A REPORT TO THE BUS INDUSTRY CONFEDERATION

Prepared For:

Bus Industry Confederation

Suite 6, 6 Lonsdale Street

Braddon ACT 2612

Impact on the Australian economy of increased bus patronage

Prepared By:

CRA International

Level 1, 29 Jardine Street

Kingston ACT 2604, Australia

Date: 14 October 2006

COMPANY PROFILE

CRA International Inc (CRA) is a leading provider of economic and business consulting services to clients in the public and private sector. Founded in 1965, the company and its consulting staff in North America, Europe, Australia, and New Zealand have continually set the standards for excellence in policy impact assessments, corporate finance, business strategy and operations, auctions, antitrust, mergers and acquisitions, and regulatory economics. We differentiate ourselves from other economic consultancies by the depth and breadth of our expertise in specialist economic, regulatory, and analytical matters. Our experts bring substantive business and government experience across a wide range of industry areas and fresh perspectives to every assignment.

With the acquisition, in November 2004 of the Australian-based Network Economics Consulting Group Pty Ltd (NECG), CRA has grown to become one of the largest microeconomic consulting groups in the Asia Pacific region. CRA now consists of more than 75 consultants and research and support staff based in Canberra, Sydney, Melbourne, Wellington and Auckland. Augmenting our core team is an international network of widely experienced associates, including academics and industry and government experts, who share our commitment to achieving the highest possible standard of work for our clients.

CRA undertakes assignments for domestic and international clients on the economic aspects of regulation, competition policy, trade practices, intellectual property rights and related issues. Much of this work requires developing and applying new ways to accurately model market behaviour and the effects of regulation and trade practices legislation on business transactions and growth strategies.

CRA's consultants have extensive experience advising on access pricing issues for regulated services in relation to applications for declaration, commercial negotiations and access disputes, and proposed undertakings before the Australian Competition and Consumer Commission. They also formulate responses to regulatory and pricing reviews, and provide analysis and expert evidence for regulatory and legal disputes in matters that have included landmark trade practices litigation.

CRA's work also covers privatisations, infrastructure appraisals, anti-competitive conduct investigations, mergers and acquisitions, regulatory risk analyses, financing, public policy analysis, and other diverse matters requiring careful assessment and strategic input.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1 Traffic congestion is a major threat to the sustainability of Australian cities. The cost of traffic congestion in terms of lost time and increased vehicle operating costs was about $22 billion in 2005–06 and is expected to rise strongly over the next 15 years. Increased fuel consumption associated with congestion gives rise to substantially higher greenhouse gas emissions. It also results in emissions of other gases and particulates that impose substantial health costs on the Australian community.

2 In this report we examine the economic effects of a 10 per cent increase in bus patronage without specifying the mechanism by which the required increase in patronage is achieved. The results from this work can be used to calculate what sort of program could be undertaken to increase bus patronage and at the same time improve the well being of the Australian community.

3 To enable the effects of policies towards the bus sector to be assessed, as part of this project a model of the Australian economy broken down by States and Territories was further developed so that it contained a “bus sector” as a separately modelled industry in each state and territory. “MMRF-BUS” is the only model of the Australian economy we are aware of that includes a bus industry as a separately modelled sector.

4 As well as the direct economic effects of increased bus use we calculate that a 10 per cent increase in bus occupancy rates would in each year:

- Reduce congestion costs by between $255 million to $645 million depending upon the assumed unit cost associated with congestion.
- Save 5 lives and result in 76 fewer cases of serious injury due to traffic accidents.
- Save $104 million in traffic accident costs.
- Reduce greenhouse gas emissions by 409,340 tonnes.
- Improve the health of the Australian community by around $20 million.
- Reduce noise costs by $11.8 million.

5 We simulated these effects in MMRF-BUS along with the simulated increase in bus patronage. When we simulated the lower estimate of the reduction in congestion costs together with the other effects we found that in the long run a 10 per cent shift towards bus usage would expand real household consumption by $420 million per annum.

6 Approximately half of the $420 million would accrue to non-bus road users in terms of reduced congestion costs. Thus, if bus users are forced to bear all of the cost associated with encouraging increased bus use there will be an underutilisation of bus transport in Australia.

7 To put the simulated rise in real consumption of $421 million per year into perspective, at a real discount rate of 7 per cent such an effect is equivalent to around $3.5 billion in net present value terms assuming an economic life of 30 years for programs to increase bus usage and assuming the long-run benefit identified in the simulations occurred in year 10. This calculation indicates that the Australian community could spend about $3.5 billion to achieve a 10 per cent shift towards bus usage and the Australian community would be still better of than not undertaking such expenditure.

1. INTRODUCTION

8 The transport sector makes a major contribution to the Australian economy and the welfare of the community. However, the sector also imposes substantial external costs on the community in the form of traffic congestion, road accidents, air and noise pollution.

9 The BTRE estimated that traffic congestion cost the Australian economy $12.8 billion a year in 1995. Based on traffic flows in 2005–06 and accounting for inflation we estimate that congestion cost the Australian economy about $22.3 billion in 2005–06 or 19.8 cents per vehicle kilometre.[1]

10 Congestion also raises vehicle emissions.[2] Congested traffic conditions almost double fuel consumption compared to free-flow conditions. Therefore, congestion can double gas and other emissions from a stream of traffic. Congestion in the six capital cities is estimated to result in an additional 13 million tonnes of greenhouse gas emissions compared to free-flow traffic conditions.[3] This is equivalent to around 17 per cent of the total greenhouse gas emissions from the transport sector.

11 Increased fuel use also results in increased emissions of other pollutants. Congestion results in additional emissions each year estimated, for 2000 at 750,000 tonnes of carbon monoxide, 75,000 tonnes of nitrogen oxides, 115,000 tonnes of volatile organic compounds and 5,000 tonnes of particulate matter.[4] These emissions impose significant health and property damage costs on the Australian community.

12 For example, in 2000 motor vehicle-related ambient air pollution is estimated to have accounted for between 900 and 4,500 morbidity cases—cardio-vascular and respiratory diseases and bronchitis—and between 900 and 2000 early deaths.[5] The cost of morbidity ranged from $0.4 billion to $1.2 billion, while the cost of mortality ranged from $1.1 billion to $2.6 billion. This does not include the health costs of motor vehicle accidents.

---

1 Bureau of Regional and Transport Economics (BTRE) 1999, Information Sheet 14: Urban transport—looking ahead.

2 Carbon dioxide, methane, nitrous oxide and ozone precursors, etc.

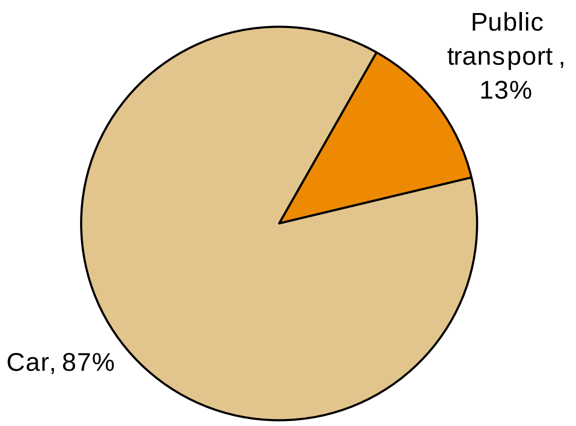
3 BTRE 2003a, 'Greenhouse Gas Emissions from Transport: Australian Trends to 2020', Report 107, Canberra. BTRE 2003b, 'Greenhouse Gas Emissions from Transport: a Macro Modelling Approach', Working Paper 52, Canberra.

4 BTRE 2003a, op cit.

5 BTRE 2005, 'Health Impacts of Transport Emissions in Australia: Economic Costs', Working Paper 63, Canberra.

13 A main source of the problem is Australia's high dependence on motor vehicles for passenger transportation. Private passenger motor vehicles, or cars, dominate passenger transportation in Australia, accounting for 87 per cent of total passenger trips Australia wide (Figure 1).[6]

Figure 1: Shares of passenger transport task



Source: Bus Industry Confederation 2004.

14 The reliance of Australians on passenger vehicles to meet their transport needs is projected to be even stronger in the future. It is projected that traffic will be more than 40 per cent higher in 2020 than it was in 2002 (Figure 2).[7] Over this period, car traffic is projected to rise by 33 per cent as a result of increasing car use per person (12 per cent increase) and population growth (18 per cent increase).[8] Light commercial vehicle traffic is also expected to grow strongly.

15 In addition, the road freight task is also projected to rise significantly over the next 10 to 15 years. Over this period continued innovation in trucking operations will see payloads per truck rise significantly but these gains will not be sufficient to meet the increased demand for road freight so that an increasing number of truck movements will be required to handle the projected increase in the road freight task over the next 10 to 15 years.

6 Bus Industry Confederation 2004, Fact Sheet: Passenger Transport Activity in Australia.

7 Gargett, David and John Gafney 2004, 'Traffic Growth in Australian Cities: Causes, Prevention and Cure', Bureau of Regional and Transport Economics Staff Paper.

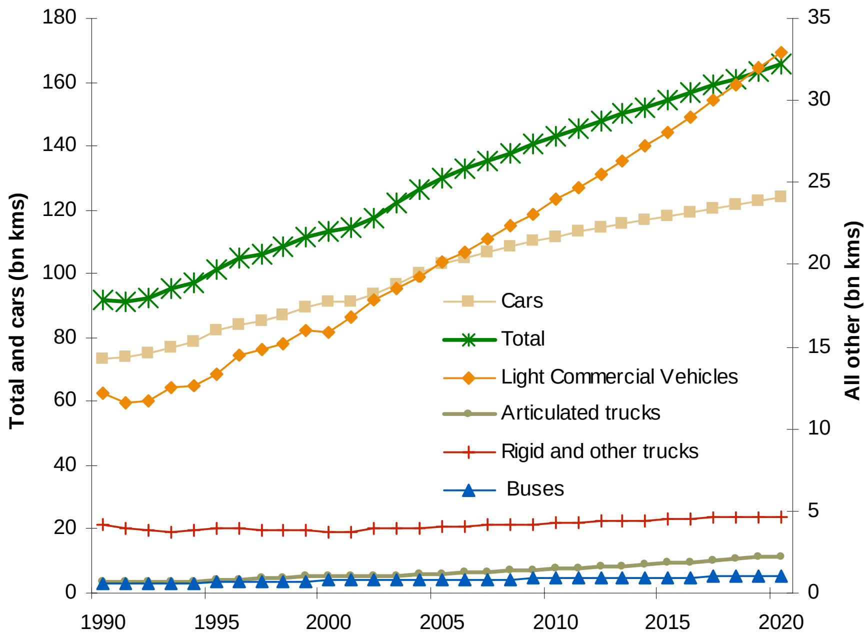
8 Growth in motor vehicle demand is driven by rising per capita incomes and population growth.

16 The increased traffic congestion resulting from increased car and truck movements is estimated to see the direct costs of traffic congestion rising from $20 billion a year to over $40 billion a year in 2020. Even with significant advances in fuel efficiency and emissions controls, the costs of air and noise pollution will expand substantially.[9]

17 Governments have a range of options for addressing urban traffic congestion. These include investment in roads, demand management policies (congestion charges, traffic restrictions, taxes, etc.), traffic management policies (intelligent transport systems, rule enforcement, etc.), vehicle performance policies (e.g., fuel efficiency and emissions standards) and urban planning.

18 A possible efficient approach to addressing urban congestion is to increase the private cost of passenger motor vehicle use to more closely reflect the full costs (private and external) of vehicle usage. Another response would be substitution towards alternate means of transportation, mainly in the form of public transportation.

Figure 2: Base case projections of metropolitan vehicle kilometres 1990–2020



Source: Gargett, David and John Gafney 2004.

9 BTRE 1999 op cit.

19 In this paper, we report on a study of the implications for the Australian economy of a shift in traveller preferences away from motor vehicles towards bus transportation. Specifically, we consider the implications of a 10 per cent increase in bus patronage at the expense of private vehicle travel. It is assumed that this increase could be accommodated by the bus industry via an increase in bus occupancy rates. In effect, we model a productivity improvement in bus operations as demand is transferred towards an underutilised resource.

20 The analysis employed an extended version of the MMRF-GREEN general equilibrium model of the Australian economy, described in Section 2 of this report. The extended version has been called MMRF-BUS and this model estimates the impact of the shift on gross domestic product (GDP), real consumption spending, trade and other macroeconomic variables. It also estimates changes to the structure of the economy resulting from the impact of the shift on the output and employment of each sector of the economy.

21 It should be noted that, as currently structured, the model does not capture the environmental and health implications of the modelled shift in transport usage. We thus undertake side calculations to quantify the environmental and health implications of the change in transport arrangements.

2. THE ECONOMIC BENEFITS OF INCREASED BUS USAGE

22 The Centre of Policy Studies (CoPS) at Monash University was commissioned by CRA International (CRA) to undertake a preliminary examination of the economic effects of greater usage of bus services, leading to increased efficiency in the operation of these services.

23 Specifically, CRA's brief was to model a change in commuters' and travellers' tastes from the use of private motor vehicles to the use of bus services that resulted in a 10 per cent increase in the productivity of bus services.

24 The economic modelling was undertaken in an extended version of the MMRF-GREEN model. The extension involved adding a bus industry to the model.[10] We outline below how MMRF-BUS was created.

10 For a more detailed description of the theoretical structure of the MMRF-GREEN model, see Adams, P.D., M.J. Horridge and G. Wittwer 2003, "MMRF-GREEN: A Dynamic Multi-Regional Applied General Equilibrium Model of the Australian Economy, Based on the MMR and MONASH Models", CoPS Working Paper G-140, Centre of Policy Studies, Monash University, Melbourne. For an overview of the model, see Adams, P.D., M.J. Horridge and B.R. Parmenter 2000, "Forecasting for Australian Regions Using the MMRF-GREEN Model", *Australasian Journal of Regional Studies*, 6(3), pp. 293–322.

2.1. Creation of MMRF-BUS

25 In MMRF-BUS, there are 55 industry sectors in each state of the model's eight regions (the six states and the two territories). All but one of the industries produce a single commodity.[11] The industries include a "dummy industry", Private Transport Services, which treats private households' operation of their motor vehicles. This "industry" purchases fuel, spare parts, repairs and financial services and on-sells them to households. The industry's only costs are these inputs, as it uses no labour or capital. For this project, we constructed a Bus transport industry. This was done by splitting the Road passenger transport industry into two new industries, Bus transport and Other road passenger transport (mainly taxis and trams).

26 Investment is allocated across industries[12] to maximise rates of returns to investors (households, firms). Capital creators assemble, in a cost-minimising manner, units of industry-specific capital for each industry. Each state has a single representative household and a state government. There is also a federal government. Finally, there are foreigners whose behaviour is summarised by export demand curves for the products of each state and by supply curves for international imports to each state.

27 As is standard in CGE models, MMRF-BUS determines the supply and demand for each regionally-produced commodity as the outcome of optimising behaviour of economic agents. Regional industries are assumed to choose labour, capital and land so as to maximise their profits while operating in a competitive market. In each region a representative household purchases a particular bundle of goods in accordance with the household's preferences, relative prices and its amount of disposable income.

28 States are linked via interstate trade, interstate migration and capital movements and governments operate within a fiscal federal framework.

29 For a more detailed description of the theoretical structure of the MMRF-GREEN model, see Adams, et al.[13] For an overview of the model, see Adams, Horridge and Wittwer .[14]

30 For this project, CoPS added a Bus transport industry to MMRF-GREEN and we have called the revised model MMRF-BUS.

---

11 The exception is Petroleum Products which produces various fuels such as automotive petrol, aviation fuels, diesel and LPG. Of particular relevance to this project are that there are three separate industries relating to road transport: Road passenger transport, Road freight transport and Private vehicle transport. These industries are discussed more in Section 2.2.

12 Including investment in new vehicles by households.

13 Adams, P.D., M.J. Horridge and B.R. Parmenter 2000, "Forecasting for Australian Regions using the MMRF-GREEN Model", *Australasian Journal of Regional Studies*, 6(3), pp. 293–322.

14 Adams, P.D., M.J. Horridge, G. Wittwer 2003, "MMRF-GREEN: A Dynamic Multi-Regional Applied General Equilibrium Model of the Australian Economy, Based on the MMR and MONASH Models", CoPS Working Paper G-140, Centre of Policy Studies, Monash University, Melbourne.

31 The bus industry was created by splitting the Road passenger transport industry into 2 new industries, Bus transport and Other road passenger transport (mainly taxis and trams). The details of the construction of the Bus transport industry are set out in Appendix A.

Table 1: Bus transport industry, 2002–03, $m

Industry	Wages & salaries	Total income	Total expenses	Operating profit before tax
6121 Long-distance bus transport	215	850	798	52
6122 Short-distance bus transport	821	2,327	2,463	173
Bus transport industry	1,036	3,177	3,261	225

*Values are in 2005 prices.

32 The Bus transport industry used in the model is described in the third row of Table 1. The industry had total income of $3.2 billion in 2002–03.

33 Sales by the Bus transport industry are summarised in Table 2. The left-hand column of Table 2 shows sales in terms of basic values (that is, in terms of prices received by the suppliers of bus services), while the right-hand column is in terms of purchasers' values (that is, in terms of prices paid by bus users). The latter is around 12 per cent lower on average than the former, indicating an average subsidy of that size on bus use.

Table 2: Estimated bus transport sales, 2001–02, $m

	Basic values	Purchasers' values
Industries (for intermediate use)	134	103
Households	1,059	889
Government consumption	716	716
Exports	1,092	917
Total Sales	3,001	2,521

2.2. MODELLING THE EFFECTS OF A SHIFT IN TRANSPORT PASSENGER MODE

34 The bus scenario which CRA asked CoPS to model is one in which a switch by travellers/commuters towards bus transport increases the productivity of the Bus transport industry. The scenario carries the implied assumption that bus services are currently underutilised and that the bus system could carry the increased number of passengers without (significantly) adding to capital and operating costs.

35 For this preliminary study, CoPS simulated the impact on the economy of a 10 per cent increase in bus patronage at the expense of private vehicle travel, without considering the cause of the shift in preferences. They therefore imposed the following set of shocks:

- a 10 per cent all input-saving technical change for the Bus transport industry;
- a 10 per cent increase in household demand for Bus transport;
- a 10 per cent increase in state governments' demands for Bus transport (10 per cent more passengers on school bus services); and
- a 10 per cent increase in foreign visitors' demand for Bus transport.

36 In order to accommodate the last three set of shocks, CoPS allowed the model to compute the change in household tastes for Bus transport and the variable determining the position of the foreign demand curve for Bus transport. Since, it was assumed that the extra bus passengers were switching from private motor vehicles, households usage of Private passenger transport was reduced in line with a reduction in passenger kilometres equivalent to the additional passenger kilometres that households travel on buses (including school children on government subsidised buses). Similarly it was assumed that foreign visitors reduce the passenger kilometres travelled in self-drive rental vehicles (an output of the Finance and business services industry).

37 While MMRF is a dynamic model allowing year-on-year results to be traced out, for this preliminary study we simplify the exercise by conducting a set of long-run results (which shows the effects after some 8 to 10 years).[15]

38 The main economic features of this long-run specification are that:

- The rate of unemployment is assumed to be fixed in each state, so that at the national level, given an unaffected working-age population and participation rate, the aggregate level of employment is also (virtually) fixed. Thus we assume that the change in transport mode preferences (including the productivity improvement in the Bus transport industry) has no lasting effects on the national employment level, with any effects the preference change has on the economy-wide demand for labour resulting in a slight movement in the national real wage level. The fixed state unemployment rates are accommodated by population movements between the states (i.e., by implied changes in rates of net interstate migration).
- In long-run mode the economy-wide rate of return is assumed to be fixed. That is, we assume that on average the rate of return is determined by the world interest rate. Investment in an industry is positively related to the industry's rate of return compared with the economy-wide rate. The relationship reflects a degree of risk-averseness, with investors requiring a premium on industries negatively affected by the shocks, and prepared to accept a discount on positively-affected industries. In line with the long-run comparative static nature of the simulation, capital stocks adjust to their desired level (with the same percentage change as investment).

15 A short-run analysis was also undertaken and is documented in the Appendix.

- Private consumption in each region is a function of regional household disposable income. Real public consumption by the federal government is assumed to be unaffected by the transport preference switch State governments, however, are assumed to alter their public consumption in line with changes in their revenue bases.

- It is assumed that the transport preference switch has no impact on the balance of trade, with the national average propensity to consume adjusting slightly to accommodate this.

- It is assumed that the shocks will have no effect on the national consumer price index (CPI). Underlying this assumption is the idea that the Reserve Bank adjusts monetary policy to achieve a given inflation target and this target is not affected by such events as we analyse here.

2.3. RESULTS

39 The effects on the Australian economy of the travel-mode switch are shown in Table 3. It can be seen that the switch to buses increases Australian real GDP by $174 million in the long run. The productivity improvement in Bus passenger services that accompanied the travel-mode switch of itself accounted for a GDP increase of over $350 million (assuming the policy had been implemented at the start of 2005–06). However, the correct measure of GDP to compare the productivity improvement to is GDP at factor cost (i.e., value added)[16]. It can be seen from Table 3, that the effect on GDP at factor cost of the mode switch is around $250 million in the long run. The discrepancy is due to a lowering of indirect tax revenue by substituting buses in favour of car transport. This is because there are substantial subsidies, negative indirect taxes, on bus transport and positive indirect taxes on car use which declines in the simulation.

Table 3: Long run macroeconomic effects of a travel-mode switch to buses

	$ million	Per cent
Real GDP at market prices	174	0.02
Real GDP at factor cost	257	0.03
Real household consumption	125	0.03
Real public consumption	0	0.00
Real investment	–93	–0.04
Real international exports	111	0.07
Real international imports	–32	–0.02
Capital	–109	–0.04

*Values are in 2005 prices.

16 Gross domestic product at factor cost is the value at factor cost of the product, before deduction of provisions for the consumption of fixed capital, attributable to factor services rendered to resident producers of the given country. It differs from the gross domestic product at market prices by the exclusion of the excess of indirect taxes over subsidies.

40 The remaining difference between the direct effect of the productivity on value added and the change in GDP at factor cost is due to changes in aggregate primary factor inputs (including other costs, such as holding charges).

41 It will be noticed that even when it is assumed that there is no effect of the travel-mode switch on the balance of trade, real exports exceed real imports, with a consequent depressing effect on the gain to real consumption. This is due to a negative effect on the terms of trade accompanying the expansion in exports.

42 The effects on output by industry of the travel-mode switch are shown in Table 4. It can be seen that there is a small positive increase in output projected for most industries. Only 9 industries are negatively affected. The dummy industry, Private transport services, is the most negatively affected, but this simply reflects less travel in private motor vehicles. The slight fall in Finance and Business services output results from a switch by tourists from self-drive rental vehicles. It will be noticed that the expansion in the Bus passenger transport industry is slightly less than 10 per cent. This is because one of the simplifications introduced for our preliminary simulations was to abstain from modelling a travel-mode switch for intermediate usage of road vehicles. As can be seen, this has little influence on the results. Intermediate sales make up only 4.5 per cent of bus sales, and thus the industry’s output increases by 9.55 per cent. This small difference means that there is a very slight fall in Bus passenger transport’s demands for input (since the output increase is not quite equal to the input-saving productivity improvement). Thus there is a small decline in Road passenger transport output, and in the output of one of its major inputs, Petroleum products (principally diesel fuel). The small negatives for Public services and Water services result from our assumption of no change in total real government expenditure, despite an increase in sales of school bus services to government.

Table 4: Effects on industries of travel-mode switch to buses

Industry	Long Run
Agriculture	0.05
Forestry	–0.01
Iron ore	0.12
Non-ferrous ores	0.07
Black coal	0.08
Oil	–0.02
Natural gas	0.00
Brown coal	0.02
Food products	0.07
Textiles, clothing, footwear	0.08
Wood & paper	0.02
Chemicals	0.05
Petroleum products	–0.09
Non-metallic mineral products	0.00
Cement	0.00
Steel	0.05
Aluminium, manganese	0.00
Other metal products	0.04
Cars & parts	–0.10
Other manufacturing	0.03
Electricity generation (a)	0.02
Electricity supply	0.01
Urban gas distribution	0.05
Water	–0.01
Construction	–0.02
Trade & hotels	0.00
Road passenger transport	–0.13
Road freight	0.02
Rail passenger transport	0.05
Rail freight	0.06
Water passenger transport	0.02
Sea freight	0.04
Air passenger transport	0.08
Air freight	0.00
Services to transport	0.02
Communications	0.00
Financial & business services	–0.07
Ownership of dwellings	0.00
Public services	–0.01
Other services	0.04
Private transport services	–0.39
Bus passenger transport	9.55

(a) Aggregate of 9 MMRF electricity generation industries.

3. BENEFITS FROM REDUCED TRANSPORT EXTERNALITIES

43 A 10 per cent increase in bus usage at the expense of motor vehicles will generate substantial economic and social benefits from reduced traffic. These external benefits are in addition to the economic benefits estimated by the MMRF-BUS model and include:

- benefits associated with reduced traffic congestion;
- a reduction in the costs arising from motor vehicle accidents;
- a reduction in motor vehicle emissions and the associated health and property costs associated with vehicles;
- reductions in traffic noise; and
- improved health for bus users.

44 In this section we provide estimates of the order of magnitude of the external benefits associated with a switch from cars to buses.

3.1. THE REDUCTION IN CAR USAGE

45 To estimate the external benefits of increased bus usage it is necessary to obtain an estimate of the extent of the reduction in car transport activity.

46 In 2004, buses and coaches travelled 1,968 million vehicle kilometres in both urban and non-urban areas.[17] The MMRF simulated the economy-wide impact of a 10 per cent increase in bus patronage at the expense of cars. To calculate the reduction in car usage, it is necessary to convert vehicle kilometres into passenger kilometres. On average, buses carried 10.7 passengers per vehicle kilometre in 2000.[18] Assuming the same average load applied in 2004, this implies that buses provided 21.1 billion passenger kilometres in 2004. A 10 per cent increase in bus patronage therefore implies a 2.1 billion passenger kilometre reduction in car usage.

47 Assuming a 1.64 occupancy rate for cars,[19] this converts to a reduction in car usage of 1.29 billion vehicle kilometres. The average car travelled 13,900 kilometres in 2004.[20] This means that a 10 per cent increase in bus usage would reduce the number of cars by around 93,000 vehicles.

---

17 Australian Bureau of Statistics (ABS) 2005, *Survey of Motor Vehicle Use*, cat. no. 9208.0, ABS, Canberra.

18 BTRE 2003a, op cit.

19 Derived from Bus Industry Confederation 2004, Table 6.

20 ABS 2005, op cit.

48 In estimating the impact of the switch to buses on transport externalities, it is assumed that the 10 per cent switch is concentrated in urban areas.

3.2. CONGESTION COSTS

49 Congestion costs were estimated to be $12.8 billion in 1995.[21] This was based on a total of 86 billion passenger kilometres in metropolitan areas. The cost was projected to rise to $29.7 billion by 2015. The 1995 figure was equal to 14.9 cents per vehicle kilometre. Adjusting this figure for inflation, the corresponding estimate of the congestion cost per vehicle would be 19.8 cents per kilometre in 2006. Total motor vehicle use in the capital cities was 109.3 billion passenger kilometres in 2004.[22] Based on the average rate of growth in vehicle kilometres over the period 2000 to 2004, we project total vehicle kilometres in capital cities to be 112,493 in 2006. Therefore, adjusting the 1995 estimate of congestion costs for inflation and the number of motor vehicles, the estimated cost of congestion in 2006 is around $22.3 billion.

50 A 10 per cent increase in bus usage reduces car use by 1.29 billion vehicle kilometres a year. At a unit congestion cost of 19.8 cents per passenger kilometre, the annual congestion cost saving from the switch to buses amounts to $255 million23. At a unit cost of congestion of $0.5 per kilometre as estimated by the Bus Industry Confederation[24] the congestion cost saving would rise to $645 million.

3.3. TRAFFIC ACCIDENT COSTS

3.3.1. Fatalities

51 Fatal accident statistics by various motor vehicles for 2004 and 2005 are summarised in the Figure 3. In Table 5, we provide estimates of the impact of a 10 per cent increase in bus patronage on the expected number of road fatalities. In 2004, the fatality rate per billion passenger kilometres was 1.5 for buses and 3.9 for cars. If these numbers are taken as estimates of the risk of fatality, the 10 per cent increase in bus patronage could be expected to result in 8 fewer fatalities each year.

---

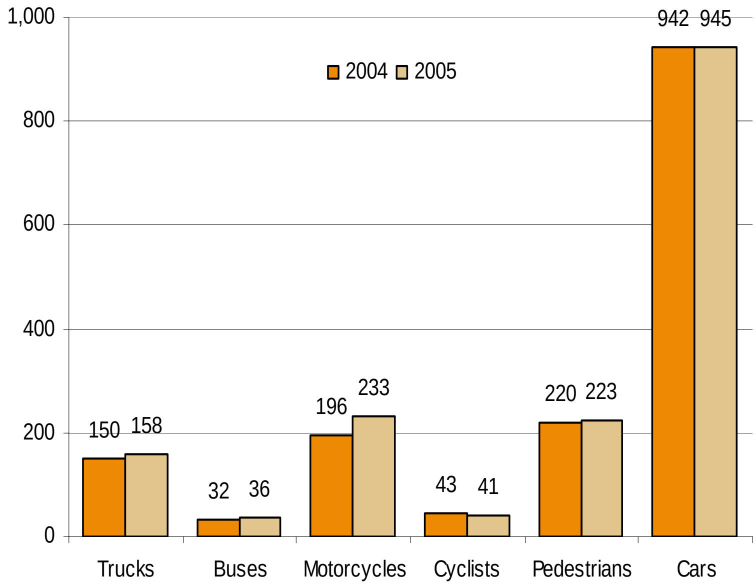
21 BTE 1999, op cit.

22 ABS 2005, op cit.

23 The marginal cost of congestion would rise with increases in traffic volumes, probably at an increasing rate. The 19.8 cents per passenger kilometre is an average cost of congestion and so the $255 million is an underestimate of the cost of congestion.

24 Source: J. Stanley, personal communication.

Figure 3: Fatalities by transport mode



Source: Australian Transport Safety Bureau (ATSB) 2006, Road Deaths Australia 2005 Statistical Summary.

Note: The categories under which fatalities are reported are driver of a motor vehicle, passenger, pedestrian, motorcyclist and cyclists. Data is provided for fatalities involving buses and trucks. We have derived the estimate for cars by subtracting bus and truck fatalities from motor vehicle driver and passenger fatalities.

Table 5: Fatality rates for cars and buses: 2004

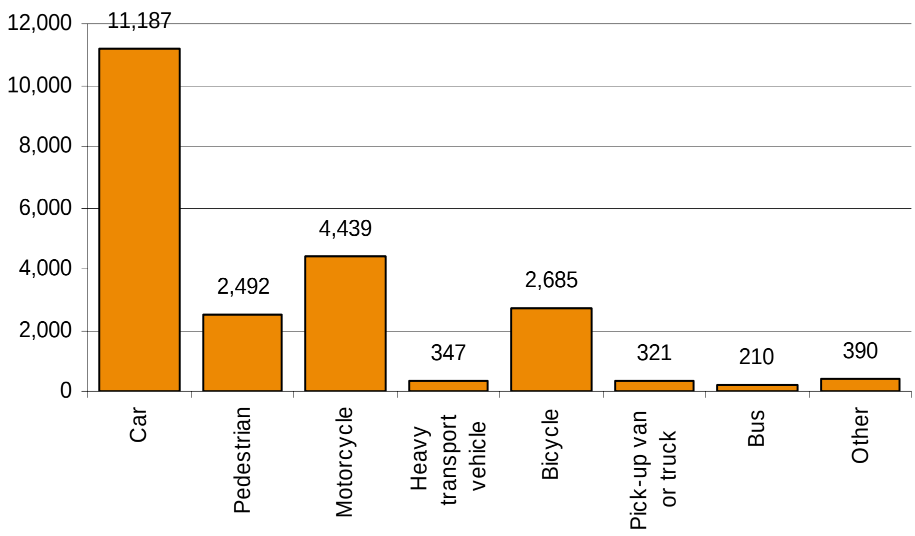
	Cars	Buses
Fatalities	942.0	32.0
Billion vehicle kilometres	147.7	2.0
Fatalities/billion vehicle kilometres	6.4	16.3
Average number of passengers	1.6	10.7
Billion passenger kilometres	242.3	21.1
Fatalities/billion passenger kilometres	3.9	1.5
Change in passenger kilometres (billion)	–2.1	+2.1
Change in fatalities	–8.2	3.2

Source: ATSB 2006, Road Deaths Australia 2005 Statistical Summary.

3.3.2. Serious injuries due to road crashes

52 The shift from cars to buses would significantly reduce the number of serious injuries due to road crashes. The latest published serious injury data is for the year July 2002 to June 2003.[25] In that year occupants of cars accounted for 51 per cent of serious injuries while buses accounted for only 1 per cent (Figure 4).

Figure 4: Serious injury due to road crashes (12 months to June 2003)



Source: ATSB 2004, Serious Injury Due to Road Crashes, November.

53 The serious injury rate for buses in that year was around 10 per billion passenger kilometres compared to a rate of 46 per billion passenger kilometres for cars. If these figures are indicative of current relative injury risks, the shift from cars to buses would result in 76 fewer serious injuries each year (Table 6).

25 ATSB 2004, Serious Injury Due to Road Crashes, November. The definition of serious injury used in this report is consistent with the International Road Traffic and Accident Database (IRTAD) definition. IRTAD defines seriously injured (or hospitalised) road users as accident victims admitted to hospital as in-patients and who remain there for at least 24 hours, excluding those who die.

Table 6: Serious injury rates for cars and buses (2002–03)

	Cars	Buses
Serious injuries	11,187.00	210.00
Billion vehicle kilometres	147.73	1.97
Serious injuries/billion vehicle kilometres	75.73	106.71
Average number of passengers	1.60	10.70
Billion passenger kilometres	242.30	21.10
Serious injuries/billion passenger kilometres	46.18	9.95
Change in passenger kilometres (bkp)	–2.10	+2.10
Change in serious injuries	–97.42	21.00

Source: ATSB 2004, Serious Injury Due to Road Crashes, November.

3.3.3. The cost of traffic accidents

54 It was estimated that road crashes cost Australia $15 billion in 1996.[26] The average cost of a fatal crash was $1.7 million; serious injury crash, $408 000; minor injury crash, $14,000; and property damage only crash (PDO), $6,000. Taking these figures and adjusting for inflation, the average cost of traffic accidents in 2006 would be as follows:

- fatal accident crash costs of $2,056,929 per crash;
- serious injury crash of $507,689 per crash;
- minor injury crash of $17,142 per crash; and
- property damage only crash of $7,227 per crash.

55 These figures probably understate the current cost of road crashes because they assume that crash costs are the same in real terms as in 1996. However, medical costs, wages, and a number of other costs have increased in real terms over the past decade. The estimates for 2006 are therefore conservative.

56 To obtain an estimate of the contribution of increased bus usage to reducing the cost of traffic accidents, we need to make a number of assumptions to obtain estimates of the number of vehicle crashes in 2006 according to the above categories to obtain crashes per million vehicle kilometres.

26 BTRE 2000, Road Crash Costs in Australia, Report 102. The BTRE obtained data on the number of fatalities and serious injury traffic accidents from the ATSB. Estimates the number of minor injury and property only damage crashes was obtained from insurance reports.

57 In 1996, the distance travelled on Australian roads by all motor vehicles was 168 billion vehicle kilometres. Based on the number of crashes in 1996,[27] the incidence of crashes per 100 million vehicle kilometres was:

- fatal accident crashes of 1.05 per 100 million vehicle kilometres;
- serious injury crashes of 10.4 per 100 million vehicle kilometres;
- non-serious injury crashes of 86 per 100 million vehicle kilometres; and
- property damage only crashes of 210 per 100 million kilometres.

58 Since 1996, improvements to roads, vehicle safety features and other factors have seen a reduction in traffic accident rates. In 2005 there were 1,481 fatal crashes involving 1,768 fatalities.[28] The fatal crash rate had therefore fallen since 1996 to 0.74 per 100 million vehicle kilometres, an improvement of 29 per cent. There is no data for the number of other categories of crashes for 2005. Each fatal accident in 2005 involved 1.10 fatalities, a similar rate to that in 1996 of 1.04 fatalities per fatal crash.[29]

59 In 2003–04, 22,248 serious injuries were sustained in traffic accidents, a similar figure to that for the previous three years.[30] To obtain an estimate of the number of serious injury crashes in 2005, it is assumed that the number of injuries per crash is equal to 1.3, the same rate as applied in 1996, and that the number of serious injury crashes in 2005 was the same as in 2002–03. This implies that there were 17,423 serious injury crashes in 2005.

60 There is no recent information on the number of minor injury and property damage only crashes. To obtain an estimate of the number of these crashes in 2005, it is assumed that the incidence of these crashes per 100 million vehicle kilometres fell by the same percentage amount as that for fatal crashes; that is, by 29 per cent.

61 Based on these assumptions, our estimated crash rates are 0.74 per 100 million vehicle kilometres for fatal crashes, 8.8 for serious injury crashes, 60.6 for non-serious injury crashes and 142.0 for property damage only crashes.

27 Reported in BTRE 2000.

28 ATSB 2005, op cit.

29 ATSB 2005, op cit.

30 ATSB 2004, op cit.

62 The 10 per cent increase in bus patronage involves a reduction of 1.29 billion vehicle kilometres. In 2004, total motor vehicle kilometres were 199 billion. The shift to buses therefore reduces total motor vehicle kilometres by 0.6 per cent. The estimated reduction in traffic accident costs due to increased bus patronage is summarised in Table 7. On the basis of our assumptions, the increase in bus usage is estimated to save $104 million a year in traffic accident costs.

Table 7 : Estimated reduction in traffic accident costs

	Crashes per 100 million vehicle kilometres	Estimated number of crashes	Estimated reduction in crash numbers	Cost per crash ($ million)	Cost savings ($ million)
Fatal crash	0.7	1,481	9.60	2.0569	19.74
Serious injury crash	8.8	17,419	112.88	0.5077	57.31
Minor injury crash	60.6	120,670	782.02	0.0171	13.41
Property only	142.0	282,740	1,832.34	0.0072	13.24
Total					103.70

3.4. EMISSIONS

63 The bus and coach sector has significant potential to assist in reducing transport sector externalities because, compared to passenger motor vehicles, buses are a cost effective but underutilised transport mode. Cost effectiveness arises because buses are able to service more passengers than motor vehicles, although convenience is a major factor supporting choice in favour of cars.

64 In 2004, the average fuel consumption for buses was 26.6 litres per 100 kilometre compared to 11.5 litres per 100 kilometres for cars.[31] Adjusting these fuel consumption figures for average occupancy in 2004 (1.6 for cars and 10.7 for buses) gives 7.0 litres per passenger 100 kilometres for cars and 2.5 litres per passenger 100 kilometres for buses. Therefore, for every commuter shifted from a car to a bus, there would be a fuel saving of 4.5 litres per 100 kilometres.

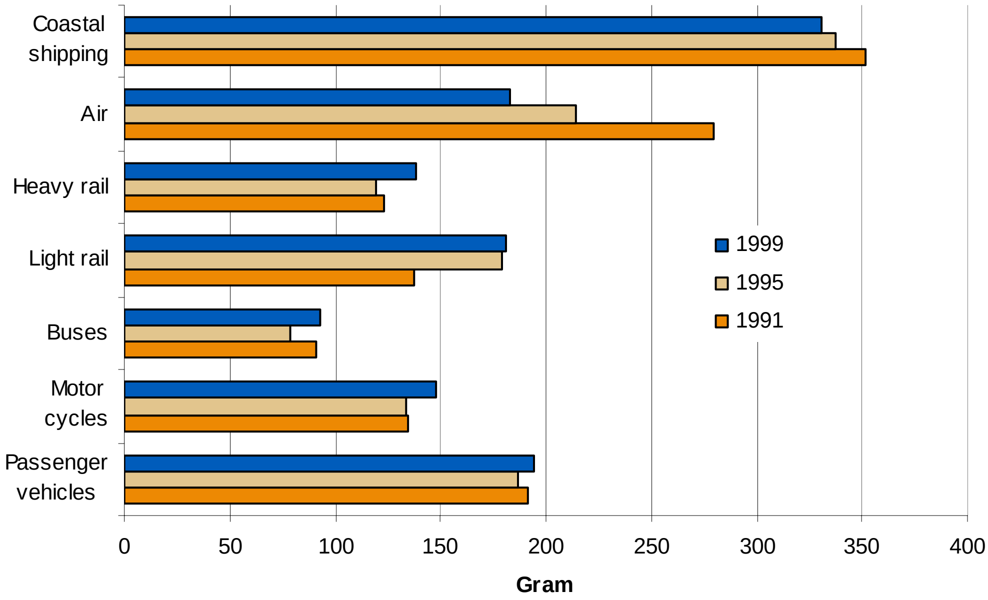
3.4.1. Greenhouse gas emissions

65 Because bus transport is so fuel efficient per passenger kilometre travelled it also has the lowest emissions of greenhouse gases per passenger kilometre.

31 ABS 2005, op cit.

66 In 2002, greenhouse gas emissions per passenger kilometre for buses were 93 grams CO^2 equivalent compared to 194 for cars and 185 for the transport sector as a whole (Figure 5).[32] A 10 per cent increase in bus patronage involves a 2.1 billion decrease in car passenger kilometres. Shifting a passenger to a bus therefore would reduce greenhouse gas emissions by 194 grams per passenger kilometre, since we have assumed that no additional bus vehicle kilometres would be involved. As a result greenhouse gas emissions from motor vehicles would fall by 409,340 tonnes per year.

Figure 5: Greenhouse gas emissions per passenger kilometre



Note: Emissions per passenger kilometre are equal to energy used per passenger kilometre (MJ) multiplied by emissions per unit of energy use (grams CO_2 equivalent).
Source: Australian Greenhouse Office 2002.

3.4.2. Other emissions

67 The reduction in passenger kilometres would also reduce emissions of pollutants such as carbon monoxide, nitrogen oxides, volatile organic compounds and particulate matter. Emissions per million vehicle kilometres are summarised in Table 8 for the main types of motor vehicles. Assuming that the emission rates are the same now as in 2000, a 10 per cent increase in bus usage, by reducing car usage by 1.29 billion vehicle kilometres, would reduce annual emissions of carbon monoxide by 25,313 tonnes, NOX by 2,379 and volatile organic compounds by 3,792 tonnes.

32 Australian Greenhouse Office 2002, 'National Greenhouse Gas Inventory 2000: Analysis of Trends and Greenhouse Indicators 1990 to 2000'.

Table 8: Transport vehicle air pollution 2000 (tonnes per million vehicle kilometres)

	Carbon monoxide	Nox	Volatile organic compounds
Cars	19.62	1.84	2.94
Light commercial vehicles	19.51	2.37	2.41
Trucks—rigid and other	9.03	8.29	2.52
Trucks—articulated	6.45	14.16	1.79
Buses	10.14	9.57	2.82
Motor cycles	21.15	0.88	4.41
Total	85.90	37.12	16.88

Source: BTRE 2003a, BTRE 2003b, and ABS 2005.

3.4.3. Improved health

68 Studies of air pollution episodes have shown that very high levels of ambient air pollution are associated with strong increases in adverse health effects. In addition, increased bus patronage has the potential to increase the amount of exercise undertaken by travellers who switched from car travel to bus travel. Thus increased bus patronage has the potential to improve fitness levels of the community and thereby reduce health costs associated with weight related health disorders.

69 With respect to the health costs associated with air pollution, the Bus Industry Confederation (BIC) has previously estimated that the health costs associated with ambient air pollution generated by vehicles at $4.3 billion in 2000 (see Table 9).[33] BIC estimated pollution costs from cars to be $1,347 million.

70 The estimates have been updated to 2006. This involved estimating emissions per vehicle kilometre in 2000, adjusting these figures for inflation between 2001 and 2006 and multiplying by projected vehicles kilometres for 2006. The latter projection was obtained by applying growth in vehicle numbers over the period 2000 to 2004 and applying this growth rate to the 2004 figure. The resulting estimates are presented in Table 9 in terms of dollars per million vehicle kilometres.

71 For cars, the pollution cost in 2006 is estimated to be $0.016 per vehicle kilometre. The increase in bus patronage would reduce car use by 1,290 million vehicle kilometres and therefore result in a reduction in air pollution costs of around $20 million each year. Because we assume bus vehicle kilometres are unchanged, just more passengers, there is no offsetting increase in emissions from buses.

33 Bus Industry Confederation 2001, ‘Getting the Prices Right: Policy for More Sustainable Fuel Taxation for Road Transport in Australia’, Submission to the Commonwealth Fuel Tax Inquiry, October, p. 47.

Table 9: Estimated air pollution costs from road transport in Australia 2006 ($ million)

Vehicle	Capital cities	Other urban	Other areas	Total
Cars	1,537	228	–	1,765
Motorcycles	1,104	237	–	1,341
LDVs	72	17	–	89
Rigids	1,713	228	–	1,941
Articulateds	382	81	–	463
Buses	492	96	–	588
Total	5,300	887	–	6,187

Source: CRAI estimates based on figures provided in Bus Industry Confederation 2001.

3.5. NOISE

72 Transport noise is a nuisance and is widely recognised as a disbenefit affecting daily life. Noise may also contribute to a range of adverse health impacts. Transport noise arises from tyre contact with road surfaces and from engines. Estimates of potential urban road traffic noise damage costs for 2001 are presented in the Table 10.[34] For urban areas, damage costs range between $668 million and $1,878 million. The central estimate is $1.2 billion. These estimates are derived from a US study by Delucchi and Hsu (1998) in which the marginal cost of noise was estimated for a range of vehicle types on urban roads in the US.[35]

73 In 2001, there were approximately 108,000 passenger vehicle kilometres travelled in Australian capital cities and other urban areas.[36] This means that urban noise costs from cars in 2001 was around 1 cent per kilometre. This figure has been updated to 2006 by applying an inflation factor based on the increase in the consumer price index between 2001 and 2006. A 10 per cent increase in bus usage reduces car use by 1.29 billion vehicle kilometres a year in urban areas. This means that the increased bus patronage would contribute to a reduction in annual noise costs of $11.8 million.

34 See Bus Industry Confederation 2001, Getting the Prices Right: Policy for More Sustainable Fuel Taxation for Road Transport in Australia, Submission to the Commonwealth Fuel Tax Inquiry, page 64.

35 Delucchi, M and Hsu, Shi-ling 1998, The External Damage Costs of Noise Emitted from Motor Vehicles, Journal of Transport and Statistics, October, pp 1–24.

36 The ABS (2004) divides total motor vehicle passenger kilometres into urban and non-urban areas. About 75 per cent of the total motor vehicle passenger kilometres was in urban areas. A split for 2001 into urban and non-urban is not available from the ABS. We therefore take the 2001 figure for total motor vehicle passenger kilometres and assume that 75 per cent of that total was in urban areas.

Table 10: Potential urban road traffic noise damage costs for Australia 2001 ($million)

Vehicle	Capital City		Other		Urban Total	
	Low value	High value	Low value	High value	Low value	High value
Cars	330	1,072	72	234	402	1,306
Motorcycles	4	20	2	8	6	28
LDVs	48	157	17	57	65	214
Rigids	75	140	17	31	92	171
Articulateds	61	94	21	32	82	126
Buses	16	25	5	8	21	33
Total	534	1,508	134	370	668	1,878

Source: BIC 2001, page 64.

3.6. SUMMARY OF EXTERNALITY BENEFITS

74 If the 10 per cent shift to buses was permanent, it would generate substantial benefits through reduced traffic congestion, reduced accidents and reductions in emissions. The reduction in car travel of 2.1 billion passenger kilometres (1.29 billion vehicle kilometres) would have the following benefits:

- At 19.6 cents per passenger kilometre, the annual congestion cost saving from the switch to buses amounts to between $255 million. At a unit congestion cost of $0.5 per kilometre as estimated by the Bus Industry Confederation the congestion cost saving would be $645 million per year.
- The switch to buses could be expected to save 5 lives a year and result in 76 fewer cases of serious injury due to traffic accidents.
- On the basis of our assumptions, the increase in bus usage is estimated to save $104 million a year in traffic accident costs.
- Based on an average fuel consumption of 11.4 litres per 100 kilometres and a fuel cost of $1.20 per litre, the shift to buses would save $176 million a year in fuel costs.
- At 194 grams emitted per passenger kilometre by cars, the saving of 2.1 billion passenger kilometres would reduce greenhouse gas emissions by 409,340 tonnes a year. Given considerable scientific and economic uncertainty about the costs of greenhouse gas emissions, it is not possible to place a value on this reduction in emissions.
- The increase in bus patronage would result in a reduction in air pollution costs of around $20 million each year.

- The increase in bus patronage would contribute to a reduction in annual noise costs of $11.8 million.

4. TOTAL IMPACT OF A 10 PER CENT SHIFT TO BUS USE

75 To estimate the economy wide effects of a switch to bus use the identified savings in congestion, accident and noise and air pollution costs were simulated along with the 10 per cent shift towards bus usage.

76 The simulation involved:

- Removal of congestion costs in the private passenger transport industry equivalent to $255 million per annum. This was simulated as a productivity improvement in the private passenger transport industry;
- A reduction of $104 million per year in accident costs. This was simulated as a productivity improvement in the private passenger transport industry;
- A reduction of $32 million per year in health cost associated with noise and air pollution. This was simulated as a productivity improvement in the provision of health services;
- a 10 per cent all input-saving technical change for the Bus transport industry;
- a 10 per cent increase in household demand for Bus transport;
- a reduction in the use of cars equivalent in passenger journeys to the 10 per cent increase in bus patronage;
- a 10 per cent increase in state governments' demands for Bus transport (10 per cent more passengers on school bus services); and
- a 10 per cent increase in foreign visitors' demand for Bus transport.

77 The long run macro economic effects are given in Table 11. A long run expansion in real household consumption of $421 million per year is indicated. The long run increase in real household consumption is assumed to be achieved in year 10 and that the rise in real household consumption grew linearly to this amount. Given these assumptions and assuming that the program to stimulate increased bus patronage has an economic life of 30 years, we calculate that the 10 per cent expansion in bus patronage would generate a present value[37] increase of $3.5 billion in real household consumption over the economic life of the program that expanded bus usage.

---

37 A real discount rate of 7 per cent was used to calculate the present value.

Table 11: Long run macroeconomic effects of a travel-mode switch to buses including reductions in congestion, accident costs and health costs

	$ million/ year	Per cent
Real GDP at market prices	294	0.04
Real GDP at factor cost	451	0.06
Real household consumption	421	0.09
Real public consumption	0	0
Real investment	-250	-0.11
Real international exports	30	0.02
Real international imports	-92	-0.05
Capital	-291	-0.10

*Values are in 2005 prices.

78 The results indicate that the community could spend up to $3.5 billion to expand bus usage and the community would still be better of than not undertaking the expenditure.

5. CONCLUSIONS

79 The simulation results indicate our analysis indicates that the switch to bus usage would generate annual benefits in the long-term equivalent of about $420 million per annum. Approximately half of these benefits accrue to non-bus road users in terms of reduced congestion costs. Thus, if bus users are forced to bear all of the cost associated with encouraging increased bus use there will be an underutilisation of bus transport in Australia.

80 To put the range of possible annual benefit of between $420 million, at a real discount rate of 7 per cent such a range of benefits is equivalent to $3.5 billion in net present value terms assuming an economic life of 30 years for programs to increase bus usage and assuming the long-run benefit identified in the simulations occurred in year 10. This calculation indicates that the Australian community could spend about $3.5 billion to achieve a 10 per cent shift towards bus usage and the Australian community would be still better of than not undertaking such expenditure.

APPENDIX A: ESTIMATION OF DATA FOR THE BUS TRANSPORT INDUSTRY IN MMRF-BUS

81 CoPS at MONASH University developed the MMRF-BUS model. This appendix explains how the data for the bus sector in MMRF-BUS was obtained.

82 There are 3 industries covering road transport in the standard MMRF-GREEN data base. They are Road passenger transport, Road freight transport and Private transport services. Bus transport falls within the first of these industries, Road passenger transport. This industry (ANZSIC 612) comprises:

- ANZSIC 6121 Long distance bus transport;
- ANZSIC 6122 Short distance bus transport (including tramway); and
- ANZSIC 6123 Taxi and other road passenger transport.

83 The first task of forming the new Bus transport industry was to extract the first two 4-digit industries from the total Road passenger transport industry. Certain data, shown in Table 12, is available at the 4-digit ANZSIC level from the Australian Bureau of Statistics experimental estimates for 2002–03 (ABS 2005a).

Table 12: Road transport statistics, 2002–03, $ million

Industry	Wages & salaries	Total income	Total expenses	Operating profit before tax
6121 Long distance bus transport	215.1	850.1	797.9	*52.3
6122 Short distance bus transport (including tramway)	921.0	2,633.4	2,462.7	*172.6
6123 Taxi and other road passenger transport	*163.6	2,453.5	1,913.4	547.2
Total (612 Road passenger transport)	1,299.6	5937.0	5,174.0	772.1

ABS states that “estimate has a relative standard error of 10% to less than 25% and should be used with caution”.

Source: Extracted from ABS 2005a, Table 3.1.

84 It can be seen that the first two industries make up about 60 per cent of the total Road passenger transport industry activity, but some 87 per cent of the wage bill (and a little less than 30 per cent of before-tax operating profit). It will also be noticed that the second of the two industries is not entirely comprised of Short distance bus transport, as trams are included in this category. There does not appear to be any official figures on the value of output of the tram industry. Some limited information on road passenger transport trips is available from an industry Fact Sheet supplied by CRA. It can be deduced from these figures that trams are responsible for around 8.8 per cent of trips taken on public and private buses and trams. We therefore deduct that percentage from the first two rows in Table 12 to obtain figures for just the bus sector. We estimate that the wage bill for the Bus industry in 2002–03 was around $1.036 billion and its output around $3.177 billion.

85 The above information gives us a basis for splitting the MMRF Road passenger transport industry into bus transport and other (taxis and trams). For instance, we could initially split all sales and all inputs in the proportions of 53.5 per cent (buses) and 46.5 per cent (other), i.e., by the ratio of estimated income for buses to total income for the road passenger transport industry. In a second stage, the wage bill could be split 79.7 per cent to buses and 20.3 per cent to other. This would accommodate for the much higher labour costs as a proportion of total costs for the Bus industry as compared with the Taxi industry indicated in Table 10. All non-labour input costs estimated in the first step would then have to be scaled down to accommodate the higher wage costs imposed in the second step.

86 The above carries the implied assumption that the sales shares in the Bus industry and in the Other road passenger industry are the same. However, there is information that there are some considerable differences between the two categories of Road passenger transport. In particular, taxis sell a considerably higher share of their output to industries than buses. In order to incorporate these differences we need estimates for sales of the two road passenger industries by type of purchaser. Such sales estimates are available from ABS commodity cards. The ABS supplied us with the relevant figures for 1998–99. These figures are unpublished as they are at a working detail level and are subject to greater errors and omissions than normally associated with ABS figures. However, they are suitable for our current purpose of forming part of an input-output data base.

87 In Table 13 we show our estimates for sales by the new Bus transport and Other road passenger transport industries for the data base year (2001–02) for the current study.

Table 13: Estimated bus transport sales, 2001–02, $ million

	Basic values	Purchasers' values
Industries (for intermediate use)	134	103
Households	1,059	889
Government consumption	716	716
Exports	1,092	917
Total Sales	3,001	2,521

88 It can be seen from Table 13 that the bulk of bus sales are to final users. Less than 5 per cent of sales are to industries, with almost two thirds of these sales being to the Public Services industry, and most of the remaining third being to Financial & business services and Trade and accommodation. Also of interest is that sales to international tourists (exports) make up over a third of bus purchases, slightly more than direct household purchases. Purchases by Government cover the funding of school bus services. These numbers appear to be in line with bus use (kilometres travelled) figures published in the Survey of Motor Vehicles (ABS 2004). They show that in the year to 31 October 2003, route services accounted for only 34 per cent of kilometres travelled. School buses made up a further 21 per cent of kilometres, leaving 44 per cent covered by other services such as tours and charter services.

89 The left-hand column of Table 13 shows sales in terms of basic values (i.e., in terms of prices received by the suppliers of bus services), while the right-hand column is in terms of purchasers' values (i.e., in terms of prices paid by bus users). The latter is around 12 per cent lower on average than the former, indicating an average subsidy of that size on bus use. The unpublished ABS commodity card figures for 1998–99 distribute the subsidy evenly over intermediate purchasers and exports. No explanation for the subsidy being assigned just to these categories was provided with the data. Given this, the standard approach would be to distribute the subsidy over households as well as industries and international exports. The subsidy rate for households and international tourists was estimated as 16 per cent and for industries as 23 per cent, which yielded the same overall subsidy rate as for the ABS figures.

90 The next task was to estimate bus sales across the 8 states and 2 territories. The most natural way of doing so is by spreading bus transport across the states in line with the interstate pattern for the original MMRF Road passenger transport industry. An examination of the MMRF data base indicates that the interstate pattern for Road passenger transport approximates that for Gross State Product (GSP) as found in ABS (2005b). Victoria and South Australia are a little overrepresented and Queensland, Western Australia, Tasmania and the Northern Territory slightly underrepresented in Road passenger transport activity. However, ABS figures for motor vehicle usage, in terms of number of buses and kilometres travelled by buses, indicate a somewhat different interstate pattern. In the third column of Table 14 we estimate the state pattern of bus output on the basis of the motor vehicle survey figures by taking a weighted average of the bus number and kilometre figures.

91 A comparison of the estimated bus output interstate shares to those for population and GSP indicates that the two most populous states are considerably underrepresented in bus travel, while Queensland, Western Australia and the Northern Territory are appreciably overrepresented. This might be a result of the patterns of geographical area to population. However, for all vehicles the interstate vehicle pattern is much closer to the population/GSP pattern.

Table 14: Estimated state shares of bus activity, 2002–03 (per cent)

	Bus numbers*	Kilometres travelled*	Estimated bus output	GSP share#	Population share#
New South Wales	28.4	27.7	27.9	35.0	33.6
Victoria	18.2	21.8	20.9	25.6	24.7
Queensland	24.6	23.4	23.7	17.0	19.1
South Australia	7.2	6.3	6.5	6.6	7.7
Western Australia	13.8	13.5	13.6	10.9	9.8
Tasmania	2.1	2.7	2.6	1.7	2.4
Northern Territory	3.9	3.2	3.4	1.2	1.0
Australian Capital Territory	1.8	1.4	1.5	2.0	1.6
	100.0	100.0	100.0	100.0	100.0

* Computed from ABS figures for bus usage (ABS 2004, Table 4); figures are for year ended 31 October, 2003.

Computed from ABS figures for GSP and population (ABS 2005b), Tables 9.2 and 9.3.

Splitting the Road passenger transport industry into bus services and other

92 Ideally, we would have wished to have undertaken a full split of the Road passenger transport industry in line with the data estimates outlined above. However, given the resource constraints on our preliminary analysis, we had to make a few simplifying assumptions. The first of these was rather than splitting the Road passenger transport input column, we simply assumed that Bus services' entire inputs are comprised of purchasers from the Road passenger transport industry. This is a common modelling device that carries with it the simplifying assumption that there is no difference between the input structure of Bus services and that of the rest of the Road passenger transport industry. In the previous sub-section we noted a higher labour share for buses than for other road passenger activities. However, the labour intensity of the existing MMRF Road passenger transport industry is similar to that which we estimate for buses, and it was thus decided not to vary from the existing industry labour/output ratio in this preliminary study.

93 The second simplification has to do with the distribution of bus activity across states and territories. It will be recalled from Table 14 that our estimates of the interstate pattern of bus output while broadly following that of GSP shows sizeable divergences from it. For instance, NSW accounts for 35 per cent of GDP but we estimate that this state has slightly less than 28 per cent of bus services output. Also recall that the interstate pattern of Road passenger transport much more closely follows that of GSP. For some smaller states this can create a problem. For instance our estimate of the Northern Territory's share of bus output of 3.4 per cent is almost three times as large as its GSP share of 1.2 per cent. Using our estimate yields a NT bus industry considerably larger than the NT Road passenger transport industry in the initial MMRF data base. This combined with some substantial differences between the existing Road passenger transport industry sales and our estimated sales pattern for the new bus industry, the use of the Table 14 state shares of bus output would result in a number of negative flows in the (other) Road passenger transport industry, once the new bus industry was subtracted from it. In order to overcome this without a substantial revision to the current data base, new estimates for state shares of bus output were made. These new estimates retain the flavour of our original estimates (e.g., NSW and Victoria under-represented, and Queensland and WA over-represented in bus output). However, the new estimates were chosen so as to allow the problem of negative entries in the residual Road passenger transport industry to be removed. These new estimates are: NSW 31.1 per cent, Victoria 23.0, Queensland 22.0, SA 7.0, WA 12.0, Tasmania 2.0, NT 1.2, and ACT 1.7.

94 Using these new state shares, an estimated Bus transport output figure for each state (and territory) was computed. For each state the total sales of Bus transport were initially allocated across major sales category using the national proportions. The aggregate intermediate sales figure for a state's bus industry were spread over purchasing industries and states in accordance with the sales pattern for intermediate sales of the existing Road passenger transport industry. Similarly for sales to households (and to state governments), a state's aggregate bus output was disaggregated into region of purchase in accordance with the parent Road transport industry's interstate sales pattern. Estimated subsidies to the Bus transport industry (computed as the differences between purchasers' values and basic values) were spread across purchasers in accordance to the pattern of direct sales. For each purchase of Bus transport, the value of the sale was subtracted from the corresponding parent Road transport sale. For a number of Road transport sales this resulted in negative flows. In such cases, a non-negative figure was assigned to each of these sales and the data base was rebalanced.

APPENDIX B: SHORT RUN MODEL SIMULATION

95 The short-run simulation is designed to provide an indication of how the economy would respond to the shift towards greater bus patronage a year or two after the switch in preferences towards bus transport takes place.

96 The key assumptions in the short run simulation are as follows.

B.1 LABOUR MARKETS

97 In the short run it is assumed that the population (and participation rate) is fixed in each state with changes in employment levels resulting in changes in state unemployment rates. At the national level it is assumed that the real consumer wage rate (the wage rate deflated by the national CPI) is fixed, with changes in labour demand being fully reflected in changes in employment.

Rates of return on capital, investment and capital stocks

98 It is assumed that for each regional industry capital stocks are fixed in the short run, with regional industry capital rental rates (and hence rates of return) varying in response to changes in capital input demands. The one exception to this is the Passenger Motor Vehicle "industry" whose capital inputs comprise households' use of their own cars. In this case households must vary their capital usage in order to alter the output of the industry. As in the long-run, investment-capital ratios are fixed.

Real Consumption

99 Again, in each state, private consumption is linked to household disposable income. However, real public consumption is held fixed for the states as well as the federal government.

Balance of trade

100 For the short run we drop the assumption of a fixed national balance of trade.

Results

101 The short run results are given in Table 15.

Table 15: Short run macroeconomic Effects of a Travel-mode Switch to Buses

	Per cent	$ million
Real GDP at market prices	0.03	227
Real GDP at factor cost	0.04	313
Real household consumption	0.00	6
Real public consumption	0.00	0
Real investment	–0.03	–64
Real international exports	0.16	248
Real international imports	–0.02	–37
Employment	0.00	319 (jobs)
Capital	–0.02	–67

*Values are in 2005 prices.