Reviewing the performance of the Australian transport sector against the European Union, Great Britain, France and Sweden

John F. Odgers

RMIT University

john.odgers@rmit.edu.au

Abstract

This paper analyses the performance of Australia's transport sector relative to that of the corresponding sector in Great Britain, France and in Sweden, and in places to the European Union (EU). The review covers the period 1970 to 2007 or the latest available yearly data. Its scope is limited to an analysis of freight transport, passenger transport, energy consumption, CO2 emissions and road fatalities. Among its key findings are that Australia has consistently achieved a relatively faster rate of annual growth in both road transport freight and rail transport. Second, energy consumption by the transport sector in both France and Sweden over the years 1997-2007 has grown more quickly than consumption in the total economy, whereas in Australia the overall change in final energy consumption by the transport sector is lower than the % change for the total final energy consumption. Third, Australia did not perform well in respect of reducing CO_2 emissions across the whole economy relative to France, the United Kingdom or Sweden over the years 1971-2005. Policy implications arising from this analysis are outlined. The paper concludes with an outline of some limitations of this research and proposed areas for future research.

Keywords: Transport sector, international comparisons, outputs and outcomes

1. Introduction

This paper reviews the performance of Australia's transport sector relative to that of the European Union in total and in comparison with the transport sector in Great Britain, France and in Sweden. The review covers the period 1970 to 2007, with a special focus on the years 1990-2007.

The primary data source for the comparisons it presents is OECD (2009).

The rest of this paper is divided into the following sections:

- Brief Overview: Australia, France, Great Britain, Sweden, European Union
- Metrics selected for comparative analysis
- Detailed comparisons against chosen metrics
- Key findings
- Policy implications
- Conclusions and future research

2. Brief Overview: Australia, France, Great Britain, Sweden, and the European Union

Table 1 presents data on size, population, GDP (measured in US$ current prices & Purchasing Power Parity), GDP per capita and growth in measured GDP for Australia, France, Sweden and Great Britain.

Table 1: Comparative data: Australia, France, Great Britain, and Sweden

Characteristic	Australia	France	Great Britain	Sweden
Size [1] (km^2)	7692024	543965	209331	449960
Population 2006 (millions) [2]	20.605	61.203	58.846	9.074
Population density (persons/ km^2)	2.7	112.5	281.1	20.2
GDP 2006 (US$b, current prices and PPPs) [2]	735.2	1962.1	1997 [4]	316.7
GDP /capita 2006 ($US current prices & PPPs)	35681	32059	32936 [4]	34902
% ACG GDP [5] 1990-2006	5.86%	4.25%	4.94%	4.14%
% ACG GDP 2000-2006	5.79%	4.20%	4.82%	4.30%
% ACG Population 1990-2006	1.19%	0.48%	0.36%	0.37%
% ACG Population 2000-2006	1.23%	0.61%	0.46%	0.38%

Notes
1. For Australia, Department of Foreign Affairs and Trade (2009). For France, National Institute of Statistics and Economic Studies; for Great Britain UN SYSTEM-WIDE EARTHWATCH Web Site; for Sweden EEA (2005) Part c, P. 491.
2. OECD Factbook 2008(a) *:* Total population - Evolution of the population: 1950-2050
3. OECD (2009a), Table 02-01-01-T1[1] .
4. GDP is for UK rather than for Great Britain
5. ACG is average annual compound growth; GDP measured in $US Current prices & PPPs.

France, Great Britain and Sweden were chosen as direct comparators to Australia for several reasons.

- All four nations are fully developed, first world economies with quite similar GDP per capita and average annual compound growth (ACG) rates for GDP growth (measured in $US Current prices & PPPs.) over the years 1900-2006 and 2000-2006 respectively (OECD 2008). Australia's rate of GDP growth as measured has however been faster than that of the other three nations over both time frames.
- Sweden suffers similar challenges to that faced by Australia in that it is relatively a large European nation in land area with a small population and only a few major cities. Due to the small domestic market the country is export focused.
- 'OECD (2005) noted both that the UK economy is more reliant than most other EU countries on roads, partly because the transport intensity of production is relatively high, and also that congestion is among the worst in Europe' (Crafts 2009). Australia is likewise more reliant on road transport.
- Collectively these four nations are relatively medium sized in respect of population. Australia's population is more than double that of Sweden; whereas France and Great Britain have a population slightly more than three times that of Australia. There are stark contrasts however between the four nations in respect of population density, as noted in table 1. Australia is extremely sparsely populated at the national level with only 2.7 persons per square kilometre. At the state level, the ACT had the highest population density at 147 people per square kilometre, followed by Victoria with 23, NSW with 9 and Tasmania with 7 (ABS, 2008). Sweden's total population density of 20.1 persons per square kilometre is about ten percent lower than Victoria's. Great Britain is by far the most densely populated of the four nations studied in this research, outstripping the second most densely populated nation, France, by 170 inhabitants per square kilometre.

The European Union has undergone a range of changes since 1950 when it comprised only six nations — Belgium, France, Germany, Italy, Luxembourg and the Netherlands — and was the European Coal and Steel Community (EUROPA, 2009a). By 1995 the European Union comprised fifteen nations: these original six countries together with Austria, Denmark, Finland, Greece, Ireland, Portugal, Spain, Sweden and the United Kingdom. Collectively these nations are sometimes abbreviated as European Union (15) or EU (15). The land area of EU (15) is 3.24 million km^2 (Banister and Stead 2002), or about 42% 0.42%. Across Europe as a whole transport intensity became less efficient between 1970 and 1995 (Banister and Stead 2002). In 2004, the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia joined the EU to form European Union (25): (EUROPA, 2009a). 2004 also witnessed the signing by these twenty five countries of a treaty establishing a European Constitution (EUROPA, 2009). In 2006 the GDP of the EU(15) nations in current prices and PPPs was $US12245.8 billion as compared to $US6158.6 in 1990 and $US9505.4 in 2000 (OECD 2008).

3. Metrics selected for comparative analysis

The following metrics have been used to undertake a comparison of the transport sector's performance across both time and the selected countries.

- Thousand million tonne kilometres – Freight transport by roads
- Thousand million tonne kilometres – Freight transport by rail
- Thousand million passenger kilometres transport by private cars
- Thousand million passenger kilometres transport by buses and coaches cars
- Thousand million passenger kilometres transport by road total

- Thousand million passenger kilometres transport by rail
- Thousand million passenger kilometres transport by road and rail
- Final energy consumption 1997-2007
- CO2 emissions from energy
- Transport fatalities roads 1997- 2007

Four separate time frames have been used for most comparisons: 1970, 1990, 2000 and 2007 since they are the ones used by the OECD (2009).

4. Detailed comparisons against chosen metrics

The first set of comparison presented is in the area of freight transport. Table 2 summarises the % average annual compound growth rate over three time frames: 1970-2007, 1990-2007 and 2000-2007.

Table 2: % Average annual compound growth in Freight transport Thousand million tonne-kilometres: Australia, Great Britain, France, Sweden, European Union.

Country and freight mode	%ACG 1970-2007	% ACG 1990-2007	% ACG 2000-07	Rate of growth
AUS Freight transport Roads	5.50	4.66	4.25	Slowing
GBR Freight transport Roads	2.00	1.66	1.95	Slowing
FRA Freight transport Roads	3.13	3.53	1.69	Slowing
SWE Freight transport Roads	5.46	2.09	1.95	Slowing
EU Freight transport Roads	4.05	3.49	3.98	Slowing
AUS Freight transport Rail	4.72	4.91	5.83	Rising
GBR Freight transport Rail	-0.40	1.70	2.35	Rising
FRA Freight transport Rail	-1.34	-1.20	-4.38	Falling
SWE Freight transport Rail	1.26	2.53	3.62	Rising
EU Freight transport Rail	-0.41	-1.13	1.50	Rising
AUS Total freight transport: Road+Rail	5.06	4.79	5.06	Steady
GBR Total freight transport: Road+Rail	1.70	1.57	1.79	Steady
FRA Total freight transport: Road+Rail	1.69	2.43	0.47	Slowing
SWE Total freight transport: Road+Rail	3.41	2.22	2.57	Slowing
EU Total freight transport: Road+Rail	2.38	2.20	3.43	Rising
AUS % share: Road to total Road+Rail	0.42	-0.13	-0.78	Falling
GBR % share: Road to total Road+Rail	0.30	0.09	0.16	Falling
FRA % share: Road to total Road+Rail	1.41	1.07	1.21	Falling
SWE % share: Road to total Road+Rail	1.97	-0.13	-0.42	Falling
EU % share: Road to total Road+Rail	1.63	1.26	0.52	Falling

Source: OECD (2009b): Trends in the Transport Sector .

The first point of note in Table 2 is relatively faster rate of annual growth in both road transport freight and rail transport freight in Australia in each of the three time periods measured. Second, the average annual rate of growth in road transport freight in Australia, France and Sweden in the period 2000-07 is lower than the %ACG over the years 1970-2007, with Sweden showing the largest decline in average annual growth. Third, the rate of growth in road freight transport volumes in the European Union over the entire 1970-2007 period has been faster than that in Great Britain and France, but slower than that experienced in either Australia or Sweden. Fourth, the annual average percentage rate of growth of national rail freight in Australia has been fairly steady over the period 1970-2007; whereas it is falling at an increasing rate in France, rising steadily in Sweden and rebounding in the 2000-2007 period across the European Union. However in Australia 'interstate road is forecast to slightly increase its mode share of interstate freight, while rail and coastal shipping are forecast to slightly decrease their mode' (Bureau of Infrastructure, Transport and Regional Economics 2010 p.v).

> Overall, the total interstate freight task in Australia is forecast to grow much faster (3.61 per cent per year from 2008 to 2030) than the rate of population growth (1.58 per cent per year) and also faster than the average national GDP growth (2.79 per cent per year), although with freight growth beginning to saturate with respect to GDP, the differential will be reducing over time' (Bureau of Infrastructure, Transport and Regional Economics 2010 p. v).

Finally the % share of the national total freight volume carried by road is falling in all of the five regions analysed in this study. In the case of the European Union, one of the catalysts may have been the Marco Polo programme, enacted in 2003, that 'aims to relieve congestion of road infrastructures and improve the environmental performance of the whole transport system by shifting part of road freight to short sea shipping, rail and inland waterway' (EUROPA, 2007). The Marco Polo II program that is set to run from 2007 to 2013 has as one of its aims to 'help to shift at least the expected aggregate increase in international road freight traffic, but preferably more, to short sea shipping, rail and inland waterways or to a combination of modes of transport in which road journeys are as short as possible' (EUROPA 2009b).

The next data analysed are for total passenger transport movements. Table 3 shows by nation the break up of total passenger transport by road and rail in five separate years. It also specifies the % average annual compound growth rate for each parameter over three time periods: 1970-2007, 1990-2007 and 2000-2007.

The first notable element of the data presented in Table 3 is that the average annual percentage rate of growth in total passenger transport by private cars in Australia over the 1970-2007 period is considerably stronger than any of the three comparator nations. Over the period 1970 - 2007, the average annual rate of growth of passenger transport by private cars has been the highest in Australia with an annual average growth (2.64% pa) exceeding that in Britain (2.44% pa), France (1.9%) and in Sweden (1.56%). These relationships apply equally to the 1990-2007 time frame and to the most recent period of 2000-07, Australia has recorded the highest %ACG of 1.3%, Sweden second (1.16%), Great Britain third (1.09%) and France showing a decline to 0.41% pa. Only the European Union (26) has achieved a faster rate of annual compound rate of growth in private car passenger transport over this period (3.03 % pa compared with 2.64% pa for Australia). In the most recent period for which data are available (2000-2007) however, Australia's average annual compound growth rate in total passenger transport by private cars of 1.3% outstrips that of the EU (26) of 1.2% pa.

Average annual compound growth in passenger transport on buses and coaches has also been the strongest in Australia both for the period 1970-2007 and for 2000-2007. Of the five nations / regional areas covered in this study, only Sweden has experienced a negative annual rate of growth in private passenger transport by buses and coaches between 1990 and 2007 inclusive; in the period 2000-2007 the average annual percentage drop in passenger transport by buses and coaches in Sweden of -1.58% pa was more than double that of the preceding eleven years. The average annual compound rate of change for passenger transport by rail over the 1970-2007 period presents a markedly different story, with Sweden achieving the highest average increase per year (2.23%), and Australia the lowest (-0.11% pa). In the most recent period, 2000-2007, Sweden still leads with an average annual compound rate of growth of 3.45% pa for rail passenger transport; Great Britain follows with 3.44% pa growth; France with 2% pa growth in rail passenger transport and Australia with 1.84% pa growth in rail passenger transport. Finally, the average annual rate of growth in total passenger transport by road and rail over the years 2000-2007 in Australia has been slightly higher than of its population growth (i.e. 1.33% pa versus 1.23% pa); and the same applies for France (i.e. 0.73% pa compared with 0.61% pa). In contrast, in both Great Britain and Sweden, the rate of growth in demand for road and rail passenger transport during 2000-2007 has been around three times as fast as population growth.

Table 3: Total passenger transport across time by mode and nation

Country and mode	1970	1990	2000	2006	2007	% ACG 1970-07	% ACG 1990-07	% ACG 2000-07
	Thousand million passenger-kms							
AUS Tot pass. Transport private cars	100.2	200.7	240.5	258.7	263.2	2.64	1.61	1.30
AUS Tot pass. Trans buses & coaches	6.5	17.5	17.4	18.9	19.2	2.98	0.53	1.40
AUS Tot pass. Transport Road	106.7	218.2	257.9	277.5	282.4	2.67	1.53	1.30
AUS Total passenger transport Rail	13.4	10.4	11.3	12.5	12.9	-0.11	1.27	1.84
AUS Total pass. transport Road + Rail	120.0	228.6	269.2	290.0	295.2	2.46	1.52	1.33
GBR Tot pass. Transport private cars	283.0	588.0	639.7	686.1	690.0	2.44	0.95	1.09
GBR Tot pass. Trans buses & coaches	60	45.6	46.5	49.9	49.8	-0.50	0.52	0.98
GBR Tot pass. Transport Road	343.0	633.6	686.2	736.0	739.8	2.10	0.92	1.08
GBR Total passenger transport Rail	30.4	33.2	38.2	45.3	48.4	1.26	2.24	3.44
GBR Total pass. transport Road + Rail	373.4	666.8	724.4	781.3	788.2	2.04	0.99	1.21
SWE Tot pass. Transport private cars	56.1	85.9	91.9	97.0	99.6	1.56	0.87	1.16
SWE Tot pass. Trans buses & coaches	8.5	9.7	9.5	8.7	8.5	0.00	-0.77	-1.58
SWE Tot pass. Transport Road	64.6	95.6	101.4	105.7	108.1	1.40	0.73	0.92
SWE Total passenger transport Rail	4.6	6.6	8.2	9.6	10.4	2.23	2.71	3.45
SWE Tot passenger transp Road + Rail	69.2	102.2	109.6	115.3	118.5	1.46	0.87	1.12
FRA Tot pass. Transport private cars	305.0	586.0	699.6	723.8	727.8	2.38	1.28	0.57
FRA Tot pass. Trans buses & coaches	25.2	41.3	43.0	44.9	47.1	1.70	0.78	1.31
FRA Tot pass. Transport Road	330.2	627.3	742.6	768.7	774.9	2.33	1.25	0.61
FRA Total passenger transport Rail	41.0	63.7	69.9	78.8	80.3	1.83	1.37	2.00
FRA Total pass. transport Road + Rail	371.2	691.0	812.5	847.5	855.2	2.28	1.26	0.73
EU Tot pass transport private cars	1,458.2	3,119.1	4,050.7	4,391.9	4,402.1	3.03	2.05	1.20
EU Tot pass. Trans buses & coaches	337.9	526.1	473.8	485.7	500.4	1.07	-0.29	0.78
EU Tot. passenger transport Road	1,796.1	3,645.2	4,524.4	4,877.5	4,902.5	2.75	1.76	1.15
EU Total passenger transport Rail	301.3	383.3	363.2	387.3	393.7	0.73	0.16	1.16
EU Tot. Pass. transport Road + Rail	2,097.4	4,028.5	4,887.6	5,264.3	5,296.2	2.54	1.62	1.15

Source: All data from OECD (2009) Trends in the Transport Sector tables

The data presented in Table 4 shows the estimated passenger kms travelled by private car and in total per capita in Australia, France and Sweden in the years 1970, 1990, 2000 and 2006. Table 5 also presents the % of total passenger transport by private car, and the average annual compound rates of growth for three time periods: 1970-2006, 1990-2006, and 2000-06.

Table 4: Passenger transport kms/ capita over time

	Estimated passenger-kms (000s) / capita			
	1970	1990	2000	2007
AUS: Passenger transport by private car	8.01	11.76	12.56	12.31
AUS: Total passenger transport (TPT)	9.60	13.40	14.06	14.05
AUS: % TPT by private car	83.5%	87.8%	89.3%	87.6%
FRA: Passenger transport by private car	6.01	10.33	11.86	11.89
FRA: Total passenger transport (TPT)	7.31	12.19	13.77	12.66
FRA: % TPT by private car	82.2%	84.8%	86.1%	93.9%
GBR: Passenger transport by private car	5.23	10.57	11.18	11.65
GBR: Total passenger transport	6.34	11.39	11.99	13.31
GBR: % TPT by private car (TPT)	82.5%	92.8%	93.2%	87.6%
SWE: Passenger transport by private car	6.98	10.04	10.36	10.98
SWE: Total passenger transport (TPT)	8.60	11.94	12.35	13.06
SWE : % TPT by private car	81.1%	84.1%	83.9%	84.1%

Source: All passenger kms estimates derived from data extracted from OECD (2009).

One of the most interesting points in Table 4 is the quite similar number of annual passenger kilometres per capita across the four nations. Second, individual travellers in all four nations have over the period 1970-2007 increased their use of private cars as opposed to other modes of transport. This is especially the case in France where the percentage of total passenger transport kilometres per capita taken in private cars has increased to almost 94% in 2007, compared with slightly more than 82% in 1970. Sweden's situation is similar to France in that the % average annual compound growth in passenger transport by private car exceeds that of passenger transport kms / capita overall and the private cars' share of passenger transport is actually still growing, albeit only very marginally. However in the more recent period 2000-2007 the rate of growth of kilometres travelled per capita by private car has dropped in Great Britain by some 5%. The private car's share of per capita total passenger kilometres travelled has also dropped slightly in both Australia and in France, against a back drop of slightly positive annual growth in total passenger transport kilometres per capita.

The third aspect of our analysis centres on energy usage and energy emissions. Table 5 presents data for the years 1997-2007 on energy consumption by the transport sector and by the economy overall. Energy consumption by the transport sector in both France and Sweden over the years 1997-2007 has grown more quickly than consumption in the total economy. Indeed in Sweden's case, while energy consumption in the transport sector has grown by over 14%, national energy consumption growth has been negative. The same relative consumption growth pattern is evident in France: 7.6% growth in the transport sector versus only 4.7% growth in total energy consumption. Final energy consumption in the transport sector of both the European Union (EU) group of 15 and the larger EU 27 group has similarly grown at a faster rate than final energy consumption in total. Australia stands alone: Table 5 shows the reverse to be the case with the overall change in final energy consumption by the transport sector (11.3% change) being lower than the % change for the total final energy consumption. However as indicated in the last column of table 5, the Australian transport sector still consumes an appreciably greater amount of final energy than any of the comparators used in this study.

Table 5: Final energy consumption: Transport sector and Total economy 2007

Country/ region	Final energy consumption: Transport sector [1] 2007 Mtoe [2]	% Change 1997 to 2007	Final energy consumption Total economy 2007 Mtoe[2]	% Change 1997 to 2007	% Transport consumption to total consumption 2007
Australia	27.13	11.3	75.93	15.8	35.7%
France	45.96	7.6	164.97	4.7	27.9%
Sweden	8.25	14.2	34.35	- 4.9	24.0%
United Kingdom	45.05	5.7	145.05	- 3.5	31.1%
EU 15	295.40	28.3	1 044.54	14.7	28.3%
EU 27	337.50	16.3	1 223.92	5.7	27.6%

Notes:
1. Including non-energy use.
2. Million tonnes of oil equivalent.
Source: OECD in Figures 2009

Table 6 excludes data from Australia but clearly shows a change in type of fuel consumed in the transport sector in Europe over the period 1995-2007. While the rate of consumption of gasoline has reduced slightly over the period 1995- 2007 in France, Sweden and the 27 European Union members, the use of gas./ diesel fuel and more pointedly bio fuels have both increased. The fuel shares of each of the three fuel types used in the transport sector of the nations studied have also changed markedly. There has been a decisive shift toward gas / diesel fuels in France, Sweden and the United Kingdom; and a growing use of biofuels particularly in Sweden, and in Germany where in 2007 it accounted for 9.9% of fuel consumption in the transport sector (EAA, 2008).

Table 6: Changing energy use in transport sector

	Final energy consumption in transport sector % Average annual compound growth			% change in fuel shares 1995 to 2007		
Country/ region	**Motor spirit**	**Gas/ diesel**	**Biofuels**	**Motor spirit**	**Gas/ diesel**	**Biofuels**
France	-3.4	2.5	18.3	-15.5	13.1	2.3
Sweden	-1.1	4.1	85.9	-17.4	12.1	5.3
United Kingdom	-1.8	3.5	85.0	-16.1	15.2	0.9
EU (27)	-1.9	4.0	36.7	-18.1	15.3	2.7

Notes: 1. For Sweden and UK biofuels in 1995 constituted minimal % fuel use in transport. To calculate an ACGR a figure of ten terajoules was imputed for 1995 consumption of biofuels.
Source: EAA (2008): CSI 037 Figure 3. Final energy consumption in the transport sector

Table 7 shows data on the rate of growth in CO_2 emissions across the whole economy over three distinct time frames. Australia did not perform as well in respect of reducing CO_2 emissions across the whole economy relative to France, the United Kingdom or Sweden over the years 1971-2005. In 1990, 739 million tonnes of CO_2 were released from the EU transport sector, rising to 900 million tonnes in 2000 with road transport accounting for 84% of the 2000 figure (Banister and Stead, 2002). In 2008 the Australian transport sector accounts for 14% of total CO_2 emissions (Infrastructure Australia 2010) and the transport emissions 'are one of the fastest growing sources of emissions growth in Australia' (Infrastructure Australia, 2010). Infrastructure Australia (2010) also reports that 'strong growth in the emissions from the transport sector is expected to continue, with direct CO_2 equivalent emissions projected to increase 22.6 per cent over the period 2007 to 2020 (or around 1.58 per cent a year).' Given these data it is clear that Australia's transport sector needs to substantially improve its performance before Australia as a nation can enhance its international ranking as a CO_2 emitter.

Table 7: Rate of change in CO_2 emissions over time across whole economy

Country/ region	% ACG 1971-2005	%ACG 1990-2005	%ACG 2000-2005
Australia	2.89	**2.51**	**2.15**
France	**-0.34**	**0.59**	**0.47**
Sweden	**-1.42**	**-0.26**	**-1.14**
United Kingdom	**-0.48**	**-.034**	**0.30**
EU (27) Total	**NA**	**-021**	**0.69**

Source: OECD Factbook 2008

The last comparison explored is the incidence of road fatalities. Table 8 compares the incidence of road fatalities across the four selected nations and the European Union group of 15. Australia has almost the same number of road fatalities per 100000 of population as France and the EU 15 group. Sweden has a substantially lower number of road fatalities per 100000 of population. According to the Organisation for Economic Co-operation and Development (OECD) across the EU-25, Great Britain has one of the lowest road death rates for all persons, at 4.3 per 100,000 people in 2008. This compares to the EU-25 average of 8.6 per 100,000 people (Department of Transport, 2010). Unfortunately the rate of decline in road fatalities in Australia over the period 1997-2007 is the lowest of the four recorded in Table 8. However, over the five years to 2008 in Australia national road deaths decreased by an average of 1.4% per year (Department of Infrastructure, Transport, Regional Development and Local Government, 2009, p. 1).

Table 8: Road fatalities 1997- 2007

		Road accidents 2007	
	% of fatalities compared 2007/ 1997	Killed and injured, thousands	Killed per 100 000 population
Australia	- 9.3	NA	7.7
France	- 45.3	107.8	7.5
United Kingdom	- 18.3	257.2	5.0
Sweden	- 12.9	27.2	5.2
European Union (15)	- 29.2	1 552.5	7.9

Source: OECD in Figures 2009 : Economy, Transport 2007

Table 9 presents data on road fatalities for the longer time frame 1970-2007. It reinforces the point that over the long periods from 1970-2007 and 1990-2007 France, Great Britain and Sweden have all been more successful than Australia at reducing both the total annual number of road fatalities and in quickening the average annual rate of reduction in road fatalities. Australia however has had some success reducing the number of roads deaths per 100 million vehicle kilometres travelled. In 1976, 3.55 deaths per 100 million kilometres travelled on Australian roads occurred; whereas in 2007, the figure had dropped to 0.74 deaths per 100 million kilometres travelled (Department of Infrastructure, Transport, Regional Development and Local Government, 2009, Table 6, p. 18).

Table 9: Road fatalities: 1970-2007

	Killed in road injuries (000s)					% ACG 1970-2007	% ACG 1990-07	% ACG 2000-07
	1970	1990	2000	2006	2007			
Australia	3.8	2.3	2.3	1.8	1.6	-2.31	-2.12	-5.25
France	16.4	11.2	8.1	4.7	4.6	-3.37	-5.08	-7.67
Great Britain	7.8	5.4	3.6	3.3	3.1	-2.49	-3.29	-2.22
Sweden	1.3	0.8	0.6	0.4	0.5	-2.72	-2.86	-3.19
EU (26)	85.1	69.4	56.2	42.9	42.3	-1.87	-2.86	-3.95

Source: OECD (2009) Table C3

5. Key findings

This section outlines the key findings from this international comparative analysis. Table 10 summarises four important areas in which the Australian transport sector has either grown more quickly or less quickly relative to its counterpart in France, Great Britain and Sweden in the period covered by this paper.

Table 10: Australian transport sector's relative performance

Australia has grown more quickly respect of	Australia has grown less quickly in respect of
Average annual percentage rate of growth in total passenger transport by private cars in Australia over the 1970-2007 period is considerably higher than any of the three comparator nations. Australia has the strongest average annual compound growth in passenger transport on buses and coaches in whole period 1970-2007, and for 2000-2007	Australia has the lowest (-0.11% pa) average annual increase in passenger transport by rail over the 1970-2007 period. It is also the lowest for the most recent period 2000-2007 (1.84%), compared with France (2%), Great Britain (3.44%), Sweden (3.45%).
Australia's final energy consumption in the transport sector over the years 1997-2007 is higher than France and the United Kingdom. Australia is the only country of the four studied where national energy consumption and transport energy consumption have both increased considerably over the period 1997-2007.	Between 1997 and 2007 the overall change in final energy consumption by the Australian transport sector (11.3% change) is lower than that of Sweden (14.2%) and EU 27 (16.3%) and EU 15 (28.3%).
Australia did not perform well in respect of reducing CO_2 emissions across the whole economy relative to France, the United Kingdom or Sweden over the years 1971-2005. Infrastructure Australia (2010) reports that 'strong growth in the emissions from the transport sector is expected to continue up to 2020'.	
	Australia's reduction in the number of annual road fatalities over the years 1970-2007 and 2000-07 is lower than that of France, Great Britain and Sweden.

6. Policy implications

This section attempts to briefly outline some broad policy implications that stem from the international comparisons discussed in the earlier sections of this paper and the four key areas of Australia's transport system's comparative performance summarised in table 10. Its overall purpose is however not to act as a 'story board' for consumption by governmental decision makers and / or their policy advisors; nor is its primary purpose to commend or argue for the continuation of policies that have supported the Australian transport sector's favourable performance, since others perform those tasks more than adequately. Rather, its main aim is to sketch out possible policy reforms or innovations in those areas where the data used in this research indicate that reforms and at times incentives will be needed before Australia's transport sector achieves outcomes comparable to the other nations detailed in this study.

The first aspect shown in table 10 confirms the continuing dominance of private motor vehicles over rail for individual passenger transport over the last almost four decades. Unless this long-standing trend can be at least partly reversed, there is a strong likelihood that both traffic congestion — along with its economic costs — and environmental damage will continue unabated. Thus we contend that it is vital for us as a nation to frame public transport people moving strategies that are well researched, that are informed by extensive stakeholder inputs and dialogues, that are long-term in nature, that recognise state differences but seek to develop national standards and best practice approaches, and that are securely funded over the life cycle of projects involved. Over-arching these requirements is the need to ensure that both communities in general and individual commuters are able to feel confident that these new strategies will and do actually deliver to them a reliable, sufficiently frequent, well integrated, safe and acceptably comfortable alternative to their private motor vehicles.

The second aspect detailed in table 10 relates to final energy consumption. While the total percentage growth in final energy consumption in the Australian transport sector during 1997-2007 was lower than that in Sweden, it was higher than both that in France and in the United Kingdom. Compounding this is the fact that the Australian transport sector consumes a greater share of total final energy usage (35.7%: table 5) than any of the nations and regions studied. Also significant is the fact that while freight transport's share of total transport energy consumption in Australia is only 38% 'it is growing at a higher rate than passenger transportation (ABARE 2009). Additionally ABARE (2009) notes that a shift to more energy intensive modes.

> Shifts within the passenger and freight transport sectors from less energy-intensive to more energy-intensive modes (structural effect) are estimated to have led to an increase in energy consumption of 8 petajoules. The freight transport sector contributed to an increase of 11 petajoules, while shifts within the passenger transport sector offset this by 3 petajoules.

Conversely there has been an efficiency effect at work in the Australian transport sector that 'resulted in a reduction in energy use of 0.9 per cent a year' over the years 1989-90 to 2006-7' (ABARE 2009). Energy savings were made in both passenger travel (48 petajoules) and freight haulage (118 petajoules). Despite such efficiency gains, we contend that there is a pressing need for either completely new national policies or the refinement and strengthening of existing ones aimed at reducing energy consumption per unit of economic output in the Australian transport sector. Incentives to motor vehicle manufacturers to hasten the speed of innovation in engine efficiency and to introduce more environmentally benign drive motors and vehicle configuration could also be considered. However ABARE (2009) proffers a cautionary word about the effect on energy intensity of such technological advancements in automobile engineering:

> fuel efficiency of cars has contributed to downward trends in energy intensity (0.7 per cent a year), but part of this has been offset by the increased use of heavier and more energy-

intensive cars. As a result, energy intensity of average car fleets in Australia declined by just 0.1 per cent a year [over the period 1989-90 to 200-6] (ABARE 2009).

The third area detailed in table is in relation to CO_2 emissions. The European Union has clearly grasped this very thorny nettle with the EU Heads of State and Government in 2007 setting, among other aims, an energy target to be met by 2020 of a reduction in EU greenhouse gas emissions of at least 20% below 1990 levels (EUROPA 2010). Targets are admittedly much easier to set than to achieve. Recognising this, the European Commission in early 2008 proposed binding legislation to implement the 20-20-20 targets. This ‘climate and energy package’ was agreed by the European Parliament and Council in December 2008 and became law in June 2009 (EUROPA 2010). In early 2010, post the Copenhagen Summit, the best that the Australian government seems prepared to do is to commit to Australia having a 5 per cent reduction target with no conditions applying. On a more specific level Miller (2009) reports that the Australian government was considering mandatory CO_2 vehicle emissions standards: a move supported by NRMA, but opposed — unsurprisingly — by the Australian automotive industry. It is clear that Australia as a whole will need to frame and effectively implement new and substantial policies and corresponding legislation if it is to come close to closing the growing gap in CO_2 emissions between Australia and its European counterparts. A detailed discussion of the likelihood of such ground-breaking policies being achieved is beyond the scope of this paper.

The final area detailed in table 10 concerns road fatalities in total and per thousands of population. While it is not this paper’s main focus nor does space permit, a brief examination of the main causes of road fatalities will inform the outline of policy implications. Inappropriate speed for the conditions continues to be the predominant cause for heavy truck crashes in Australia (Driscoll, 2009, p. 3). Assuming the same to be the case for private motor vehicles, an immediate policy implication is an ongoing stress on the need for on-going driver education programs and most probably driver re-education over time. Driscoll (2009) also reports that one in six serious truck crashes occurred on Australia's National Highway One. Before Australia can perform on a level footing with the likes of France, Great Britain and Sweden in respect of further reducing road fatalities, based on such evidence there is a strong case to be put for ensuring sufficient and sustained funding to build and maintain safer roads throughout Australia. Reducing road fatalities to levels comparable with those achieved overseas and reported in this paper also requires further and sustained research and development efforts to achieve the design and manufacture of holistically safer motor vehicles. How much of a role government funding should play in such R & D efforts and what other subsidies or incentives are appropriate is beyond the scope and remit of this paper, but deserving of serious analysis and informed debate. Advancing each of these policy prerequisites requires informed and mature dialogue and a unity of purpose across all stakeholders: in this sense the 2010 National Road Safety Conference is an encouraging event. Finally, the willing and complete adoption of a Safe System approach to road safety, as directly and strongly recommended by the International Transport Forum (ITF) (2008) along with the seven other policy initiatives also proposed by the ITF (2008, p. 13) are prerequisites for sizable and sustainable reductions in Australia’s road fatalities and serious injuries.

7. Conclusions and future research

The Australian transport sector has grown consistently over the last four decades. Annual growth in freight transport measured in thousand million tonne-kilometres has been slightly lower than average annual compound growth in GDP. Annual growth in total passenger transport by road and rail on the other hand has been less than one quarter of the average compound rate of growth in GDP over the years 1990-2007. Our over reliance on private vehicles for passenger transport is still evident, although the same is true in France, Great Britain and Sweden. Our statistics on energy consumption, the rate of reduction on CO_2 and on the number of road fatalities may be regarded as less favourable than the comparators used in this study.

The analysis presented in this paper has limitations. It does not consider important issues such as traffic congestion, or the relative use of intelligent technologies in transport, or the amount of governmental funding of the transport sector. It has not included other nations that are claimed by some to be more relevant comparators to use in such an investigation of the Australian transport sector. The United States of America and Canada are two that come quickly to mind. It is planned to replicate this study by comparing the Australian transport sector directly against those two nations, provided the necessary comparative data are available. It is also planned to add further metrics: the three issues just mentioned are among such planned additions.

References

ABARE 2009, *End use energy intensity in the Australian economy*: *Energy intensity in the transport sector.* Canberra, ACT.

Akerman, J. and Hojer, M. 2006, How much transport can the climate stand? — Sweden on a sustainable path in 2050, *Energy Policy* 34: 1944-1957.

Australian Bureau of Statistics 2008 *Regional Population Growth, Australia, 2007-08*, Catalogue Number 3218.0, Canberra.

Banister, D. and D. Stead 2002, Reducing Transport Intensity" *EJTIR* **2**(4/3): 161-178.

Bureau of Infrastructure, Transport and Regional Economics 2010, *Interstate freight in Australia*: Research Report No. 120, BITRE, Canberra.

Crafts, N. 2009, Transport infrastructure investment: implications for growth and productivity, *Oxford Review of Economic Policy* **25**(3): 327-343.

CSIRO 2008, *Modelling of the Future of Transport Fuels in Australia*, A report to the Future Fuels Forum, June.

Department of Foreign Affairs and Trade 2009, *Australia in Brief: The Island Continent,* Australian Government, Barton, ACT.

Department of Infrastructure, Transport, Regional Development and Local Government 2009*, Road Deaths Australia 2008 Statistical Summary*, Road Safety Report No. 4, Canberra.

Department of Transport 2010 *Fatalities in reported road accidents: 2008 Road Accident Statistics* Fact sheet No. 2 – 2010, London, Great Britain.

Debrincat, L. and Rascol, D. 2007, *The urban transport plan in Ile-de-France: an evaluation after six years of implementation*, Association for European Transport and Contributors 2007.

Driscoll, O. P. 2009, *Major Accident Investigation Report 2009*, National Transport Insurance, Springwood , Queensland.

EUROPA 2007, *Intermodal transport: The Marco Polo Programme,* http://europa.eu/legislation_summaries/transport/intermodality_transeuropean_networks/l24159_en.htm, accessed 29 March 2010.

EUROPA 2009a, *The history of the European Union*, http://europa.eu/abc/history/2000_today/2009/index_en.htm accessed 28 January 2010.

EUROPA 2009b, *Regulation (EC) No 1692/2006 of the European Parliament and of the Council of 24 October 2006 establishing the second Marco Polo programme* http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2006:328:SOM:EN:HTML, accessed March 29 2010.

EUROPA (2010) *The EU climate and energy package*

Hicks, J. and Allen, G. 1999, *A Century of Change: Trends in UK statistics since 1900* Research Paper 99/111, 21 December 1999, House of Commons, London.

Infrastructure Australia 2010, *State of Australian Cities 2010*, Major Cities Unit, Infrastructure Australia, Australian Government, Canberra.

International Transport Forum / OECD 2008, *Towards Zero: Ambitious Road Safety Targets and the Safe System Approach*; www.internationaltransportforum.org accessed May 17, 2010.

Maps of the World 2010, www.mapsofworld.com accessed March 25 2010

Miller, B. 2009, Face-off over car emission targets May 20; accessed May 7, 2010 www.abc.net.au/news/stories/2009/05/20/2576148.htm,.

National Institute of Statistics and Economic Studies, Paris.

National Transport Commission 2010, *Strategic Plan 2010/11 – 2012/13 Environmental scan*, February 2010, Melbourne.

OECD 2005, *Economic Survey of the UK*, Paris.

OECD 2009, *Factbook 2008: Economic, Environmental and Social Statistics,* Table 02-01-01-T1[1],Paris, http://www.oecd.org.

OECD 2009a, *OECD in Figures 2009* - OECD © 2009 - ISBN 9789264051997 accessed January 29 2010.

OECD 2009b, *Trends in the Transport Sector 2009* tables accessed December 14 2009 from http://www.oecd.org

OECD 2010, *Factbook 2009: Economic, Environmental and Social Statistics: Quality of life - Security - Road fatalities per million inhabitants.*