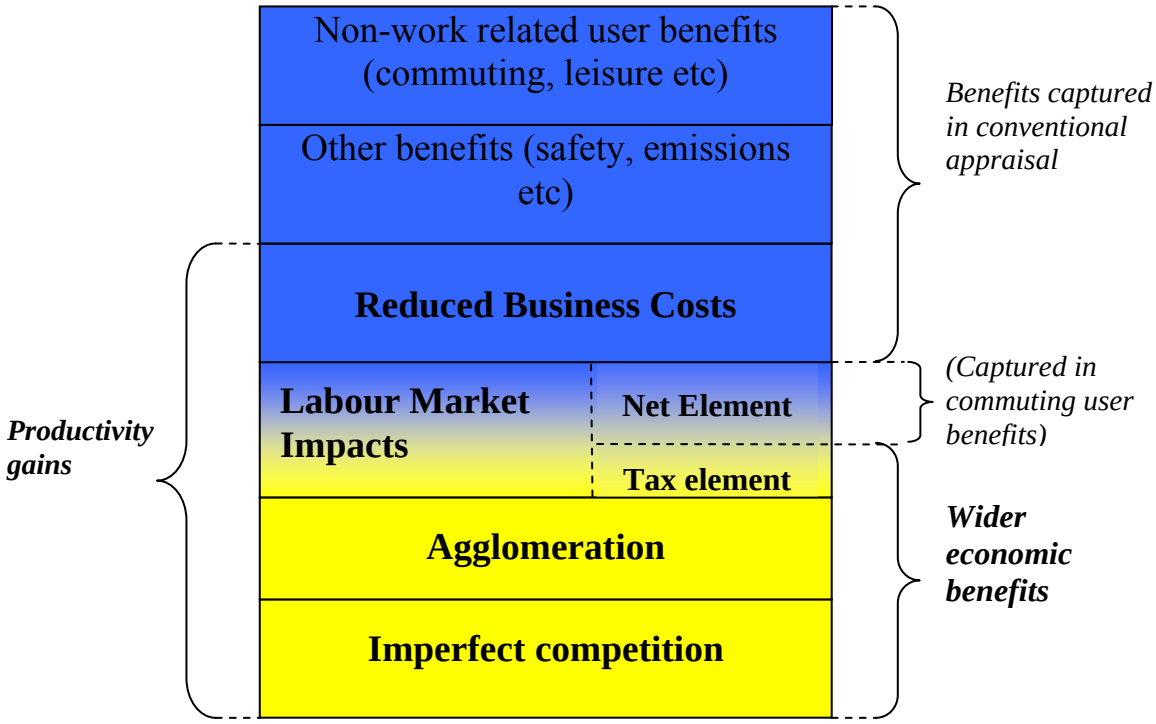
Currently transport project appraisal therefore seeks to measure the direct economic impacts under the assumption that they do neither magnify nor diminish as they pass through the economy. So the sum of the increase in wage, the reduction in price and any increased profit margin should be exactly identical to the value of the time initially saved by the accountant travelling from say Burwood to Essendon.

However, over recent years there has been increasing concern that transport appraisal does not adequately represent the indirect impacts that schemes have on the wider economy. First, concerns have been growing that the appraisal assumption of perfect competition is too strict. A significant amount of literature over recent years has addressed the potential for transport to deliver wider economic benefits – that is, benefits on the wider economy that the current approach to appraisal fails to capture. These additional benefits may arise where market failures cause the direct transport impacts to be magnified as they pass through the economy. New draft guidelines to project appraisal from the UK Department for Transport (DfT) enable the quantification of wider economic benefits caused by agglomeration economies, imperfect competition and labour market inefficiencies (DfT 2005). This approach has been found to add between 5% and 40% to the conventionally measured appraisal benefits. It should be noted that wider economic benefits, which are additional impacts that are not currently within the scope of traditional benefit-cost analysis, do not affect the validity or accuracy of the wider economic benefit assessment.

Second, benefit–cost assessments often do not express benefits from transport improvements in terms that are relevant for many stakeholders. Travel time reductions and cost savings are clearly important, but proponents of new infrastructure project invariably have other objectives to tackle in addition to efficiency gains – for instance in terms of accessibility, jobs, employment and productivity.

To understand the full set of economic impacts of transport schemes, additional analyses beyond the conventional BCA is therefore needed. Figure 13 below seeks to help illustrate the sources of and relationship between conventional appraisal benefits, wider appraisal benefits and productivity impacts. Each of the wider economic benefits identified by the DfT's guidelines are explained in turn.

FIGURE 13: RELATIONSHIP BETWEEN CONVENTIONALLY MEASURED BENEFITS, WIDER ECONOMIC BENEFITS AND PRODUCTIVITY GAINS



4.1 Agglomeration Economies

Agglomeration simply means the geographic clustering of firms and workers. Cities are one type of agglomeration. In cities we often find that wages, rents, transport costs and other prices are higher than elsewhere. The explanation for the desire to locate in cities despite the additional costs must be that firms in a wide range of economic sectors are more productive when they are clustered. For example, the motor vehicle manufacturing sector in Melbourne is highly dependent on a wide range of suppliers of component parts – 62% of all engine and components exports are based in Victoria, while Victoria accounts for 57% of the production of vehicle components nationally amounting to $5.1 billion in annual component production (ABS 2005).

Typically, firms are more productive when near other firms because they have to a wider range of necessary inputs. It is also often argued that proximity to other similar firms increases the chance of acquiring new knowledge and of building connections and networks that support or increase productivity. Research shows, for instance, that face to face contact is very important for some type of business environments. Again, for the motor vehicle manufacturing sector, 70% of automotive research and development is located in Victoria (ABS 2005).

Many firms are also more productive when they have access to a large labour market since this makes recruitment quicker and it is easier to find workers with the exact skills that they are seeking. The benefits of agglomeration are evident from the observation that, as cities grow and become denser, the firms located within them become more productive.

When we talk about density of a city, we really mean the number of firms or workers that are accessible. Rather than number of jobs or workers per square kilometre, it is more intuitive to consider the number of jobs or workers located within X generalised minutes[7]. In other words, the role of transport in supporting accessibility, and therefore agglomeration, is important. If transport is made cheaper or quicker, more firms and workers will be located within reach and, according to the literature on agglomeration, productivity will increase. Importantly, these agglomeration benefits are additional to those already captured in benefit–cost appraisal.

The DfT's guidelines outline how agglomeration benefits of a transport scheme can be calculated. The methodology uses detailed transport model outputs, economic data (such as employment and productivity) and specific evidence on agglomeration derived for this purpose.

4.2 Time and Cost Savings to Travel in the Course of Work

This element of appraisal focuses on the assumption that travel in the course of work is usually not productive in itself and reducing the time taken in transit frees up time for additional productive activity. That is, time spent travelling under high levels of congestion generates a cost to business, as shown in Chapter 2. When an individual saves one hour travelling during work time, appraisal values this time at the gross cost to the firm of the worker's time (i.e., hourly wages plus national insurance contributions and other labour related costs). Identifying the productivity gains from business cost savings is therefore simple – they are identical to the business impacts as identified in the conventional transport appraisal.

4.3 Imperfect Competition

Notwithstanding the above, the main reason for measuring time savings in the course of work is to identify the additional value to society of the activity a worker can undertake once their travel time has been reduced. Under the assumption of perfect competition the two values determining this overall gain (hourly labour cost and hourly productivity) are identical, so the reduction in labour costs is a good approximation of the productivity benefit.

However in the real economy firms are typically able to charge more for their products and services than they cost to produce. This means that the value society places on the worker's output from one hour's work (i.e. the price of whatever the worker makes in one hour) is higher than the cost of the worker's time to the firm.

[7] Generalised time is a composite measure of the perceived distance between locations, which takes into account journey time, waiting time and money costs converted into time units.

By valuing a worker's saved time at the level of costs to the firm rather than the value to society, current transport appraisal underestimates the benefits of work based travel time savings. Research has shown that these 'missing' benefits are equivalent to some 10% of conventionally measured user benefits to freight and business travel.

4.4 Labour Market Impacts

4.4.1 Productivity gains of commuting cost reductions

When individuals make decisions about whether to work, how much to work and where to work, they take many factors into account. Importantly they balance the financial gains against what we may call personal costs (e.g. giving up leisure time). If the financial returns to work increase or the personal costs decrease, more individuals are likely to choose to work, whilst some of those who already do will decide to work more or in more productive (and more demanding) jobs. The result is increased productivity.

The monetary costs of travelling to work reduce the financial gains from working, whilst commuting time increases the personal costs. Both therefore tend to reduce productivity, and we can measure the productivity impacts of changing commuting costs by assessing the resulting employment changes:

- The impact of more people working is assessed using evidence on labour supply responses to changing wages.
- The impact of more people working in more productive jobs can be assessed using land use – transport interaction (LUTI) models or by a simpler approach treating model forecasts of travel to work as proxy for employment location.

This effect is distinct from any impact that a scheme may have on the rate of unemployment. It is generally accepted among economists that long term unemployment rates are determined by structural and macroeconomic factors – in particular the flexibility of the labour market. There is a concept of a 'natural' rate of unemployment that keeps the macroeconomic instruments balanced. A lower rate of unemployment would create wage and inflationary pressures, which would force the Reserve Bank to increase interest rates until unemployment rate returns to its natural level. At a higher rate of unemployment, the Reserve Bank would lower interest rates in order to encourage increased activity levels. Within such a framework it is hard to see how transport improvements could have anything but a passing impact on unemployment rates[8].

[8] In theory, reduced transport costs could reduce the natural rate of unemployment by shifting the labour supply curve, but the impact of any one scheme will be small.

4.4.2 Wider welfare gains of commuting cost reductions

Transport appraisal counts the welfare benefits of commuting time savings by measuring individuals' willingness to pay. For those individuals who, following the introduction of improved transport services, decide to work or to work longer, the welfare benefits will be lower than the productivity gains. This is because welfare gains are net of the increased personal costs of giving up spare time.

But there is another reason why these individuals' willingness to pay for commuting time savings is lower than the productivity gains, which is not taken into account under traditional benefit–cost appraisal. Because of labour related taxation and other contributions (income tax, Medicare contributions, contributions to superannuation schemes, etc), the return to the worker as a result of extra effort (i.e. net wage) is lower than the value to society (i.e. gross wage). For this reason, where individuals change labour market decisions because of a transport scheme, the consequent tax changes are additional to the benefits currently captured in appraisal. These additional benefits could amount to about 30% to 40% of the labour market productivity gains.

4.5 Case Studies from the UK

The methodology for assessing Wider Economic Benefits (WEBs) has been applied to a number of transport schemes in the UK. This work has helped prove the robustness of the methodology and that provides sensible results. It has also provided a number of insights into when and where WEBs tend to be an important addition to conventional appraisal and how it may affect the prioritisation of schemes. The results are set out in Table 4 below.

TABLE 4: CONVENTIONAL AND WIDER ECONOMIC BENEFITS FROM UK SCHEMES ($M)

Type of scheme	Scheme	Conventional benefits	In proportion to conventional benefits			
			Agglomeration	Imperfect competition	Labour market	Total additional
Urban Rail	Crossrail	30797	24%	4%	28%	56%
Urban Road	Leeds to Bradford Highway Improvmetns	2983	30%	6%	5%	41%
Urban Road	Leeds Urban Area Highway Improvements	7966	31%	5%	3%	39%
Inter-Urban Road	Leeds to Sheffield Highway Improvements	2911	24%	6%	-2%	28%
	Average		***16%***	***4%***	***4%***	***24%***
Urban public transport package	Leeds to Bradford Public Transport Improvements	1385	18%	3%	2%	23%
Inter-Urban Road	A46 interurban road	2104	13%	6%	1%	20%
Urban Bus	Intra Leeds Bus subsidy	3588	13%	2%	2%	18%
Inter-Urban Road	M6 shoulder running	2682	11%	5%	0%	17%
Urban public transport package	Leeds Urban Area Public Transport Investment	20150	11%	3%	2%	16%
Area-Wide Bus	West Yorkshire County Bus subsidy	12223	10%	2%	2%	15%
Area-Wide Bus	South and West Yorkshire Bus subsidy	32134	8%	3%	2%	12%
Area-Wide Bus	South Yorkshire County Bus subsidy	8088	3%	3%	0%	5%

To highlight the findings and draw some tentative conclusions we discuss three schemes in further detail.

4.5.1 Crossrail

Crossrail is a passenger rail project linking London's Paddington (West) and Liverpool Street (East) termini by a tunnel crossing central London. Its main objective is to increase rail capacity at peak periods and relieve heavily crowded commuter rail and underground services into central London. Crucially it will stop at Canary Wharf, a rapidly growing financial district to the east of the traditional city district. This is seen as essential in enabling Canary Wharf's planned expansion over the next 20 years, by allowing more commuters to access the sites and dramatically reducing travel times for commuters who, in the absence of this intervention, would need to interchange onto the tube after arriving at London's western rail termini.

Crossrail also includes services to Heathrow airport – again an essential element to support London's financial districts by significantly cutting surface access times from much of central London to the UK airport with the widest range of international destinations.

Accordingly, a large proportion of the scheme's benefits arise from reduced travel times for commuters and high value business journeys to and from the airport. The scheme is, however, very expensive and has only a moderate benefit–cost ratio of about 1.7.

The assessment of Crossrail's wider economic benefits reveals striking results. By increasing the size of central London's labour catchment area, there are two significant productivity gains that are not counted in the user benefits. First, agglomeration economies add 24% to the conventionally measured user benefits. The already highly agglomerated capital enjoys large gains from associated economies of scale. Although the impact is relatively modest, less than $50 per worker per year, it adds up to large benefits for Europe's largest city.

Second, Crossrail enables a large expansion of the highly productive sectors located in the city centre and in Canary Wharf. Some 30 000 jobs are expected to be displaced to central London if the scheme goes ahead. Each of these jobs will be some 30% more productive than the displaced jobs (i.e. workers will be 30% more productive in central London than they were in their previous locations/ positions, essentially because of agglomeration). This leads to wider economic benefits that add almost 30% to user benefits.

The first impact – agglomeration benefits – captures the increased productivity of existing central London activity, whilst the second – displacement of jobs – captures the increased productivity of the additional central London workers. This is important, as it means the two impacts are additive.

When the full range of benefits from Crossrail is captured, the benefit–cost ratio increases from 1.7 to 2.6.

4.5.2 A46

The A46 scheme is a proposed dualling of an inter-city trunk road in the East Midlands region. It currently carries a substantial amount of freight to and from ports as business travel to and between a number of urban areas in the region. The majority of the user benefits therefore fall to business travel and freight. The Wider Economic Benefits were found to add about 20% to these user benefits, the majority of which were driven by agglomeration economies from better integrating the urban areas in the region.

4.5.3 Area-wide bus subsidy

This analysis assessed notional reductions in fares and increases in frequency for urban, inter-urban and rural bus services in the Southern and Western parts of the Yorkshire and Humberside region.

Given the nature of the improved services, the largest gain would relate to travel for non-work purposes, although moderate benefits would also be enjoyed by commuters. Two separate tests were modelled, one in the prosperous and metropolitan West Yorkshire area – the other in South Yorkshire, which is a designated regeneration area. They both returned similar benefit–cost ratios, at around 3.

Looking at the wider economic benefits, however, there is a significant difference between the two. The West Yorkshire intervention led to 12% additional benefits, whilst South Yorkshire would achieve 5%. Most of this difference is explained by the level of agglomeration benefits.

4.5.4 What can we learn from our experience so far?

There are a number of important conclusions we can draw from research and analysis being undertaken so far:

We have a working methodology for assessing the wider economic benefits of transport

The methodology, when applied as intended, gives sensible and intuitive results within the expected ranges. We see consistencies in findings when similar initiatives are tested using different transport models, which helps give confidence. Most often there are intuitive explanations for why some initiatives generate better results than other similar initiatives.

The wider benefits can be significant and have the potential to change prioritisation

Our case studies illustrate this – the benefit–cost ratio of Crossrail increases by more than 50%, whilst only minor wider benefits were found for the South Yorkshire bus subsidy.

Wider benefits are non-trivial and it is difficult to gauge their importance without doing a full assessment

Although we can begin to speculate about when and where wider economic benefits may and may not be important, they appear to be too scheme specific to make simple adjustments to the conventional Benefit Cost Analysis. As shown in Table 4, benefits from the three, seemingly similar, inter-urban road schemes generate wider benefits of between 17% and 28%, of which the variation in agglomeration impacts is between 11% and 24%.

That said, we can draw some lessons about wider economic benefits:

Initiatives in large cities

We tend to see larger impacts in larger and more densely developed urban areas – West Yorkshire higher than South Yorkshire, London higher than anywhere else.

Initiatives that particularly affect business travel

Initiatives such as intra-city improvements or ports access (air or sea) tend to bring a large proportion of benefits to business travel and freight, which can be the most important drivers of agglomeration impacts. This partly explains why in our case studies we found A46 and Crossrail to deliver significant additional gains, whilst there were little extra for area-wide bus subsidies.

Initiatives that improve connectivity between nearby cities

These tend to have a particularly positive impact on the size of labour markets (effectively allowing nearby cities to merge their respective travel to work areas) as a high proportion of trips tend to be for business purposes.

Road, and to some extent rail, initiatives

Road and rail have a higher proportion of economically important journeys, whilst tram, bus and other modes are typically for lower value journeys and for non-work purposes.

4.6 Application to Melbourne East – West Links Assessment

That the methodology has been applied with proven results in the UK context does not necessarily ensure transferability to the Australian or Victorian contexts. There are two aspects that may affect the applicability of the UK guidelines for our purposes.

The extent to which the benefits captured in the UK guidelines are additional to those normally captured in Australian BCA will depend on the scope of the latter. For instance, the missing benefits related to "imperfect competition" will depend on how business time savings are valued. In the UK they are estimated at the labour costs to the firm. If the equivalent value of time used in Australian BCA is a more complete measure of time savings to firms, this element of wider benefits may not be additional.

Apart from this, our initial review of the UK as opposed to the Australian approach to BCA has indicated that they are sufficiently consistent to consider the wider benefits to be fully additional in both contexts. This means that there is scope to apply the UK methodology to estimate the indirect benefits that could flow to the wider economy as a result of undertaking initiatives to improve transport efficiency in Melbourne. From the UK experience, these wider economic benefits could be substantial by enhancing productivity gains by industry.

The previous section discussed the characteristics of transport projects in the UK that seem to be associated with larger wider economic benefits. This is not, however, a comprehensive list of drivers of high wider economic benefits. The purpose of discussing these instances was merely to observe some common themes from the UK evidence.

Having said this, the nature of the East–West Link initiative is such that it meets a number of these characteristics, in particular:

- It is an initiative in a large city;
- It is likely to particularly affect business travel; and
- It involves significant road infrastructure investment.

Furthermore, whilst the East–West Link is not intended to connect two cities (an instance where high wider economic benefits were observed in the UK), neither did Crossrail, which displayed the largest wider economic benefits (in proportion to user benefits) of all the schemes that have been assessed.

It has been argued that Melbourne differs from London in terms of population density and thus the methods for deriving wider economic benefits are not transferable. Whilst looking at population comparisons alone may support this conjecture, by measuring or considering density different ways, Melbourne is still a key and dense city:

- Employment density in the CBD is 25% higher than London;
- The driver of high WEBs may perhaps more accurately be expressed as a city's rank-order. That is, how large and important the city is compared to other economic centres. This is because many types of industrial sectors will only locate in one of the largest cities in a country/ region and it is these sectors that tend to benefit from agglomeration economies.

4.7 Conclusions

Congestion in Melbourne has emerged as a key issue for the Victorian Government with increasing attention being given to initiatives to reduce the cost of congestion to society. Recent high rates of economic growth experienced by the Australian and Victorian economies have placed greater demand on the transport system to deliver increased levels of efficiency and reliability that can sustain that growth into the future.

This requires greater sophistication in the analysis of options to deliver outcomes that meet the broader expectations of society. Traditionally, benefit–cost analysis had been used in Australia to assess infrastructure projects, including some notable applications such as the Ord River Scheme (Davidson 1972). Such analyses have sought to estimate their direct impacts on users of the infrastructure.

Recent applications of economic appraisal of infrastructure projects have recognised the flow-on effects from such investment to the broader economy, including productivity gains to labour through more efficient combining of resources and skills resulting from the better co-location of firms. While these indirect benefits accrue to the wider economy, they are easily quantified. As a key connector for economic activity, transport logistics and distribution would seem to play a central role in facilitating the realisation of those potential productivity gains.

The motor vehicle manufacturing industry in Australia has recognised the existence of such benefits through its attempt to extend the productivity gains brought about by economic reform by seeking to extract higher productivity through a more efficient transport and distribution sector given its dependence on suppliers of components to the production process.

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Appendix 1

A1 Freight and the Victorian Economy

A1.1 Trends in Freight

Since 1995, the Australian and in particular the Victorian freight networks have been handling a significant increase in freight volumes. This trend is expected to continue in the future. Further, given the forecast continued growth in GDP, there is expected to be a doubling of the national freight task from its 2000 level by 2020 (NTC 2006). This increase in freight volumes is expected to occur across most of the nation's networks and will lead to further demands for infrastructure investment and management to meet the expected doubling of the freight task across Australia.

A direct effect of increasing freight volumes has been the increase in the size of transport vehicles and rolling stock used to move freight.

- Interstate train lengths have increased from 12 00 metres to 15 00 metres on the east coast rail networks and the double stacking of containerised freight on the major Adelaide to Perth rail path is becoming the norm. Continued capital investment by both the Victorian and Australian Governments and key government agencies is designed to increase the efficiency of both the Victorian and national rail networks.
- On the roads, truck lengths and load carrying capacity have increased. B doubles have become common in urban areas and B-triples have a national road network outside Victoria. The National Transport Commission's program of developing and implementing Performance Based Standards (PBS) for road vehicles is aimed to enhance the productivity of the road freight industry and to extract more benefit for the road dollars spent.
- The size of ships operating in Victorian ports has also been increasing: grain and container ships are increasing in size as ship owners seek to lower costs by using more cost efficient ships to cope with the increase in trade through ports.

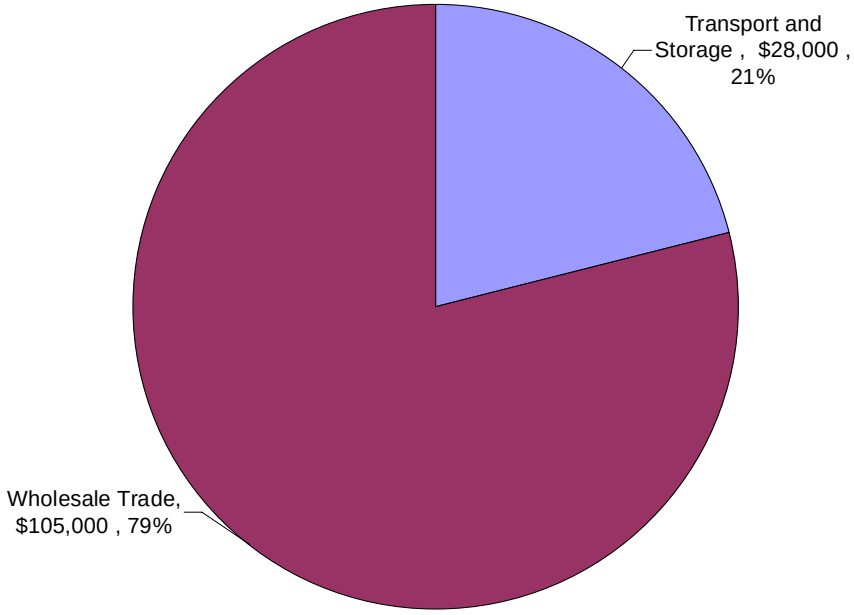
Connecting infrastructure from Victorian Transport Distribution and Logistics (TDL) networks to new freight centres will need to be designed to accommodate the changes outlined above.

The trade carried by Victoria requires sophisticated TDL services to accommodate its variety, value and volumes. The State's exports of dairy and agricultural products require food quality and temperature controlled storages. Imports of highly valuable and hazardous chemicals as raw material for the plastics industry and extensive chemical production facilities require state of the art storage and handling facilities.

A2 Economic Impact of TDL Networks

Statistics on employment within the TDL sector are classified by the Australian Bureau of Statistics as 'Transport and Storage' and 'Wholesale Trade'. In 2005-06 the TDL sector in Victoria is estimated to have generated approximately $133 billion[9] in income, with wholesale trade contributing 79% and transport and storage contributing 21%, as shown in Figure 14. The ABS has estimated that the TDL industry is responsible for 8.9% of Victoria's GSP and 238,000 jobs (ABS 2007). Work commissioned by the Victorian Government more recently, using a broader definition of the TDL industry found that the employment contribution was in the order of 334,000 jobs and the GSP contribution 14.7% (Victorian Government 2007b).

FIGURE 14: VICTORIAN TDL INCOME BY SEGMENT ($M)



Victoria's TDL networks are the key systems on which major Victorian economic activity takes place. It is an accurate statement to say that without these TDL networks all Victoria's trade, manufacturing and service economies would cease.

A number of studies have recently evaluated the economic impact of the principal export TDL systems in and around Melbourne. They provide further indication of maintaining efficient and competitive exports and imports infrastructure to Victoria.

[9] This estimate is based on 2005–06 estimates of economic activity by industry under ABS Catalogue 8155.0

A2.1.1 Melbourne Airport

The economic value of Melbourne Airport is approximately $536 million annually to Victorian GSP and leads to the employment of over 10 000 persons. The lack of a curfew on airport operations is estimated to add approximately $268 million annually to the Victorian economy and over 4 000 jobs (Sinclair Knight Merz, 2003) in 2006/07.

A2.1.2 Victorian Ports

The Victorian port sector contributes over $3 billion annually and almost 16 000 jobs to the Victorian economy as shown in Table 5.

TABLE 5: CONTRIBUTION OF VICTORIAN PORTS TO STATE GSP AND EMPLOYMENT

Port	Contribution to Victorian GSP ($ millions)	Employment (full time equivalent)
Port of Melbourne	2 500	13 748
Port of Geelong	328	1 385
Port of Hastings	67	241
Port of Portland	122	509
Total Contribution	**3 017**	**15 883**

A3 Infrastructure and Expenditure

Efficient and effective TDL infrastructure is vital for the Victorian economy. Victoria currently has high quality road, rail and port systems with the initial infrastructure investment, often 30 years old, still being used and expanded both for current and future use[10]. Continuing investment in TDL infrastructure will be required if Victoria is to compete both locally and in global markets.

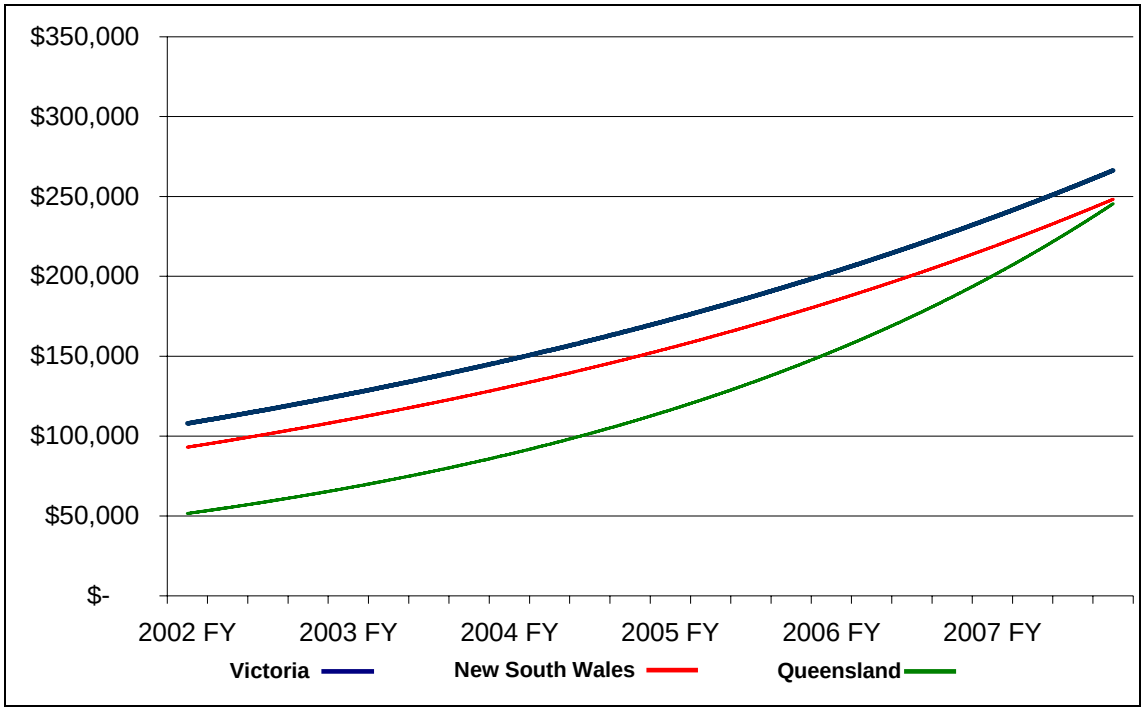
The increase in expenditure on infrastructure in the Victorian TDL sector, as measured by the value of completed construction of TDL fixed assets[11], has broadly followed the increase in the freight task handled, which has been fuelled by Australia's strong economic growth since the mid 1990s. TDL infrastructure investment has tended to lag demand rather than lead demand with TDL services often facing capacity constraints as the current infrastructure does not meet demand. TDL industries have partially overcome the capacity constraints by using higher productive equipments, but there are still required steep improvements in TDL capacity on a regular basis; this is particularly evident in the road networks where capacity increases are required on a frequent basis.

[10] The initial development of Swanson Dock in 1968 was for a one berth container terminal with two container cranes and a total throughput of 160 000 containers. Swanson Dock in 2007 has eight berths and a throughput of 2 million containers with a predicted capacity of 3.5 million containers by 2020.
[11] 8752.0 - Building Activity, Australia, Feb 2007

The lower levels of spending on TDL infrastructure in the 2002–2003 periods, shown in Figure 15, reflects the lower level of activity following the economic slowdown after September 2001 and the widespread drought that affected eastern Australia in 2002–2003.

This slowdown in the growth of spending on TDL construction was mirrored in a reduction in TDL employment reflecting the lack of certainty that TDL businesses felt about expanding their businesses during that time. The strong acceleration in expenditure on TDL construction since 2004, in particular the growth in spending in Queensland, reflects the general improvement in economic conditions nationally.

FIGURE 15: AVERAGE QUARTERLY EXPENDITURE IN TDL CONSTRUCTION BY STATE ($000) 2002/07



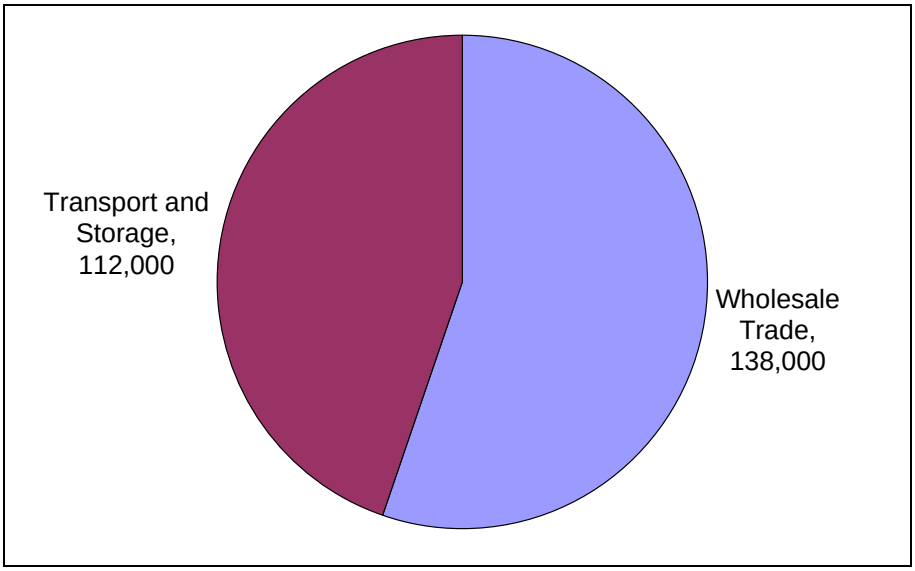
Retail/wholesale Trade - Buildings primarily used in the sale of goods to intermediate and end users.
Transport - Buildings primarily used in the provision of transport services, and includes the following categories:

- Passenger transport buildings (e.g. passenger terminals)
- Non-passenger transport buildings (e.g. freight terminals)
- Commercial car parks (excluded are those built as part of, and intended to service, other distinct building developments)
- Other transport buildings

A4 Transport Distribution and Logistics Employment for Victoria

The TDL sector, with its associated supply chain services, generates employment within, and attracts investment income to, the metropolitan and regional communities of Victoria. In Victoria, 250 000 people were employed in the TDL sector in February 2007, representing 6% of total Victorian employment. As shown in Figure 16 for the TDL sector, transport and storage employs 112 000 people, while 138 000 people were employed in wholesale trade[12]. Efficient transport links across Melbourne are also important in ensuring that the necessary skilled labour has good access to places of employment.

FIGURE 16: EMPLOYMENT IN THE VICTORIAN TDL SEGMENTS 2007



Source for all employment data is ABS 2007.

A5 Trade Flows within Melbourne between Victoria and the rest of Australia

A5.1.1 Maritime Trade

The maritime trade passing through Victoria's ports, while representing only 5% of the volume of all Australia's maritime based trade, comprises almost 40% of its total value. Victoria moves over $73 billion of trade across its wharves[13], of which $60 billion is through Melbourne.

[12] As reported in Australian Bureau of Statistics Labour Statistics, May 2007.
[13] 5368.0 - International Trade in Goods and Services, Australia, May 2007.

A5.1.2 Interstate Freight

Over 20 million kilo tonnes of freight moves between Melbourne and the other major capital cities each year. Road is the dominant modal choice for carrying freight between east coast capital cities. Rail is the preferred mode for moving freight to and from Western Australia. While this is not the case on the eastern seaboard, planned upgrades on the main rail network between Melbourne and Brisbane are expected to encourage more freight onto rail.

Over the last ten years, the volume of freight handled by the Victorian TDL network has grown at more than 5% per annum across air, sea and road, and growth on rail reached almost 10% (see Table 6)[14]. This decade of steady growth has faltered on only two occasions. The first was a minor slowdown in 2002 that reflected the global economic trends in the aftermath of September 11, 2001. The other more peaked slowdown was a reflection of significant changes in the demand for TDL services that occurred as a result of drought conditions in 2001–2003.

[14] Although the measures in Table 6 differ from the net-tonne kilometre measure of the Bureau of Transport and Regional Economics, the growth rates for the period correlate with those expressed in *Report 112: Freight Measurement and Modelling in Australia* (BTRE 2006)

TABLE 6: VICTORIAN FREIGHT TASK 1996–2005

Freight Task	Air[15]	Sea[16]	Road[17]	Total Rail	Interstate Rail[18]	Intrastate Rail[19]
Units	Tonnes (000)	Tonnes (Million)	Tonne Kilometres (Billion)	Gross Tonne Kilometres (Billion)	Gross Tonne Kilometres (Billion))	Gross Tonne Kilometres (Billion)
1996	156	29.6	23.9	11	9	1.70[20]
2005	235	46.8	36.6	20.36	19	1.36
Change '96–'05	51%	58%	54%	85%	111%	-20%
Growth[21]	5%	5%	5%	7%	9%	-2%

A6 Trade Flows through Port of Melbourne

The port of Melbourne is Victoria's largest port and Australia's largest container port, handling over 2.1 million TEU[22], nearly 40% of the Australian total during 2006–2007 (Port of Melbourne data). Of this number, a little less that 20% is cargo originating in other domestic locations, the overwhelming majority of which is short-haul ferry trade carried between Northern Tasmanian and Melbourne.

[15] Maritrade data estimates Victoria having 28% of the national air freight task in 1996 and 33% of the national air freight task in 2005 (Maritrade, 2005)

[16] Meyrick in-house analysis of Victorian port data sets

[17] BTRE data sets, State road freight task estimates and projections (share of aggregate freight task model)

[18] GTK Data based on Melbourne to Albury and Melbourne to Adelaide corridors from ARTC Annual reports for 2004/05, and scaled estimate based on ARTC Annual report 1998-99 data

[19] Data taken from Pacific National submission to the Review of Victorian Rail Access Regime - "2006 Forecast Model Vic PN Network V 1 - Actual Data"

[20] 1996 estimated volume on interstate rail based on comparison of Victorian rail freight task as measured by Pacific National GTK data with BTRE TK data for 2001 and 1997 periods.

[21]CAGR is the Compound Annual Growth Rate, which is the compound rate of annual change for the task over the period.

[22] Twenty foot equivalent units

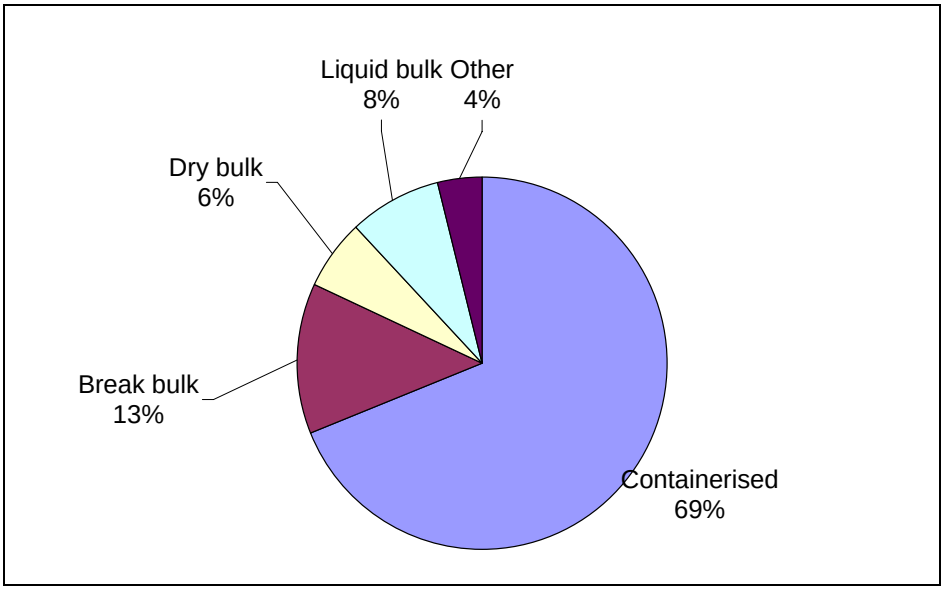
In addition, Melbourne also handles most of Victoria's imports and exports of non-containerised general cargo, with motor vehicles (imports and exports), paper and newsprint (imports and exports), timber (imports) and iron and steel (exports) being particularly important components of this category (see Figure 18).

Melbourne is also an important port for the import of liquid bulk cargoes. The largest component of this group is crude oil, mostly from overseas sources with volumes varying up to two million tonnes per year. Refined petroleum products are also both imported and exported, with total movements roughly equal in volume to crude imports. Most of the State's supplies of liquid chemicals for a wide variety of manufacturing activities are also imported through the port of Melbourne.

Dry bulk cargoes make up a comparatively minor share of the total trade of the port of Melbourne, although the opening of a new grain terminal in 2000 has added 1.2 million tonnes to this category, almost doubling total dry bulk exports through the port. However, the 2005–2007 drought reduced grain exports to one-third of previous levels. The other important bulk commodities are all imports: cement, sugar, gypsum and fertiliser.

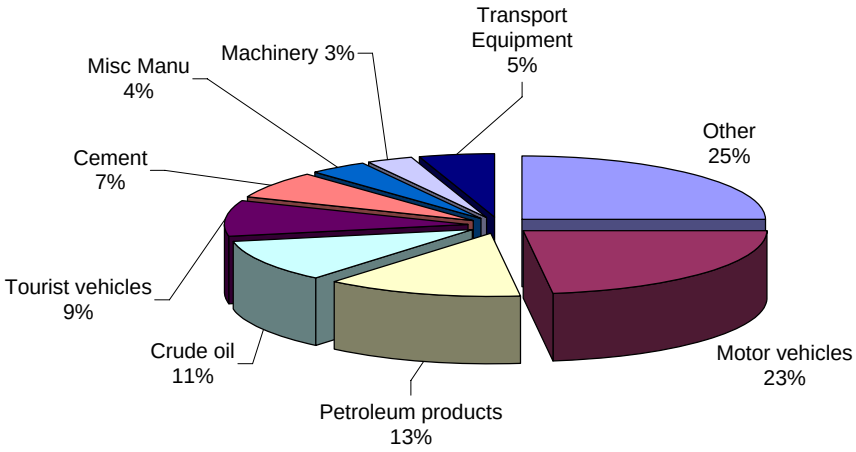
Melbourne is also Victoria's main port for passenger movements, catering for both cruise vessels and Bass Strait ferry operations at Station Pier in Hobson's Bay.

FIGURE 17: PORT OF MELBOURNE CARGO VALUE BY TYPE 2005/06



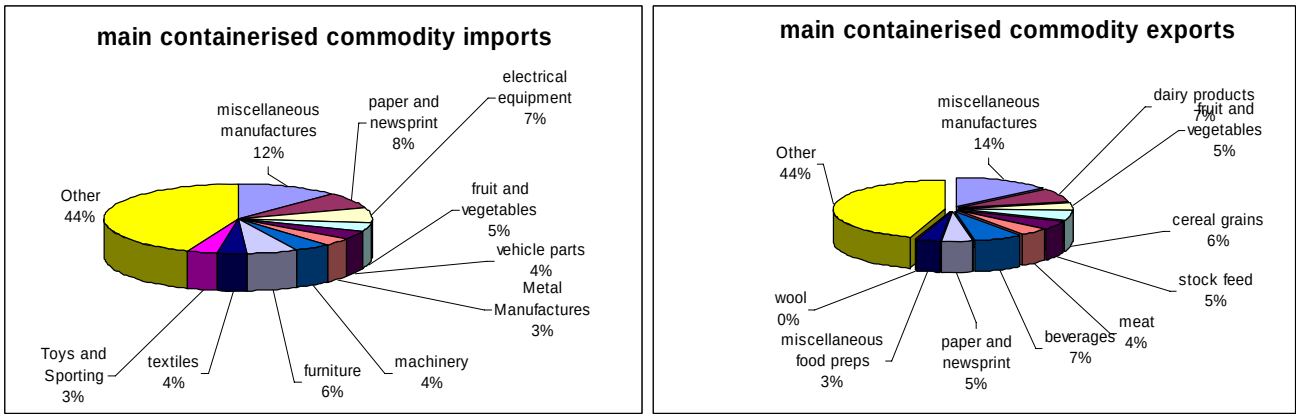
Non-containerised trade through the port of Melbourne has a substantial mix of cargo, as shown in Figure 16.

FIGURE 18: PORT OF MELBOURNE COMPONENTS OF NON-CONTAINERISED TRADES 2005/06



Containerised trade through the port of Melbourne has a significantly different mix of cargo in the import category compared to the export category, as shown in Figure 19.

FIGURE 19: PORT OF MELBOURNE COMPONENTS OF CONTAINERISED TRADES 2005/06



A6.1 Changes in the Patterns of Containerised Trade

As shown in Table 7, there was significant change in the type of commodities in containerised cargo in the period 2002–2006 when drought reduced agricultural exports and there were increased imports of electrical equipment and furniture.

TABLE 7: CHANGE IN CONTAINERISED COMMODITY PRODUCTS 2002–2006

Imports		Exports	
Miscellaneous Manufactures	-5%	Miscellaneous Manufactures	-11%
Paper And Newsprint	-28%	Dairy Products	-26%
Electrical Equipment	21%	Fruit and Vegetables	-24%
Fruit And Vegetables	-12%	Cereal Grains	0%
Vehicle Parts	-23%	Stock Feed	2%
Furniture	94%	Meat	-9%
Textiles	19%	Beverages	68%
Machinery	29%	Paper And Newsprint	13%
		Miscellaneous Food Preparations	-3%
		Wool	-100%

A6.2 Future Port of Melbourne Growth

The forecast growth in trade through the port of Melbourne, while low by comparison with our Asian trading partners, still results in a dramatic increase in the freight task by 2035 with containerised freight quadrupling in number and bulk freight doubling in tonnage in most cases (see Table 8).

TABLE 8: TRADE FORECASTS PORT OF MELBOURNE

Description	Units	2005	2010	2020	2035	CAGR 2005-35
Overseas Containers	TEU	1 490 373	2 061 940	3 553 621	7 056 748	5.32%
Mainland Containers	TEU	80 000	105 001	154 999	230 001	3.58%
Bass Strait Containers	TEU	313 185	416 420	658 923	1 150 253	4.43%
Total International and Domestic	TEU	1 883 558	2 583 361	4 367 543	8 437 002	5.13%
Bass Strait Non Containerised	Tonnes	5 147 993	6 731 811	10 357 927	17 632 037	4.19%
Break Bulk (Cars, Steel, Timber)	Tonnes	850 517	956 501	1 108 362	1 246 051	1.28%
Dry Bulk (Grain, Cement, Gypsum)	Tonnes	4 278 058	4 476 888	5 592 390	7 589 343	1.93%
Liquid Bulk (Crude and Refined oils)	Tonnes	3 409 172	3 997 065	5 313 228	7 044 172	2.45%

A7 Urban Freight

A7.1 Relationship between Economic Activity and Freight Movement

The movement of urban freight in Australia is related to the underlying economic activity in each state as measured by State Gross State Product (GSP) or nationally by Gross Domestic Product (GDP). As shown in Figure 20, there is a strong correlation between Australian GDP and urban freight movements.

Further, from Figure 21it can be seen that there is a systematic relationship between Victorian GSP and urban freight movement (as measured by BTRE freight data) for the period 1990 to 2004.

FIGURE 20: RELATIONSHIP BETWEEN AUSTRALIAN GDP AND URBAN FREIGHT MOVEMENTS

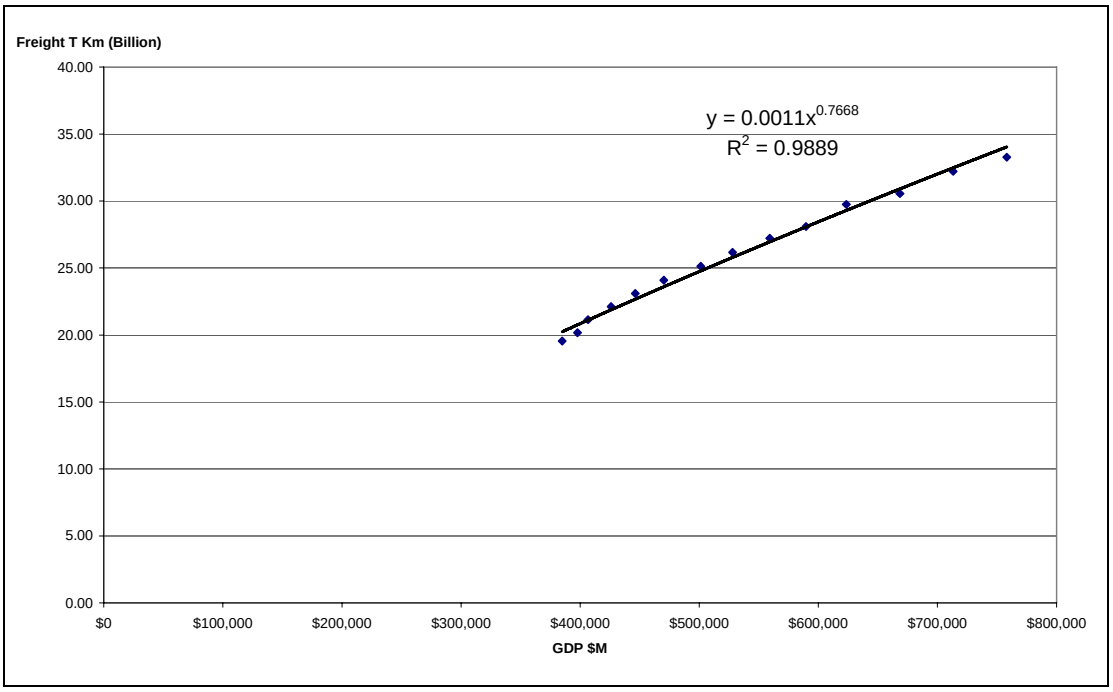
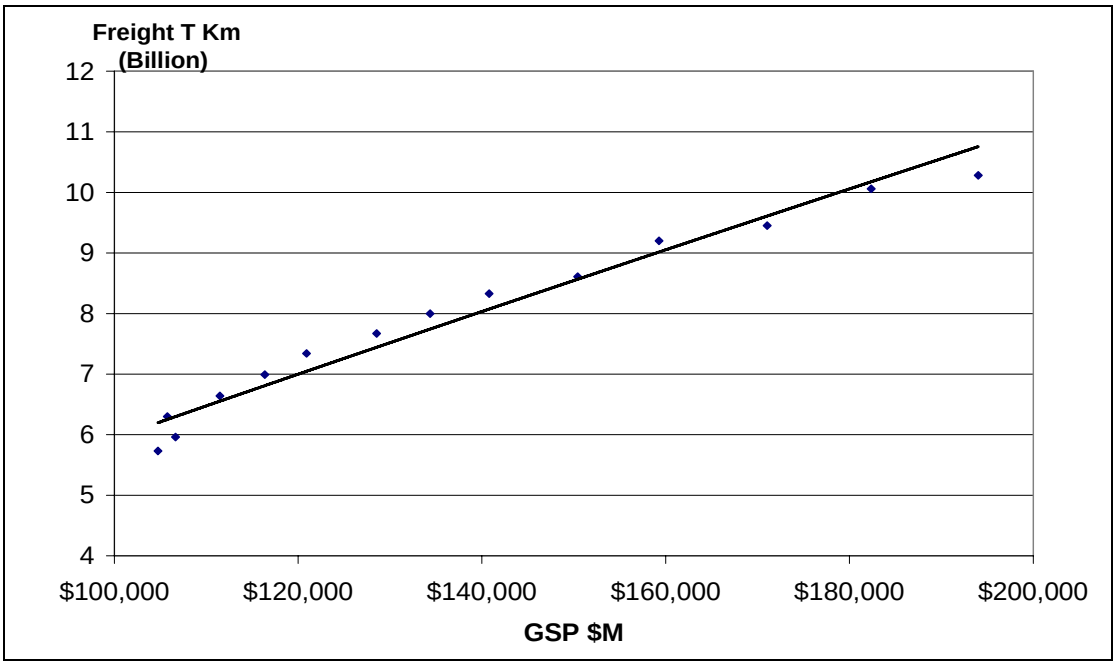


FIGURE 21: RELATIONSHIP BETWEEN GSP (1990–2004) AND URBAN FREIGHT



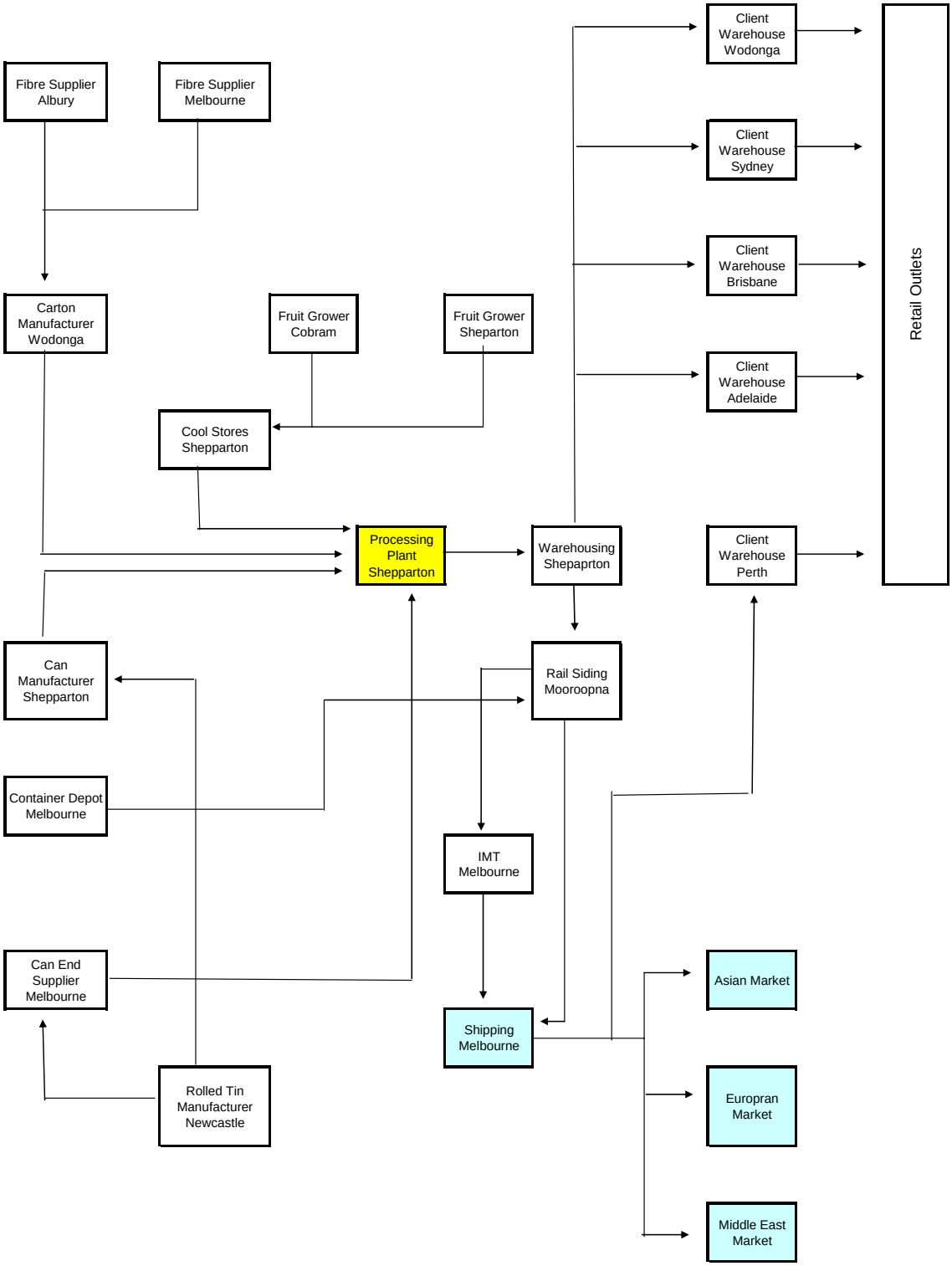
Appendix 2

A.1. The Movement of a Can of Peaches

A Can of Peaches

- The production, sale and distribution of a can of peaches to the domestic or export market uses at least **seven vehicle and three transport infrastructure types**:
  - On-road utilities, light commercial vehicles (1-2 tonne vans), tractors and trays, semi trailers, B-doubles, over these **road types**: rural roads, state and national highways, metropolitan streets and freeway systems, and on-port roads and loading facilities located by major distributors (Hume Highway and Western Ring Road and Footscray Road) in Melbourne.
  - Single stack **rail wagons** carrying containers on single line from loading/unloading facilities at the rail siding/storage facility at Mooroopna to the Port of Melbourne. The journey may be interrupted by a stop for reconsolidation of the load at Somerton IMT.
  - Intermodal facilities: Loading and unloading of consignments to increase the value of the freight delivered is a necessary feature to allow economies of scale in delivery relatively uneconomic products.
- On-road delivery meets domestic freight transport requirements for grower to factory to warehouse to client and allows peach orders to be filled in a timely and efficient way. However, by sitting its warehouse adjacent to the Western Ring Road, the contractor is adding to traffic on and off the major arterial.
- On-rail delivery in most cases meets freight transport needs for containerised orders to export port. However, constraints such as meeting vessels sometimes makes rail unsuitable and forces containers back on-road.
- Whether by road or rail, vehicle movements are duplicated along the chain, whether it is the return of empty containers to Mooroopna or the return of an empty LCV to the contractor's warehouse by the Western Ring Road.

The information for this case study was reviewed by SPC/Ardmona, based at Shepparton and Mooroopna in the Goulburn Valley, Victoria. An overarching schematic of the SPC supply chain is provided below.


Fibre Supplier Albury
Fibre Supplier Melbourne
Carton Manufacturer Wodonga
Fruit Grower Cobram
Fruit Grower Sheparton
Cool Stores Shepparton
Processing Plant Shepparton
Warehousing Shepaprton
Client Warehouse Wodonga
Client Warehouse Sydney
Client Warehouse Brisbane
Client Warehouse Adelaide
Client Warehouse Perth
Retail Outlets
Can Manufacturer Shepparton
Rail Siding Mooroopna
Container Depot Melbourne
IMT Melbourne
Can End Supplier Melbourne
Shipping Melbourne
Asian Market
Europran Market
Middle East Market
Rolled Tin Manufacturer Newcastle

In the study we consider two customers: a large metropolitan hospital group in Melbourne requiring from 70 to 150 cases of peaches for its kitchens each week; and a Japanese retail group requiring two 20 foot containers of tinned sliced peaches.

The links in the supply chain for these tasks have some common elements, commencing at the grower's peach orchard. We consider these now.

From peach orchard to processing plant

The Grower

The majority of peaches processed through the SPC Ardmona facility at Shepparton are sourced from three major growing areas:

- The Cobram region, primarily along the southern banks of the Murray River. The average distance from the orchards to the processing plant's cool stores at Maroopna is 75 km;
- East Shepparton, with an average haul distance to cool stores of 8 km; and
- Ardmona, where the average distance to cool stores is 20 km.

Fruit is picked and held in 500 kg fruit bins, with most growers changing from the older timber bins to plastic bins over the last five years. Picked fruit may be held in cool stores on the farm for one or two days, to assist in truck scheduling and ripening. Farmers will normally transport their own fruit to the processing plant, using flat bed trucks or trailers capable of carrying 20–40 bins.

Most of these trucks and trailers travel from the growers to the producer's store along rural roads or on a State highway. However, as the processing plant is located close to the centre of the city of Shepparton–Maroopna, all deliveries to the plant are required to make use of urban streets for the last two to three kilometres of the trip.

Receival at the plant can take place 24 hours a day during the harvest period, but most deliveries occur in the morning, which can lead to traffic congestion around the plant.

We have ignored in this case, delivery to the grower of supplies needed to produce and harvest peaches, such as irrigation equipment, fertilisers, machinery, servicing supplies, electronics, chemicals and hardware such as empty bins. These freight inputs occur throughout the year and are necessary to the production of peaches.

Other movements to the processing plant

In addition to the peaches arriving at the processing plant, there are other significant inputs to production that need to be transported to Shepparton.

If we start with the cans; these are sourced in two parts: the can body and the can ends. The can ends (tops) are fixed to the can body after the fruit has been put into the can body.

Tin plate is sourced by can and can-end manufacturers from a rolling plant in Newcastle. Can bodies are produced at a local plant in Shepparton and are delivered some four km by road to the site warehouse. This is a significant movement during the processing season, when peaks and maximum volumes see about 40 deliveries per day using curtain-sided semi trailer.

Cans are delivered on pallets, which feed into a can conveyor system, allowing for specific sized cans to be delivered to any one of the fruit filling stations, including the one for peaches. The transport used for this task has been purpose-designed, so that automatic transfer is possible from the truck to the can depalletiser. The trucks are owned by the can manufacturer (Visy).

Can ends are delivered direct to plant from Melbourne by road. Can ends are delivered in cartons on pallets. The pallets in both cases need to be returned either as part of a product load or as empties to their place of origin or hire.

In addition, the process requires labels for the cans. The labels are sourced from Melbourne and delivery is by truck, which is contracted by the label manufacturer. This task is often part of the back haul of the fruit to Melbourne by the major transport contractor.

The other major input required is packaging or cartons. There are two principal suppliers located in Melbourne and Wodonga. Cartons are delivered by truck and back loads are established where possible.

Other inputs such as chemicals, cleaners and administrative support materials, are sourced from Melbourne and delivered by truck.

Finished product to client

Canned peach product is palletised as bright cans (with no labels added at this stage) as it comes off the production line. It is then moved by forklift trucks into the stock warehouse for later matching to specific orders.

From processing plant to hospital bed

Let us consider the catering contractor who supplies four hospitals in the Melbourne area. The contractor has ordered for the hospitals 10 pallets of 3 kg cans of "sliced peaches in lite juice". This is an order that requires fortnightly fulfilment by the contractor. However, the hospitals do not wish to hold more than a week's supply in their hospital storerooms. A pallet comprises 72 cases and each case holds three 3 kg cans. The weekly order from the hospitals is for 1 080 cans. The distribution of this order to the four hospitals is as follows:

Hospital A – City	150 cases per week
Hospital B – Northern suburbs	70 cases per week
Hospital C – Outer eastern	70 cases per week
Hospital D – Outer western	70 cases per week

The bulk of the national distribution of SPC Ardmona product is sourced from the Shepparton or Maroopna warehouses. Cartage is carried out under contract by Phillips Transport (now part of the Toll SPD/Toll Regional Group). In the majority of cases, delivery to major customers is by B Double or single trailer (tautliners).

Since this particular order by the catering company isn't large enough to justify a dedicated B Double, with a payload capacity of over 30 tonnes, three transport options exist to transport the product to Melbourne and each demands a different transport leg within the Melbourne urban area.

- **The first option** is for the order to form part of a full B double load and be delivered to Phillips Melbourne distribution centre. The consignment is unloaded at Phillip's Melbourne depot to be collected and transferred to the catering contractor's depot (a warehouse) on the Western Ring Road by a local carrier using a rigid tray truck or van.
- **The second option** is to arrange direct delivery from Shepparton to the contractor's warehouse by semi trailer, incorporating other smaller deliveries (or drops) in the same trip.
  - This option avoids the double handling of product at the Phillips distribution centre, which is an economic trade-off against the higher unit transport costs of using a semi trailer instead of B double for the line haul from Shepparton.
- **The third option** is that the client arranges for a transport operator to provide a direct service. This may be in the form of a backloading operation, which again obviates any double handling before receival by the catering firm.

Each option is used depending on the circumstance at a particular time.

Product is held at the caterer's warehouse and despatched as required by the hospitals. The canned peaches become part of the weekly delivery to the four hospitals. The catering firm builds a full load of many products for each site and the cases of peaches form part of the overall mixed product delivery. Transport from the caterer's warehouse to each hospital is normally carried out using a one to two tonne delivery van. As the catering company has additional clients, it is likely that delivery of orders to some of these will be incorporated into the delivery run to the hospitals.

From processing plant to Japan

Now consider the case of an order from an overseas client, a Japanese retail group requiring containers of tinned sliced peaches for the Japanese retail market. Typically this order would comprise four twenty foot containers of 825 gm cans of sliced peaches in natural juice. The transportation arrangements for this consignment differ markedly from those for the hospital's order and commence with the movement of containers to the processing plant at Shepparton.

Movements to the processing plant at Shepparton

Empty containers are transported from Melbourne to Shepparton in preparation for the consignment of peaches. Typically two thirds of empty containers ('empties') are transported by truck, with the balance by rail. The empties are all unloaded at SPC Ardmona's Mooroopna container depot, where they are stored until they are required at the processing plant.

When it's time to fulfil the Japanese order, containers are despatched to the Shepparton processing plant from the Mooroopna plant on a flat bed trailer towed by a tractor. At the processing plant it is usual in the case of filling overseas orders, for one product to be despatched for one client in one container, so the 825 gm cans of sliced peaches are packaged into cartons stamped for export and packed into containers using forklift tractors.

From inland port to export port

Successfully loaded for export, the full containers are returned to the railway siding at Mooroopna. Is the consignment is in part processed for export here in terms of consignment, and customs/ AQUIS clearance at the terminal or 'inland port' facility as it is sometimes called. The containers with their cargo of sliced peaches are then loaded onto rail wagons to commence the first leg of their journey to Japan. The rail journey from Mooroopna to the port of Melbourne is usually a direct one. However, on some occasions further consolidation of wagons and container loads may need to occur, and this takes place at the intermodal terminal at Somerton on the outskirts of metropolitan Melbourne.

Once safely in Melbourne the containers on their rail wagons are taken directly to port usually Swanson Dock East. In some instances wagon could be unloaded at Dynon and trucked to the wharf. The containers and their contents are subject to further processing prior to export.

Containers or boxes are stripped from the train using large fork trucks or side lifters, mobile gantry cranes then collect the boxes and transport them to a prearranged spot in the terminal.

Boxes are stored on wharf by the stevedore. Their storage is arranged to allow efficient loading onto the ship. This loading is carried out in accordance with a ship's loading plan which is devised with the shipping company or its agent prior to the ship's arrival in port. This then allows the discharge of boxes and the loading of boxes in a way that optimises the ship's loading and stability, the order of discharge of containers at subsequent ports thus minimising dead or repositioning lifts, and ensures that refrigerated boxes are placed in areas where they can access ship's power supply if need be. The canned peaches do not need refrigeration . The receival and collection of containers within the port has in the past seen sizeable truck queuing at the gates of the terminals. This has now been largely overcome with truck management and reservation of slots administered by the stevedores.

A common alternative to the rail movement from Shepparton, the peach consignment might travel to Melbourne by road on a B double, particularly if vessel and client schedules demanded it. Road transport is able to meet less flexible delivery timetables and will be used if time precludes rail. In the case of road transport, despatch is directly from the processing plant at Shepparton to the port of Melbourne terminal. The route taken would be along the Goulburn Valley Highway to the Hume Highway at Seymour, then to the Western Ring Road and City Link to Footscray Road.

Finally the sliced peaches in their tins, packaged tightly into their cardboard cartons and loaded snugly inside steel containers are loaded on a vessel bound for Japan. As the 4000 container capacity ship sails through the Heads at Port Phillip Bay it might occur to some that the carbon footprint of the peaches is a large one. However, the peaches eventually reach their client in Japan to be sold into the retail market and ultimately to be enjoyed by discerning consumers.

A.2. The Movement of Cars into and out of Melbourne

Summary of the key lessons

- The manufacture of a vehicle for export from the Altona Toyota plant requires around 90 inputs including steel, metal, glass, wire and many other products. In production and delivery to Altona many of these inputs generate their own primary and secondary transport movements around Melbourne.
- While many inputs are sourced locally, others travel longer distances by a variety of modes.
- The importation of a Toyota vehicle usually involves a single transport movement from the Toyota shed at Webb Dock direct to the dealer.
- Even at Webb Dock while the vehicle is being prepared for sale, a number of transport movements are created, including the delivery of compliance plates from Toyota's head office in Port Melbourne, and the delivery of radios by rigid trucks from the Fujitsu Distribution Centre.
- Ninety-five per cent of imports are driven by car carrier through the Melbourne streets to dealers; the remaining 5% journey to Toyota's Distribution Centre in Laverton.
- The production of cars in Altona requires a large number of freight movements across Melbourne from various locations including the industrial centres of Laverton and adjacent operations at Altona, as well as many east–west trips such as the "milk run" on which speakers are picked up from Braeside near Dandenong in the city's outer east.
- The transportation of imported vehicles from the port of Melbourne to dealerships ideally involves one primary transport movement. The timing of that movement is determined by the needs of the dealership and is unlikely to be influenced by external attempts to optimise timing on the transport network.
- While there is only one primary transport movement of the car from the port of Melbourne to the dealership, a number of secondary movements are required. The destinations of these secondary movements are either the Toyota shed at Webb Dock (in the case of generic inputs such as compliance plates) or the dealership itself (for customer specific requests such as roof racks).

The information for this case study was provided by Mr Matthew Dusting, Toyota Logistics Operation Manager (Export & Distribution). Toyota manufactures Camry and Aurion vehicles at Altona for export and domestic sale. They also import vehicles from Japan and Thailand. The case study reviews (1) the export of a locally produced Camry, and (2) the import of a Corolla.

The Camry export case

The Camry is manufactured at Toyota's assembly plant at Altona, in the heartland of Melbourne's industrial western suburbs. In 2006, 111 610 vehicles – branded as Camry and Aurion – were produced at Toyota's Altona assembly plant.

The manufacture of a Camry for export generates over 90 inputs. Our description of the process begins with the manufacture of the steel panels.

Toyota's press plant produces steel panels and parts for the Camry. Steel for car bodies is sourced from Bluescope Steel who supply corrosion resistant zinc coated ZINCANNEAL® steel for the Camry. A number of small components needed at this stage are built in Toyota's Port Melbourne press shop and trucked to Altona.

Once pressed and welded, the car bodies are painted in the Altona assembly plant's paint shop. In this dust-free world, employees wearing lint-free overalls are air-scrubbed before commencing work on the car bodies. They use supplies of chemicals including cleaning fluids, phosphate dip, rust-proofing fluid and water-based paint.

Engine Plant

Over 98,000 engines are produced annually at Altona, using many engine parts, including cylinder blocks, pistons, cylinder head covers, exhaust manifolds, intake manifolds and bearing caps, which are made on-site. Cylinder block castings are among products sourced for the engines that are supplied externally. Completed engines head straight to the final assembly line.

In a process that takes three hours, the painted body of the Camry moves along one of seven 250 metre assembly lines, travelling at a pace similar to that in a car wash, as 182 adaptations are made to it. Some components for the assembly are built in Toyota's Port Melbourne press shop and trucked to Altona. They include bumper bars, door trims, fuel tanks and trim fabrication.

Other products sourced locally include:

- Door and window sealing assemblies from Huon at Broadmeadows in Melbourne's north;
- Braking systems: brake callipers, disc rotors and Banksia park brakes and knuckles from PBR in East Bentleigh, east of Melbourne; and
- Automotive glass from Pilkington in Laverton North, and wiring systems from Australian Arrow in Laverton, nearby Toyota's plant.

In addition, components are shipped by a number of modes into Melbourne from further afield. ACL Bearings in Tasmania provides a number of elements used in the assembly of the Camry. These elements including camshaft pulleys, filters and oil pump gears, which are transported from Tasmania and then trucked to Altona. Exterior mirrors are shipped from Schedenacker Australia, in either Taree NSW, or Lonsdale SA.

Pioneer speakers are sourced from Japan although Toyota arranges pick-up in Melbourne. Those components that arrive from overseas travel to Melbourne via a mix of air and sea freight. These movements in turn result in secondary land transport movements around the Melbourne region, including the return of empty containers to container parks, or in the case of air freight, to Melbourne airport.

To collect some of the required inputs from various suppliers around Melbourne Toyota conducts a 'milk run' four times a day. For example, speakers are collected from Pioneer's warehouse at Braeside near Dandenong in Melbourne's east.

These speakers have originally come by ship from Japan and have been moved, in their containers, to Pioneer Braeside by truck. There they are unpacked and stored until they are required. As part of the service for Toyota, Pioneer takes their speakers out of their cardboard and polystyrene packages and places them into specially designed boxes, which feed directly into the production system at Altona. The cardboard and polystyrene is recycled along with Pioneer's other recyclable products.

With its Pioneer speaker installed, the new Camry is turned out onto the apron at Altona ready to be loaded on site within three days for export to the international or domestic market.

International export market

Of the 112 000 Camry and Aurion cars produced annually, almost 80 000 were exported to the Middle East. The Camry leaves Altona and travels by road along the West Gate Freeway to Webb Dock in a car carrier which can carry up to seven vehicles. The Camry waits at Webb Dock until it is loaded onto the same vessel that brought in the imported Toyota vehicles. One export vessel leaves weekly for the Middle East.

Domestic market

Some 37 000 of the annual production of Camry and Aurion cars are sold on the domestic market. Seventy to eighty per cent of these are shipped by car carrier to Tasmania through Webb Dock; to WA, NT and Queensland by rail; or by car carrier NSW and SA. The remaining twenty to thirty per cent are sold into the Victorian market and moved by road from Altona to the dealerships.

The Corolla import case

A Corolla that is destined for Brighton Toyota on the Nepean Highway in Elsternwick began its journey two months earlier when it was ordered by the dealership approximately. It arrives as part of a weekly delivery of cars for Toyota in to Melbourne on a 4 000–6 000 vehicle capacity vessel from Japan. On its journey to the port of Melbourne the same vessel may have called at Darwin, Townsville, Brisbane and Sydney. After leaving Melbourne, the car carrier may also call at Adelaide and Perth.

At the dock

At Melbourne's Webb Dock, the Corolla is driven off the car carrier direct to the Patrick Autocare 'Toyota shed' for service and processing. Thus its first road trip in Melbourne is contained within the confines of the dock itself.

Processing requires a range of just in time inputs from suppliers. Compliance plates arrive in a light commercial vehicle from the nearby Toyota Head Office in Port Melbourne and radios arrive at the wharf in a rigid truck from the Fujitsu Distribution Centre. Other, more inexpensive products such as some badging elements are kept at the Autocare shed.

Within five days of arriving in Australia, the Corolla is fitted and detailed and ready for distribution. Ninety per cent of Toyota's imported cars are shipped directly to dealers, while five per cent are shipped 'uncoded' by road to Toyota's Distribution Centre in Brooklyn Road, Laverton where they are held until required. In this case the Corolla is destined for Toyota's Brighton dealership.

A night-time trip to the dealer

A subcontractor transports 40–50 cars a week to Brighton Toyota, resulting in an average of one road based trip every day per car carrier, which carries up to seven vehicles.

Dealers prefer deliveries to arrive outside of their peak business hours and often when the dealership is closed for sales. So most deliveries leave Webb Dock after 4 pm and are completed by midnight.

At the dealership

Specialised staff meet the car carrier at Brighton Toyota. All vehicles are washed and given a mechanical check. For those vehicles that have been pre-sold to customers (and are not destined for the dealership's showroom) the vehicles are fitted with registration plates and stickers as well as further customised detailing to meet the individual customer's specification. Window tinting is a common request and, depending on the size of the dealership, will either be completed onsite or the vehicle will be driven to the tint provider. After the last details are attended to the new Corolla is moved to the dealer's showroom where it awaits a new owner.

A.3. The Movement of a Tub of Butter

Summary of the key lessons

- The production of butter generates daily local tanker trips radiating out from the processing plant (in this case in Leongatha). Because milk production varies seasonally, 'surge storage' is required to smooth out production. This could be in raw material form at processing plants, or in finished form at the Laverton Integrated Logistics Centre (ILC) or other storage facilities, in which case there will be seasonal peaks in trucks east–west, and on supply vehicles.
- The transport of butter and other products out of the Gippsland region to Melbourne for export or domestic use, generates 38 daily round trips between the Leongatha plant and the Integrated Logistics Centre in Laverton, using the South Gippsland Highway, the Monash Freeway, City Link and West Gate. Further trips are generated between the ILC, Woolworths Distribution Centres and supermarkets (for retail) and the ILC and the Port of Melbourne (for exports).
- Inputs of other products into the Leongatha plant generate a further 32 return trips per day between the Leongatha plant and locations in metropolitan Melbourne to collect materials for product packaging and distribution, for example pallets and cardboard cartons. Backloading with product from the Laverton ILC is always sought.
- An inventory control system that monitors purchasing decisions in the supermarket triggers just-in-time delivery of products between the Integrated Logistics Centre, the local Woolworths Distribution Centre and local Safeway stores. This Supply Chain Management system is important not only in reducing inventory and rationalising the use of warehousing space, but also in controlling and minimising transport movements – thus reducing transport movements and costs.
- Taken in isolation, the movement of this single grocery item appears on the surface of it to be inefficient as it tracks east–west, and then west–east. The overall efficiency becomes evident when the advantages of consolidating products destined for common destinations (retailers' distribution centres and supermarkets) are considered. By allowing the consolidation of many lines for multiple destinations into one vehicle, the supply chain is much more efficient than using multiple smaller consignments. Similarly, the movement from retailers' DCs to retail outlets will consolidate other lines to optimise transport.

The information for this case study was provided by Mr Phil Saunders, National Storage and Distribution Manager, Murray Goulburn Co-operative Co. Limited. Murray Goulburn Co-operative, owned by 3 000 dairy farmers located in Victoria, Southern New South Wales and Eastern South Australia, is the largest processor of milk in Australia. The firm produces 3.3 billion litres of milk per annum, which is approximately 37% of Australia's milk product market. The Co-operative employs more than 2 200 people in nine manufacturing plants at Koroit, Rochester, Cobram (cheese and whey factory / nutritionals factory), Kiewa, Maffra, Leongatha, Edith Creek (Tasmania) and Leitchville, the Laverton Integrated Logistics Centre and at its head office in Melbourne.

Murray Goulburn is a major purchaser of raw materials, equipment and services, most of which are obtained locally. More than 65% of its production is exported, including milk powder and other packaged products for the global markets. This product is packaged at several processing plants including Leongatha in South Gippsland and transported to Laverton where it is containerised and then moved to the port for export. The Leongatha plant also produces processed food such as Devondale butter for the domestic and export markets.

A shopper who buys a tub of Devondale butter in the local Safeway store might be surprised to know the number and type of transport movements involved in getting it on to the dairy shelf. This case study follows the movement of a tub of butter for domestic consumption from farm to supermarket shelf and the decisions that determine those movements.

The butter originates at one of MGC's processing plants, in this case the dairy country of South Gippsland in Victoria. Murray Goulburn's network of dairy farms provides daily milk supplies to its processing plant at Leongatha. Milk is transported from the farms to the plant by one of the 144 Murray Goulburn owned milk tankers. The production and distribution of Devondale butter and other products such as milk powder for export, requires inputs of other equipment and services, and materials such as:

- packaging cartons, which are sourced from Visy in Dandenong;
- tubs for butter, which are sourced from Cryovac in metropolitan Melbourne;
- pallets for transportation purposes, sourced from Chep in Clayton; and
- bags from Amcor in metropolitan Melbourne.

These materials are trucked into the Leongatha plant from metropolitan Melbourne by a dedicated fleet of eight Murray Goulburn trucks, which travel up and down the South Gippsland Highway and Monash Freeway between Leongatha and Melbourne at a rate of 32 return trips or 1 088 pallets per day. Wherever possible backloading of product for store is undertaken.

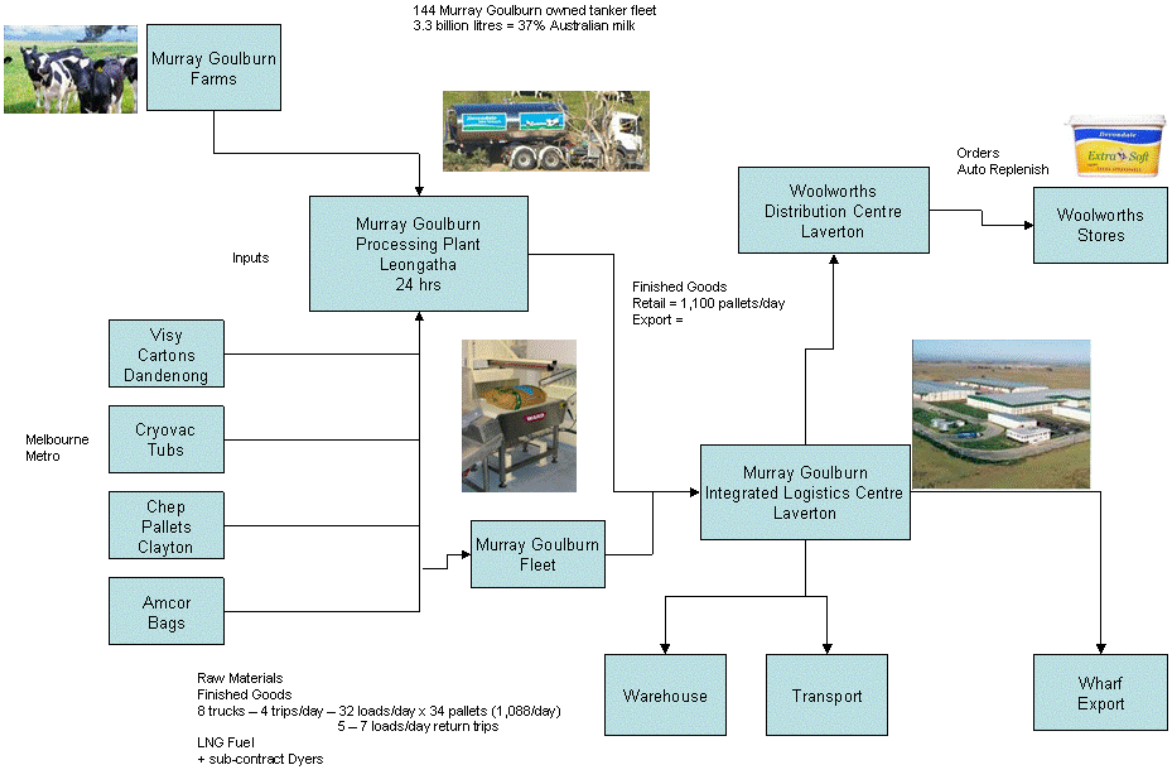
The butter is processed, dispensed into its tub, packaged and readied for transportation. It is part of a daily production of 150 pallets of butter produced by Murray Goulburn for the retail market. It leaves the Leongatha plant with a consignment of packaged Devondale butter products and this is trucked to Murray Goulburn's state-of-the-art Integrated Logistics Centre at Laverton in Melbourne's west. The route consists of the South Gippsland Highway, on to the Monash Freeway (M1) and City Link, West Gate freeway and thence to the ILC, which is located in Laverton North Angliss Industrial Estate between Doherty's Road and Boundary Road. The site was selected for its proximity to the port of Melbourne and allows for future expansion.

Arriving at the 29 hectare site, the pallets of butter are unloaded and transported by forklift to a chiller storage. The chiller has capacity for 24,000 pallets of butter, spreads, cheese and cream products and a further 12 000 pallets of UHT products at ambient temperature. It is part of 80,000 square metres of under cover storage that includes two identical milk powder stores providing storage for 50 000 double width pallets or 92 000 tonnes of dry goods. This represents a total capacity of more than 130 000 tonnes. The centre also incorporates a forklift maintenance base and a special storage and repair facility for pallets.

Electronic supply chain management guides the movement of the butter at each part of the chain. At the local Safeway stores, shoppers' butter purchasing decisions are tracked in Safeway's inventory management software, which provides data to the Murray Goulburn distribution centre, located in Laverton. The data feeds into the building of a consignment of goods for each Safeway store. Once the response trigger is reached, an automatic replenishment order for Devondale butter is generated and Safeway's Laverton distribution centre ships out the order. This in turn triggers a top-up order of butter pallets from the Integrated Logistics Centre.

A shopper might be surprised to know that his/her purchase of a tub of butter is related to a similar decision by other shoppers in the same store and that these decisions, which are electronically tracked, trigger the orders that keep the shelves stacked.

The movement of the tub of butter is shown in the following figure provided by Murray Goulburn.


144 Murray Goulburn owned tanker fleet
3.3 billion litres = 37% Australian milk
Murray Goulburn Farms
Murray Goulburn Processing Plant Leongatha 24 hrs
Inputs
Visy Cartons Dandenong
Cryovac Tubs
Melbourne Metro
Chep Pallets Clayton
Amcor Bags
Raw Materials
Finished Goods
8 trucks – 4 trips/day – 32 loads/day x 34 pallets (1,088/day)
5 – 7 loads/day return trips
LNG Fuel
+ sub-contract Dyers
Murray Goulburn Fleet
Finished Goods
Retail = 1,100 pallets/day
Export =
Murray Goulburn Integrated Logistics Centre Laverton
Warehouse
Transport
Woolworths Distribution Centre Laverton
Orders
Auto Replenish
Woolworths Stores
Wharf Export

A.4. The Movement of Plasma Television Sets

Summary of the key lessons

- A significant international supply chain is impeded by inadequately designed local roads in an area encouraging warehousing and logistics industry to locate. The supply chain operatives consider that improved transport planning outcomes would be achieved with better coordination between government stakeholders including local government, VicRoads and the local community. An example of inadequate planning is the insufficient length of green phases in the traffic light sequencing onto Mickleham Road to allow heavy vehicles to accelerate and clear the intersection.
- One of the reasons that Yusen (the forwarding agent for Pioneer) chose their current location in Tullamarine was a local government commitment to a fly-over at Western Avenue into the airport. VicRoads has since advised that this is not budgeted for by either VicRoads or the local government.
- The road design standards on the Western Ring Road, in particular the lane widths, are a significant safety issue on the Western Ring Road, which has major congestion during the day and should be widened to four lanes per carriageway in the opinion of Yusen.
- Bottlenecks on Monash Freeway affect reliability and delivery turnarounds.
- The West Gate Bridge bottlenecks flow back through the system to significantly affect heavy vehicle transport on CityLink.
- Linking the Eastern Freeway to the Tullamarine Freeway is a high priority in the opinion of this firm who shifts goods across the city.

The information for this case study was provided by Mr David Browne, Manager – Victoria, Yusen Air & Sea Service (Australia) Pty Ltd and Mr Stuart Scott, Group Manager – Logistics, Pioneer Electronics Australia Pty Ltd.

The home entertainment market in Australia is a huge and growing one. As television technology has advanced, screens have become both larger and flatter, allowing the home viewing experience to approximate more and more that of the cinema experience. The new generation of high definition televisions use either plasma or liquid crystal display (LCD) technologies.

By the end of 2006 approximately 10% of Australian households owned plasma TVs and there was a growing market.

Plasma TV production was boosted by significant jumps in demand up to this period, triggered by events such as the fall in price to below $10 000 and then to below $5 000, and the screening of important sporting events such as the Sydney Olympic Games. [23]

New model plasma TVs may initially be manufactured in Japan, then as a model shifts to high volume manufacturing, production commonly is transferred to lower cost manufacturing countries such as China or Malaysia.

This case study examines the journey of a Pioneer plasma TV from Asia to its delivery into a suburban living room in Melbourne.

A Pioneer plasma TV destined for a lounge room in Melbourne will be imported into Australia from Japan, China or Malaysia by sea or air. Sea freight is used to fill normal stock requirements and accounts for 75% of deliveries, while air freight is used in the remaining 25% of situations:

- If the manufacturer does not meet the sea freight cut-off times in the origin country
- If short-term demand in the market exceeds supply levels;
- To speed a new product line onto the market; and
- To meet peak retail demand such as at Christmas.

The turnaround between a decision to air freight from the country of manufacture to a consignment arriving at Tullamarine can be less than a week.

Whether arriving by air or sea, Pioneer's freight forwarder, Yusen Air & Sea Service, has a role in organising the movement of the plasma TV from its country of manufacture to the Importer's premises in Melbourne.

Air freight arrivals

In the case of air freight, routes vary depending on the country of origin and the availability of air freight space. A typical example is transhipping from Malaysia at Singapore, then direct to Melbourne, or potentially onto one or more domestic services within Australia and finally onto Melbourne. At each stop along this chain, the cargo is likely to be handled or moved from one airline to another.

[23] In 2007 plasma televisions sales began falling behind those for LCD and Pioneer, a maker of plasma TVs, announced that it had suspended its plans to build a new plant in the face of declining sales. The Age, Digital life, Home entertainment, "Fujitsu pulls plug on plasma", 31 December 2007, http://www.theage.com.au/news/home-entertainment/

The plasma TV, part of a consignment of TVs all individually packaged for retail, is met at the airline cargo terminal at Tullamarine airport by a rigid vehicle / taut liner despatched by Yusen, Pioneer's freight forwarder, from its site office in nearby Global Drive, located just off a major Tullamarine feeder road, Mickelham Road. Depending on the size of the order the TV will either be in Unit Load Devices (ULD), an air freight equivalent to a shipping container, or a flat type pack or as loose cargo.

Wherever possible, Yusen undertakes this trip between six and seven in the morning in order to avoid congestion on the route to the airport. Yusen faces an airport storage fee if it does not pick up its cargo within 24 hours of arrival, a fee that has been put in place due to lack of storage space at the airport.

Yusen uses a combination of its own vehicles and subcontractors for this return trip from its Tullamarine depot to the airport, depending on volumes to be collected. Yusen prefers to use its own vehicles and drivers, given that there is some skill and experience required to handle and manage the airport's cargo procedures.

The plasma TV moves to Yusen 'under bond' and customs clearance usually occurs in advance or parallel to this transfer, but prior to transporting the goods from the freight forwarder to the final consignee, in this case Pioneer.

After arrival at Yusen's depot the cargo is broken down into its composite units – in this case packaged plasma TVs. All cargo is checked against the manifest, counted, sorted, gathered and shrink wrapped for the transportation to Pioneer's main site on Boundary Road in Braeside, an eastern suburb of Melbourne.

The air freight delivery of plasma TVs does lead to a number of other secondary transport tasks for Yusen including:

- Returning of ULD container units to airline cargo terminals. Usually, Yusen stores a number of these panels until it has a full load and tries wherever possible to backload this trip.
- Moving waste packaging that comes with the air freighted consignments. This plastic packaging is stored at the depot and is regularly picked up by a third party waste collector to be recycled.

Due to the increasing size of plasma TVs, a complete consignment will often not arrive wholly on a single flight, due to aircraft space restrictions. This necessitates several trips to and from the airport to pick up the total consignment prior to ultimate delivery to the consignee.

Although located so near the airport, Yusen can experience a number of transport issues between its depot and the aircargo terminal. The local roads around the depot were not originally designed for heavy vehicles and Yusen has faced its fair share of transport planning and coordination issues due to the fragmented roles and responsibilities of various stakeholders within the broader transport system, such as local government, VicRoads and the local community. For example, an ongoing issue is traffic light sequencing onto Mickleham Road Tullamarine. The cycle times do not allow sufficient green time phases to allow heavy vehicles to pass through the intersection from a stationary start. Interestingly, one of the reasons for Yusen's location decision was a local government commitment to a flyover at Western Avenue to the airport. However, VicRoads has since advised that this is not budgeted for by either VicRoads or the local government.

Once the TV is consolidated into its consignment with other Pioneer products, the load is collated, and customs formalities are completed, Yusen delivers it to Pioneer in Braeside.

These deliveries are often undertaken in early afternoon, again to avoid congestion on the Tullamarine Freeway and CityLink routes and on the road network in general. For these movements Yusen either uses its own vehicles and drivers or subcontractors. This choice is dependant on demand.

From these delivery journeys to Braeside and other major industrial areas around Melbourne Yusen has experienced the trials of efficient freight movement first hand. The company has found that the standard and narrowness of the Western Ring Road is a significant issue, not only in the movement of heavy vehicles, but also for staff movements to and from work. It also recognises that the regular bottlenecks on the Monash Freeway are cause for significant delays to its freight deliveries. Furthermore, it has experienced significant delays whilst travelling east to west on the CityLink as a result of bottlenecks or incidents on the Westgate Bridge flowing back down the network.

Sea freight arrivals

In the case of sea freight, Pioneer's appointed Sea Freight Transport Company picks up the container with the plasma TV at the port of Melbourne and takes it direct to Pioneer Braeside for unpacking. At this point the cargo has already been cleared through all Customs and Quarantine formalities by Yusen. Plasma TVs arrive as part of Pioneer's larger sea orders and the company receives on average seven containers every weekday.

Again there is further transport involved with this one-way movement between the port of Melbourne and Braeside. For example, the sea container in which the TVs arrived needs to be returned to a container park once unpacked in Braeside.

Braeside

From its 5 000m^2 warehouse space in Braeside, Pioneer distributes all manner of Pioneer products including speakers to the Toyota plant at Fishermans Bend (see Toyota case study). Pioneer also operates another site in Mulgrave, which focuses on service and repair of Pioneer products. From Braeside, Pioneer distributes products to Victoria, South Australia, Tasmania and southern NSW. Pioneer also has operation centres in Sydney and Brisbane and a presence in Western Australia.

Once unloaded at the warehouse, the stock is sorted and customer consignments are put together. Where required these consignments are then palletised and shrink wrapped.

On average plasma TV stock is held at Braeside for no more than three weeks before being distributed via two supply channels.

In the case of stock going to larger retailers such as Harvey Norman, Pioneer contract TNT to pick up consignments from Braeside and manage its movement to retail outlets. TNT brings at least two trucks per day to Braeside to manage Pioneer's needs. Depending on the retail outlet's location, TNT moves the stock from Braeside to distribution centres at Laverton, Campbellfield or Hallam, where the Pioneer stock is unloaded and repackaged with other products for distribution to retail outlets. This stock is then held by the retailers until purchased.

Most often, the purchaser will move his or her plasma TV to its final destination via private vehicle. However, Pioneer has established a direct delivery and installation service, which bypasses the need to move all stock to retailers. Rather, once a television is purchased by a final customer, delivery and installation by Pioneer is arranged through the retailer. These TVs leave the Braeside warehouse on a needs basis in a light commercial vehicle for delivery across Melbourne direct to the purchaser. Pioneer employs its own staff to manage these deliveries and install the television. This service includes removal of all packaging materials, which are then returned to Braeside for recycling.

A.5. The Movement of Putrescible Waste [24]

Summary of the key lessons

- The decision of how, when and where domestic waste moves around Melbourne is a function of the needs of the community, the layout of our streets, the ownership and operation of landfill sites and the level of congestion. While the price of transport is a contributing factor in the decision making process, historical constructs in some ways constitute a greater influence.
- Supply chains for the same product, even within one local government area can and do differ markedly and so one cannot assume knowledge from one supply chain to the next, even in the case of the same region.
- Although recycling and improved waste management have promoted some alternatives to land fill disposal, there will continue to be a requirement for landfill areas. However with increasing urbanisation and regulatory limits the supply of urban landfill sites is limited. As a consequence, inner urban local councils must often move their putrescible waste significant distances to landfills on the outskirts of the Melbourne conurbation.

The information for this case study was provided by Mr Ian Smith, Waste Management Coordinator at the City of Stonnington Council and Mr Maurice Stabb, Director – Infrastructure at the City of Wyndham Council.

Although recycling and reuse has reduced domestic waste disposal quantities, the population of Melbourne will continue to need safe and economic waste disposal facilities.

Landfill sites do not enjoy a positive image among the community. This attitude is born of past practices where the local tip undertook few or no environmental safeguards and was poorly managed in the controls on odour, litter and traffic. Now landfill sites are required to operate at much higher safety and environmental standards. Furthermore, as standards improve and EPA Works Approvals and Town Planning Permits become more difficult to obtain, the number of available landfill sites falls. This also causes certain councils to move their putrescible waste further from its origins for disposal.

[24] Substances usually nitrogenous, which are liable to undergo decomposition when in contact with air and moisture at ordinary temperatures. Domestic waste from households is defined as putrescible waste and the transport and storage of such waste comes under particular regulations administered by the Environmental Protection Authority of Victoria.

Competition is now fierce between the various public and private owners of these landfill sites. Waste haulage is mainly contracted to private firms through competitive tendering processes. As part of this commercialisation of the service, landfill sites compete with each other to provide competitive rates to the transporters.

One such landfill is located in Wests Road in Werribee. Owned and operated by the City of Wyndham, this facility is licensed by the EPA to take putrescible and solid inert waste. This includes domestic and commercial waste, supermarket processing and food waste, garden waste, demolition material, concrete, bricks, timber, plastic, glass, metals, bitumen, trees, uncontaminated fill and shredded tyres. Wyndham uses this facility for its own council and domestic waste, but also has contracts with the Metropolitan Waste Management Group to provide landfill services for adjacent councils, private waste companies and councils in the south of Melbourne.

Waste trucks begin arriving at the facility for the 5am opening and continue trips until 4pm when receivals close prior to the waste being covered over with clean fill in the evening. This facility alone receives 270 to 280 000 tonnes of putrescible waste per annum. The Werribee site is forecast to expand when other landfills reach the end of their operational lives and fewer are able to become operational as the EPA works approval process become stricter.

At the other end of the supply chain, collection practices have changed considerably to adapt to the new methods of waste disposal. Employing side-loading trucks to collect bins has removed the need for runners to carry out rubbish collections. Recycling services have reduced the absolute number of trips to landfill sites. The transport task has in fact increased with the advent of recycling. More truck movements are required to distribute various waste products t o different sites.

The layout of the roads traversed by the garbage trucks in collecting rubbish from domestic and commercial premises, and the locations of the final destination landfill, can also determine the type of truck that is used for kerbside collection.

Take the example of Stonnington Council. Although one single municipality, there are two waste chains. Approximately half of the domestic and council waste is deposited at a council owned site on Clayton Road in Clayton, while the other half is deposited at a privately owned site in Deer Park. Both landfills are high standard facilities designed to have as little impact as possible on the environment and the community. They are built using environmental systems that are significantly better than past practices.

The City of Stonnington is part owner of the Clayton Road site, in a joint venture arrangement with the Cities of Monash, Glen Eira, Whitehorse and Boroondara. The amalgamation of councils that occurred in the 1990s saw Stonnington evolve from two councils – the City of Malvern and the City of Prahran. The City of Malvern was the part owner of the Clayton site. The City of Prahran used a tip in the Clayton area (which has since closed). These two councils also employed very different collection systems that have legacies in the post amalgamation that is Stonnington. There remain two different freight tasks for domestic waste that approximately mirror the geographic boundaries of the previous two councils. Rubbish collection in Union Street Armadale, for example, is carried out by a sole driver operation, yet in the same suburb, in nearby Hume Street, garbage is collected by a rear loader in an operation requiring three people.

These two streets (Union Street and Hume Street, Armidale) have been chosen for the case study, which follows the journey of two bags of domestic rubbish. In this 'tale of two cities', two quite different domestic waste disposal supply chains can be seen, due in part to geography and demography, and in part to the previous history of landfill site ownership. The different supply chains generate different trips, use different vehicles and employ different numbers of operators.

A bag of waste from Hume Street, Armadale

The waste put out in the green wheelie bin in Hume street is collected by either a rear loading compactor truck (requiring three people to operate) or a two-person side loading vehicle (one driver and a runner to position bins).

Waste collection starts as early as 6am in Hume Street. Cars dot the narrow street, as most residents do not have off street parking, adding to the difficulty of collecting the plastic waste bins. While the driver weaves the small truck between parked cars, two 'garbos' run to collect and dispatch the contents of the bins into the open 'mouth' at the back. An early start not only helps to avoid peak-hour congestion; the scheduling needs to account for landfill sites closing receival times, which are usually between three and four o'clock in the afternoon. This allows the tip operator time to bulldoze fill to cover the day's receivals on the tip face.

The Boroondara Transfer Station

When the truck's capacity of five to six tonnes has been reached, the driver takes the waste to the transfer station at 648 Riversdale Road, Camberwell, in the neighbouring local government area of Boroondara.

This movement will occur until the reopening of Stonnington's transfer station, which is off Tooronga Road in Glen Iris, a location that has good linkages with the Toorak Road and City Link entrances and exits.

At the Boroondara transfer station, the waste is transferred into a 50–60 m^3 transfer trailer that can hold and carry some 22 tonnes of waste per load. This vehicle will then take the load of consolidated waste to a landfill site remote from the municipality. Although there are additional costs in transferring waste from one vehicle to another, it is more cost effective than moving the smaller waste trucks direct to the landfill site. In essence, having the two or three men team idle whilst on the trips from Stonnington to the landfill site is cost prohibitive.

Transfer Station to Landfill

In its final stages, the waste is taken in the transfer trailer across the city to Boral Western Landfill site, which is three kilometres south west of Deer Park, a suburb located near the Western Highway, 22 kilometres west of the Melbourne GPO. The waste is carted across Melbourne via City Link, the Western Ring Road and the Western Highway connection to Deer Park (to avoid the cost of delay by current road construction around Laverton), a round trip distance of some 72 kilometres. On average, this trip is made approximately four times a day, six days a week.

The landfill site, resulting from Boral's quarrying operations, has many natural advantages. For example, the quarry has a naturally occurring clay floor which is ideal for preventing any potentially contaminated water reaching the water table. Another attribute is that even the lowest points in the quarry are significantly above the water table. The site is also remote from major rivers or streams and it is more than 750 metres away from the closest residence (The Dame Phyllis Frost Centre) and is more than two kilometres from the nearest zoned residential area (Brimbank Gardens).

Although there are landfill sites that may appear closer than the Deer Park option, for example Clayton, this is the most cost efficient option for the Stonnington operation described in this part of the case study. Furthermore, any marginal differential in the cost of travel to Deer Park is more than offset with the reduced vehicle operating costs that result from the use of (mainly) arterial routes.

A bag of waste from Union Street, Armadale

The green and yellow rubbish bins used by the residents of Union Street, Armadale, line the nature strip adjacent to the road in the way that Council has requested. The driver of the 25m^3 automatic side loading truck has no difficulty traversing the quiet street, in which cars are garaged on comfortably sized house blocks and there is little on street parking.

The rubbish collection task in Union Street Armadale can be carried out by the driver alone. He positions his side loading vehicle against the bins to be hooked and tipped over the side into the truck. When 10 tonnes of waste fills the loader, the driver heads east to the landfill site of 24 hectares on the southeast corner of Clayton Road and Ryans Road, Clayton where municipal waste is accepted from all member councils. From Union Street Armadale to the Clayton landfill is a journey of some 11 kilometres. Here the waste is unloaded into the landfill at the end of its journey.