26th Australasian Transport Research Forum
Wellington
New Zealand
1-3 October 2003

1. INTRODUCTION

This study of journeys to work focuses on Australia and New Zealand and their major cities using data from their population censuses from 1976 to 2001. It reveals that use of the census data is the only accurate means available of measuring the changing pattern of male and female commutes and the growth of unsustainable car dependence for all levels of government. Accurate comparisons are possible for even the minor modes (bicycle, motorcycle and walking) at local government level right down to local council election wards. Such comparisons are impossible to make with other transport surveys which have sample sizes as small as 2% of the population and are focused on one city.

The primary purpose of this study is to show that use of the census date provides a valuable diagnostic tool for transport and other planners to monitor and evaluate past and present unsustainable urban transport behaviours and assist them in targeting these behaviours with counter measures. A wide range of counter measures are briefly discussed to provide an overall perspective. The principal recommendation is that the 2006, 2011 and 2016 census data should be used for evaluating any counter measures adopted by government to address the unsustainable behaviours.

It is assumed that a sustainable city is one in which the per capita uses of fertile land, fresh water and fossil fuels are incrementally reduced by an integrated planning effort by all levels of government and the private sector. The word unsustainable specifically applies here to transport behaviours that are likely to increase per capita oil consumption, air pollution, greenhouse gas emissions and road congestion costs in the next ten years. It is also assumed that there are health benefits from walking and cycling to work. It is argued that within the next 20 years, as global cheap oil reserves deplete, unsustainable increases in per capita oil consumption could pose an energy security threat to Australia and a very serious energy security threat to New Zealand, which has only one sixth of the per capita oil reserves of Australia.

This study proceeds by graphing the 25-year trends in commuting since 1976 in Australia and New Zealand. It then defines the costs of congestion nation wide in Australia and the serious energy security threat due to oil depletion in both countries. It goes on to graph and analyse the 1996/2001 data for the larger cities; all have increasing levels of unsustainable motorisation but some have a better record than others in providing for train travelers, bicyclists, walkers or for those working at home.

1.1 METHODOLOGY

The following methodology has been used in preparing this article:

• Proceed from the general to the particular by first analysing the overall national trends for both Australia and N.Z. for the 25 years from 1976 to 2001 and highlighting the salient features of the growth in car dependency and the decline of the more sustainable transport modes at a national level. See Figures 1 and 2 and Table 1

• Analyse the overall national trends for Australia's increasing congestion costs projected to the year 2011 (see Figure 3); describe the underlying changes to the working and urban environment (Table 2); and suggest that similar trends may apply to N.Z.. Draw some conclusions about the unsustainable consequences of the current trends towards greater oil and car dependency.

• Chart the particular modal trends for the 15 year period from 1986 to 2001 for five Australian capital cities (Figure 4) and the four largest N.Z. cities (Figure 5) to highlight the more recent positive trends in the 1996/2001 inter census period and briefly outline the options available making the various modes more sustainable.
• Tabulate and rank the nine cities for the percentage of all walking trips to work by all methods and the percentage of all non-motorised trips by all methods for the nine cities. (see Table 3). Establish male to female ratios for bicycle commutes for N.Z. and five Australian cities (see Table 4).
• Recommend that targets for modal substitution be established by government to reduce car and oil dependence and that they be monitored and evaluated using the census data for 2006, 2011 and 2016.

1.2. ABBREVIATIONS AND DIFFERENT NATIONAL CENSUS CATEGORIES

Despite the minor inconsistencies between the ways the data were categorised in the early censuses they are the most comprehensive source of historical transport trends for the journey to work in both countries. There are differences in the way the data are defined in both countries. The following abbreviations and definitions have been used:

- N.Z. =Zealand
- ABS=Australian Bureau of Statistics
- SNZ = Statistics New Zealand
- The “journey to work” is referred to as the “commute”
- Persons who “journeyed to work” are referred to as “commuters”
- In N.Z. and Australia walking all the way to work is counted, but the walking trip to the public transport stop or station, or to and from car parks, is not counted.
- In N.Z. the “commute” is the journey to work and back by any one method such as a bus, car or walking. Commutes by two methods or three methods are not counted separately. However as the proportion of multi-modal trips is significantly less than in Australia, due smaller cities in N.Z., comparison of unsustainable trends in N. Z. and Australia is still relevant
- In Australia the “commute” is the journey to work by any one method or by an inter modal commute using two or three transport methods. What is counted is the complete commute by one person and the data are categorised for 1, 2 and 3 methods. Commutes by 2 or 3 methods account for 8% of all commutes in Sydney and around 5 % in the other cities.

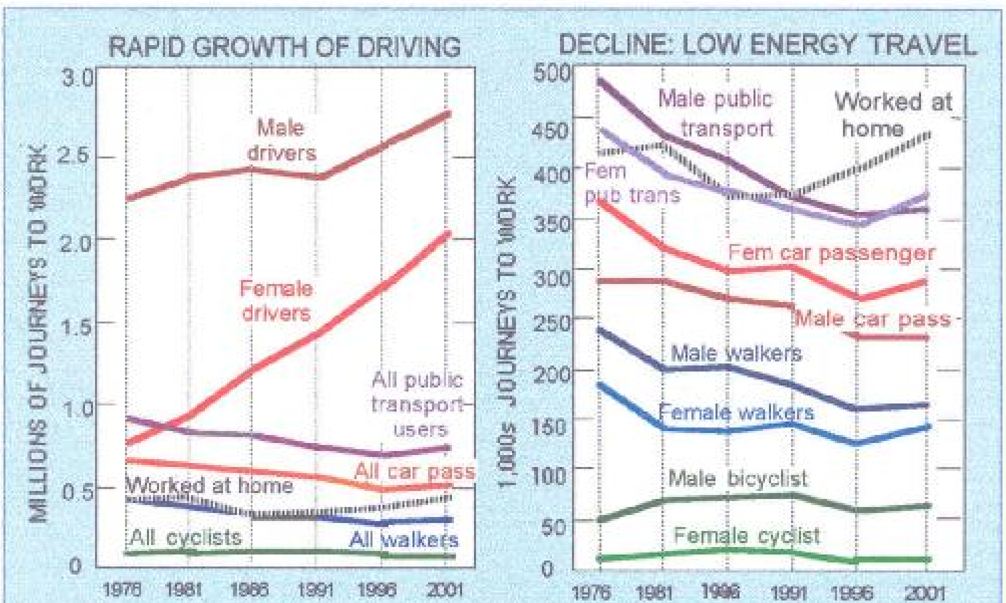
The sample surveys of the ABS count the journeys by students to places of education and the number of shopping trips can also be used to set targets for all modes of transport at the national level and in large cities. However it is not suitable for the analyses of minor modes of travel in local government areas.

2. THE GROWTH OF CAR DEPENDENT WORK FORCES

This study graphs the 25-year trends in commuting since 1976 in Australia and N.Z. and analyses the consequences.

2.1 AUSTRALIAN TRENDS 1976 TO 2001

In 2001 8.3 million Australians (43% of the 19.5 million resident population) were employed on census day but only 6.8 million (35% of the resident population) actually commuted to work on that day. The other 1.5 million were sick, on holiday, had a day off, worked at home, were part time workers who did not have any work to do on census day or did not fill in the census papers properly. Figure 1 excludes commutes to school or educational institutions by students but includes those who went to work in these places on census day. As working at home is a sustainable work practice it has been included in Figure 1 for the purposes of comparison.



NOTES: Includes P T multi-modal trips. Motorcycle, truck and taxi modes are omitted
DATA SOURCE: ABS Population Census "Basic Community Profiles" Cat No 2001.0

Figure 1 AUSTRALIA: journey to work ABS 1976 to 2001

Females accounted for 45% of employed people in 2001 compared to 33% in 1976, so it is not surprising that the most dominant trend, shown on Figure 1, has been the increase of female car commuters. There was also a large increase of male car commuters. There were only 513,220 car passenger commutes in 2001 compared to 629,100 in 1976; that is a decline in commuter car fleets' vehicle occupancy rates from 1.21 to 1.08 passengers. In 2001 54% of car passenger commutes were women. Public transport and walking declined and the number of bicycle commutes in 2001 was almost the same as in1981.

The number of commuters driving to work increased by 1.8 million between 1976 and 2001; that is, from 3 million in 1976 to 4.8 million in 2001. As a consequence commutes by persons driving increased from 51.6% to 71.8`% and most of this increase was due to women drivers (1.17 million). The number of female drivers has nearly tripled but the number of male drivers has only increased by one fifth. The upward trend of both male and female car commutes suggests that further increases to at least 5.3 million car commutes are likely by 2006.

Public transport trips decreased from 920,250 commutes in 1976 to 742,300 in 2001 by which time the number of male and female public transport travelers were nearly equal. The large decline in both male and female public transport commutes from 1976 to 1996 indicates that the prospects for increasing public transport use overall are poor, although the number of public transport commutes increased marginally between 1996 and 2001. There were also 11,300 triple mode commutes involving both a train and a bus and either a car driver or car passenger. Overall 4.1% of all commutes were dual mode and 0.45% were triple mode.

The most sustainable trend was the growing proportion of people who worked at home, from 370,000 in 1986 to 438,000 in 2001; of 53.5% of these were women. The most interesting trend since 1976 is the use of cars as means of accessing public transport, accessing other cars, or for carrying bicycles for the last part of a commute.
All dual mode trips are detailed in the Census “Classification counts” and those categories with more that 3,000 commutes are shown on Table 1

Table 1 Dual mode commutes of more than 3000 involving cars

Car/public transport...Number

Car driver/ train............62,200
Car passenger/train.....26,400
Car driver/ bus.............12,500
Car passenger/bus......12,900

Car driver/passenger...29,600
Car driver/truck.............6,220
Car driver/bicycle...........4,828
Car driver/motorcycle.....3,454
Bicycle/ train 3,200

Walking all the way to work decreased from 426,000 in 1976 to 287,900 in 1996 but increased to 316,600 in 2001. When expressed as percentage it represents a decline from 8% of all commutes in 1976 to 4.7% by 2001 and of these 54% were male commutes. These Figures greatly underestimate the contribution of walking because walking as an access mode to public transport is not counted. When walking is added to the 2001 data, 1,058,900 or 15.6% of all commutes involve walking. However this under estimates walking because there is another 1% of multi modal commutes that do not involve the use of public transport. If these are counted as well then 16.5% of all commutes involve a significant amount of walking.

The counting all the commutes involving a significant amount of walking is one way the census data (plus sample surveys to estimates distances for multi modal trips) could be used to measure the value of incidental exercise in transport as a contribution to the general fitness of the population. Australians have grown much fatter since 1976 and the medical profession has started to refer to this as a national obesity epidemic so there is a need to measure the value of incidental exercise; this could easily be done as part of the 2006 census process.

There are several male dominated commuting modes but only bicycling is shown on Figure 1. Commuting by motorcycle or motor scooter has steadily declined from 81,000 (1.5%) in 1976 to 48,100 (0.7%) in 2001 of which 92% were males. Taxi commutes also halved from 36.700 taxi trips in 1976 to 21,150 in 2001 of which 62% were males. For the first time in 2001 the ABS Census 'Community profiles' included commutes by truck; a significant 134,100 commutes by truck were counted (2.0% of all trips) of which 97% were by males.

Australia wide there has been only a small increase of bicycle commutes all the way to work from 56,300 (1.11% of all commutes) in 1976 to 92,700 (1.63%) in 2001. 80% of these were by males despite the large increase in female commuters and the large number of women who cycle as a means of recreation. However there were also 12,400 multimodal bicycle commutes (of which around 80% were by males) which increased the total proportion of bicycle commutes to 1.34% of all commutes.

2.2 NEW ZEALAND TRENDS 1976 TO 2001

In 2001 1.73 million (46%) of the 3.74 million resident New Zealand population were employed on census day but only 1.3 million (35%) of the resident population actually commuted on census day; the same proportion as in Australia. The other 430,000 did not go work for much the same reasons as in Australia. Figure 2 shows the pattern of 1.3 million commutes to work on census day and the number of those who worked at home for purposes of comparison.

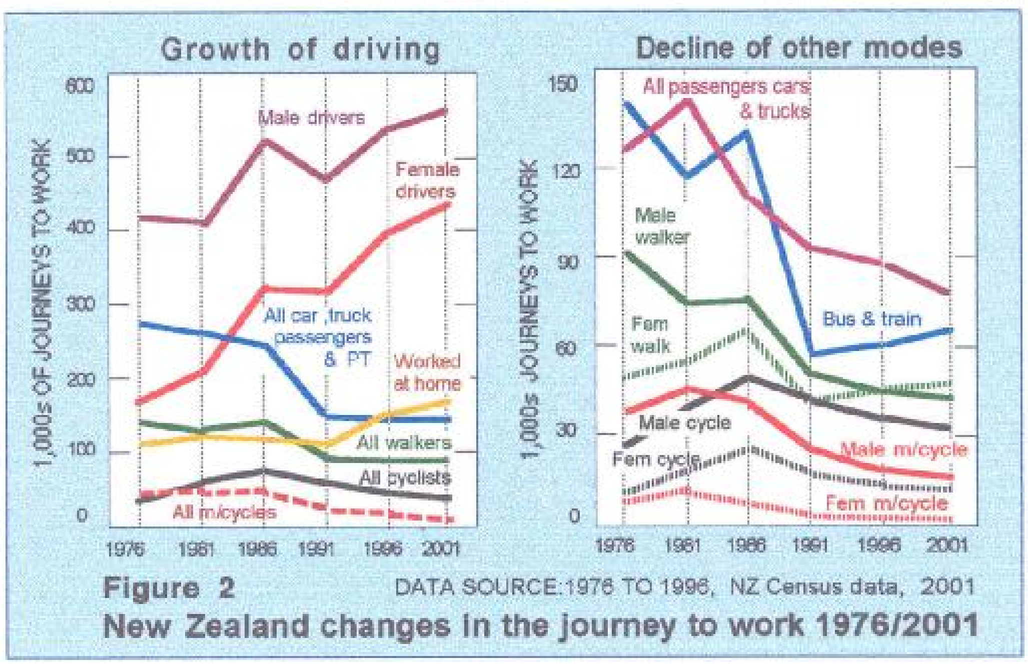


Figure 2
New Zealand changes in the journey to work 1976/2001

Figure 2 shows that since 1976 the workforce has become far more car-dependent. Public transport's market share declined from 1976 to 1996 but improved a little during the 1996/2001 intercensus period. There has been a significant decline in the proportion of the labour force commuting by walking all the way to work and the proportion of bicycle commuters is down by one third. The most sustainable trend is for those who worked at home. This increased from 42,400 in 1976 to 166,000 (12.6%) in 2001, suggesting a possible further increase by 2006. This is nearly double the growth rate of those who worked at home in Australia.

The most dominant trend has been the increase in the number of commuters driving to work from 614,150 in 1976 to 996,600 in 2001 a percentage increase from 53% to 76% in the same period. The proportion of female car commuters increased from 18.5% in 1981 to 25% in 2001. The upward trend of male and female car commutes on Figure 2 indicates that a total of just more than 1 million car commutes is likely in 2006. The small increase of 231,700 Census day commuters since 1976 was mostly due to the increasing proportion of employed females who accounted for 44% of the work force in 2001.

The unsustainable trend in the utilisation of the car fleet for commuting over 25 years is indicated by vehicle occupancy rates dropping from 1.2 passengers in 1976 to 1.08 in 2001. Public transport commutes decreased from 142,500 in 1976 to 64,250 in 2001; that is from 12.3% to 4.9% of all commutes. This indicates that the prospects for increasing public transport use overall are poor even though the number of public transport commutes has increased since 1996. Even so Wellington has a very good public transport system with plans to greatly improve the level of service that is offered.

Walking all the way to work in N.Z. decreased from 142,500 in 1976 to 92,200 in 2001; that is a decline from 12.3% to 7.1% of all commutes. By 2001 there were a similar number of both male and female walkers. The fact that only the main mode of motorised travel is counted for all N.Z. commutes means that walking trips to other modes (and between modes) are not counted. However the “walking all the way” commutes are added to the public transport commutes; walking was involved in at least 23.1% of all commutes in 1976 and 12 % of all commutes in 2001. This is a useful indicator of the contribution of incidental exercise to the general fitness of the employed.

Commuting by motorcycle or moped has also steadily declined from 47,950 in 1976 to 17,300 in 2001; that is from 4.1% to 1.3% of all commutes. In 2001 only 14% of motorcycle or moped commuters were women.

Taxi commutes are not counted by the SNZ and commutes by truck are included in the category for driving.

Bicycle commutes all the way to work increased in number from 38,050 in 1976 to 40,700 in 2001: that is from 3.3% 1976 to 3.2% an increase in numbers but not in commuter market share. This is a male dominated activity with only 30% of all bicycle commutes being made by females in 2001.

2.3 CHANGES TO THE WORKING ENVIRONMENT IN AUSTRALIA AND N.Z.?

Since 1976 there have been changes in the types of employment that have impacted on commuter travel patterns in both Australia and New Zealand. The changing role of women, the decline in manufacturing industry and the growth of service industries have all had a significant effect. There are now fewer secure full time male jobs, more part time work and more casual employment.

Table 2 shows the proportion of male full-time jobs dropping from 81% in 1973 to 68% in 2003 and the proportion of female full-time jobs increasing 39% to 53%. The Census data show that within this time frame part-time male jobs increased from 171,000 to 916,000 in 2001 and part-time female jobs increased from 690,000 to 1,773,000 jobs in 2001.The following changes also had an impact:

.

- The growth of unemployment amongst the over fifties,
- A large increase in the proportion of long term unemployed,
- Higher levels of under-employment by those in the workforce, and
- Proportionally more young people in education and postponing employment.

Table 2 Proportion of the population aged 15 and over employed in Australia

Year	1973	1983	1993	2003
Males	81	70	65	68
Females	39	40	46	53
Persons	60	55	55	60

Source: ABS

In Australia the overall unemployment rate fluctuated from 4.7% in 1976 to 9.9% in 1983; down to 5.7% in 1989; and up to a high of 11% in 1993. In the 1990s job security was much worse than in the 1970s; the average duration of unemployment was only 4 months in 1970; this had increased to 13 months by 1989. A survey revealed there were 200,000 Australians retrenched from 1997 to 2000 who had still not found a job and of the nearly 500,000 full time workers retrenched or made redundant only 57% had found another full time job. Fortunately unemployment dropped back to 7% in 2001 and by 2003 the number of long term unemployed had greatly reduced.

However the fear of unemployment still remains. Outer urban growth and the lack of public transport orientated land use planning increased the comparative advantage of the car in accessing employment. In 2003 cars are perceived as the only feasible transport option for the employed and as being necessary to keep employed and to pay the mortgage.

The pattern of unsustainable commutes in N.Z. is similar to that of Australian cities and it is assumed that similar employment changes to those described above have taken place in N.Z.. These changes indicate that making commuting less car dependent is going to be a very difficult indeed.

2.4 COMMUTING AND ROAD CONGESTION IN AUSTRALIA

The greatest congestion from the Australian car fleet is caused by the increase in the total resident population and its ongoing concentration in large urban areas where most people have to commute long distances and have poor access to public transport. In 2001 car commutes only accounted for around 11% of all urban passenger transport journeys for all purposes. As car commutes are generally longer than most other journeys they account for around 24% of the total distance traveled by car.

Furthermore car commutes are concentrated in the rush hours when urban roads are the most congested and subject to stop start driving conditions and 'cold starts'. They make a large contribution to air pollution, greenhouse gas emissions and increased fuel consumption. The BTE estimate of the costs of road congestion in Australia in $ billions to the year 2011 is shown on Figure 3 (BTE 1999). Figure 3 shows an almost parallel growth of human and car populations since 1976 with an even greater growth of congestion cost since 1995.The projected growth to 2011 of the number of commutes by all modes is much less than the increase in congestion costs.
Figure 3 shows a prediction to the year 2011 of parallel increases in total commutes and single occupant car commutes. This assumes that 'business as usual' policies and a further reduction in commuter car occupancy rates will effectively wipe out the benefits of improved fuel consumption in new cars to at least 2011.

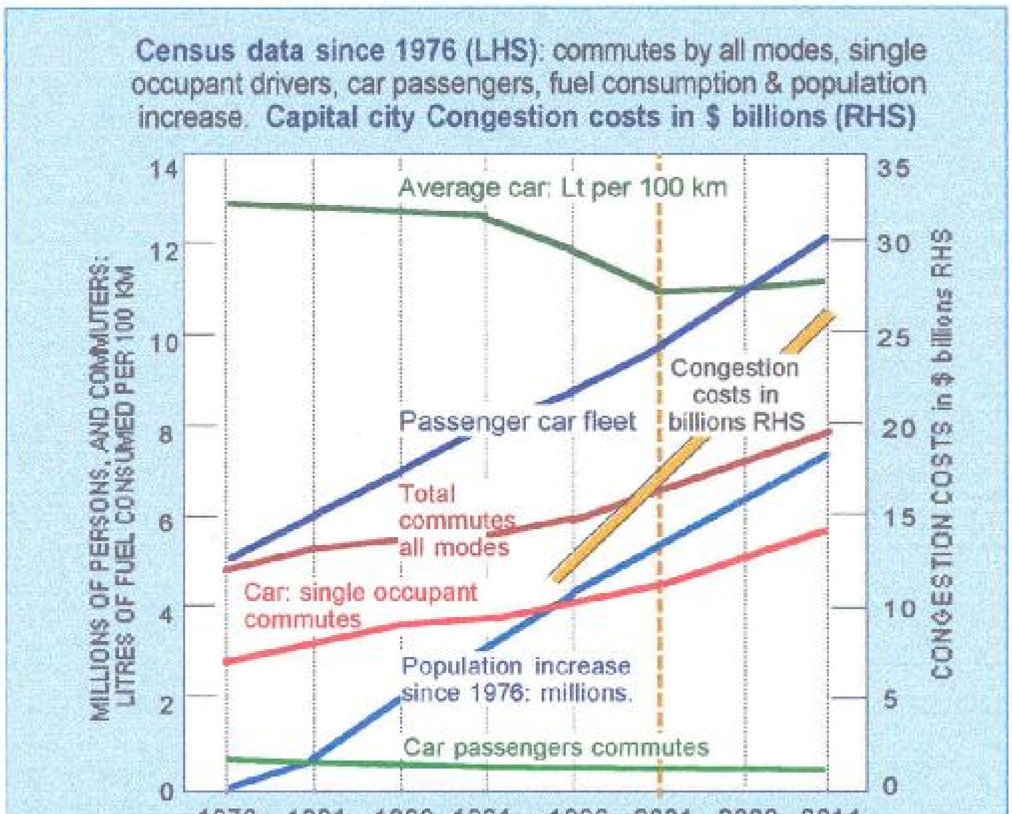


Figure 3 Unsustainable Australian commutes 1976 to 2011

The increase in total commutes is not the problem but the large increase in "single occupant" car commutes. The large increase in single occupant car commutes is the major generator of increasing congestion costs because if so many commuters did not have to drive to work there would less multiple car ownership and a smaller car fleet with higher car occupancy rates.

Figure 3 also shows estimates by the CSIRO of car fleet fuel efficiency; that is litres of petrol consumed per 100 km. Fuel efficiency improved from 1976 to 2001 but is projected to get marginally worse from 2001 to 2011 due to the growing proportion of large cars with more luxury features and four wheel drive vehicles (Foran & Poldy 2002). Since 1976 the car occupancy rate for the commuter car fleet has dropped

from 1.21 to 1.08; this is likely to reduce even further by 2011 and to be even less energy efficient in terms of energy per passenger km.
Figure 3 shows that the car population doubled between 1976 and 2001, an increase of 5 million cars that parallels the 5.4 million increase in the resident population. By 2011 the increase in the car and human population is likely to be even more concentrated in and around the existing capital cities according to recent ABS forecasts. Much of the new housing will be located in outer areas which are badly serviced by public transport.

The Australian car fleet appears likely to continue to use 10 litres of petrol (or more) per 100 kms driven to at least 2011, despite the availability of energy efficient hybrid cars, because there are no fiscal plans on the political horizon to encourage their use. The practice of subsidising car use as part of the salary package has grown to such an extent that it significantly discourages public transport use and encourages the purchase of vehicles that are larger than what they would be if not part of a salary package.

The introduction of the GST in 2000 reduced the cost of cars and the absence of import duty on 4WDs is another incentive to buy and drive them in urban areas. New cars in 2003 will have fuel efficiency labels for buyers but there are no fiscal carrots in the form of ‘green’ tax incentives to buy small energy efficient cars. There is nothing on the Australian political horizon that will reduce oil consumption by the car fleet. Some of the above also applies to New Zealand.

2.5 ADAPTING THE ECONOMY - THE END OF CHEAP OIL

By the time that the current N.Z. buyer’s market becomes a seller’s market, as world oil production begins to fall, New Zealand and Australia will be vulnerable to increasing costs of imported oil and serious oil shortages (Australian Energy News 2001).

Woodside Petroleum’s Managing Director said recently that:

“*Australia has been consuming oil three times faster than it has been discovered. Projections by Australian Government forecasting agencies indicate that Australia is facing a rapid decline in liquid petroleum production over the next decade. Liquid petroleum self-sufficiency is expected to decline from an average of 80-90% over the past decade to less than 40% by 2010. The economic implications for Australia are significant including a rapid deterioration in Australia's trade deficit on liquid hydrocarbons (from a surplus of $1.2 billion in 2000/01 to a projected annual deficit of A$7.6 billion by 2009/10)”.* (Akehurst, 2002).

The above is most alarming as N. Z. has only one sixth of the per capita oil reserves of Australia (World Oil.com 2000). The option of using gas as a transitional fuel for motor vehicles, as proposed by the Western Australian Government, may not be an option as N.Z. has only one fourth of Australia’s per capita gas reserves. (World Oil.com 2000). However N.Z. would have access to some of Australia's oil reserves. Also, N.Z. has enormous wind energy resources that could be used in the long term to produce hydrogen by electrolysis that could be used to fuel vehicles (Lovins 2003)(EECA 2003 B)(Economist 2000).

The general view within the oil industry is that Australia and N.Z. have low oil prospectivity. Fields yet to be discovered are of small to medium size and are becoming more technically demanding, e.g. heavy oil or deep-water reserves. The general view of the international oil industry regarding world oil; reserves is even more depressing (Laherrere, J., 2003).

The May 2002 Uppsala University International Conference on Oil Depletion and the May 2003 Association for the Study of Peak Oil Conference held in Paris evidenced a growing consensus on the reality of oil depletion. (www.hubbertpeak.com.) Overall there emerged a scenario of world oil depletion of 5-10% per year, a recognition that oil reserves had been deliberately overestimated by the oil industry and that there are unlikely to be more major significant reserves to be found. Middle East and American oil representatives issued warnings on the absence of any more major frontier regions except the Polar Regions and the increasing incidence of "dry holes".
For several years for every new barrel of oil discovered four barrels of oil have been consumed. Once peak oil production is passed, costs rise and quality tends to decline.

Australia and N.Z. will be exposed to a national decline in oil production at the same time as the overall world production is predicted to decline, leaving it vulnerable to serious oil shortages and price spikes. The world oil market is expected to become a seller's market as early as 2005 and by the latest 2020. Temporarily the balance of power will shift towards OPEC, but even Middle East production is expected to start falling around 2010 (Robinson, 2002).

In the short term we can expect brief but unexpected oil crises and over the next decade significant changes in oil pricing. A crisis in supply-demand balance is likely to emerge within 20 years as the impact of the growing demand of the developing economies competes for a dwindling supply with the high demand from developed countries. The USA has a particularly high demand and it has been predicted that it will import 70% of its oil by 2020.

Oil depletion has major implications for the global economy, as well as national economies, and involves major equity issues for the world's poor who will need access to affordable energy, especially for agriculture. The world faces a major challenge to find clean and enduring sources of energy. A more comprehensive industrial transformation towards sustainability is needed in developed countries like Australia and N.Z., including an all-of-government approach to decoupling per capita economic growth from per capita oil consumption as they are trying to do with some success in the Netherlands (NEPP 3 1998)(Parker 2002). Failure to create and implement national energy security policies could create a long lasting economic depression with very high and intractable levels of unemployment.

The necessary change processes will have to emphasise oil conservation as the key risk management strategy, as there appear to be no technical panaceas to enable the current high-energy consumption patterns to persist. These changes will involve lifestyle changes; oil and transport demand management measures; congestion pricing; new "energy-lean" technologies; land use and transport planning to reduce car dependence.

3. UNSUSTAINABLE TRENDS IN NINE MAJOR CITIES

In this section the transport trends in nine Australasian cities are examined to see which cities, if any, are making progress in encouraging the more sustainable commuting behaviours that reduce oil consumption. Figure 4 compares the five largest Australian capital cities ranked from right to left in terms of population size. Figure 5 compares N.Z. with four cities ranked in terms of population size.

On both Figures the percentage share of all commutes by the main modes are shown to more clearly reveal changes in market share and as an easy way of making intercity comparisons. Male and female car driver commutes are shown separately to make it easy to show the overall trends. Walking and bicycling commutes are grouped together for clarity. Walking and cycling commutes all the way to work and for intermodal commutes are shown separately in Tables 3 and 4.

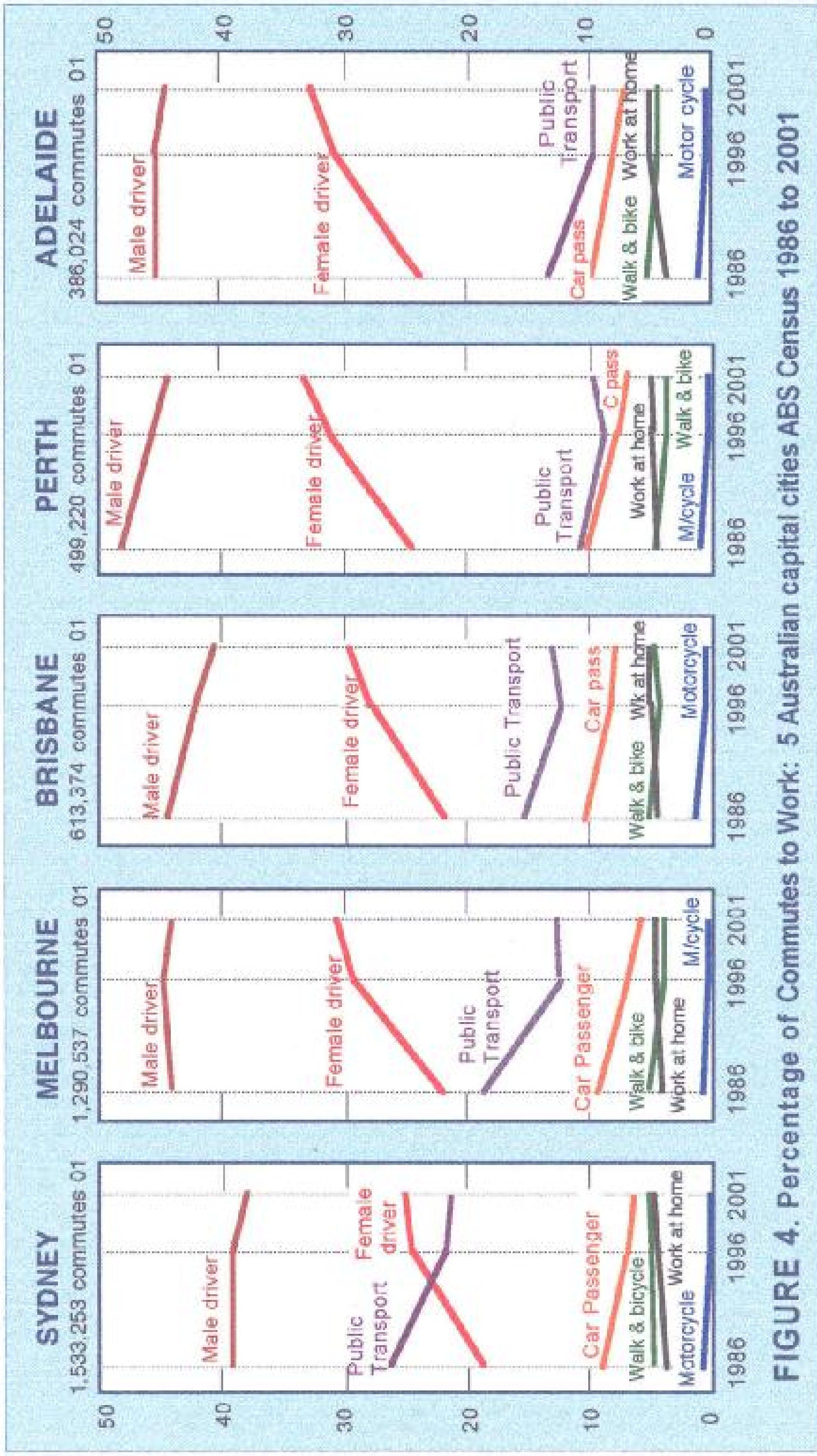


FIGURE 4. Percentage of Commutes to Work: 5 Australian capital cities ABS Census 1986 to 2001

The modal share of single occupant car commutes in Australia cities is high except in Sydney which has a significantly lower percentage of commutes by both male and female drivers and a higher proportion of commutes by public transport.

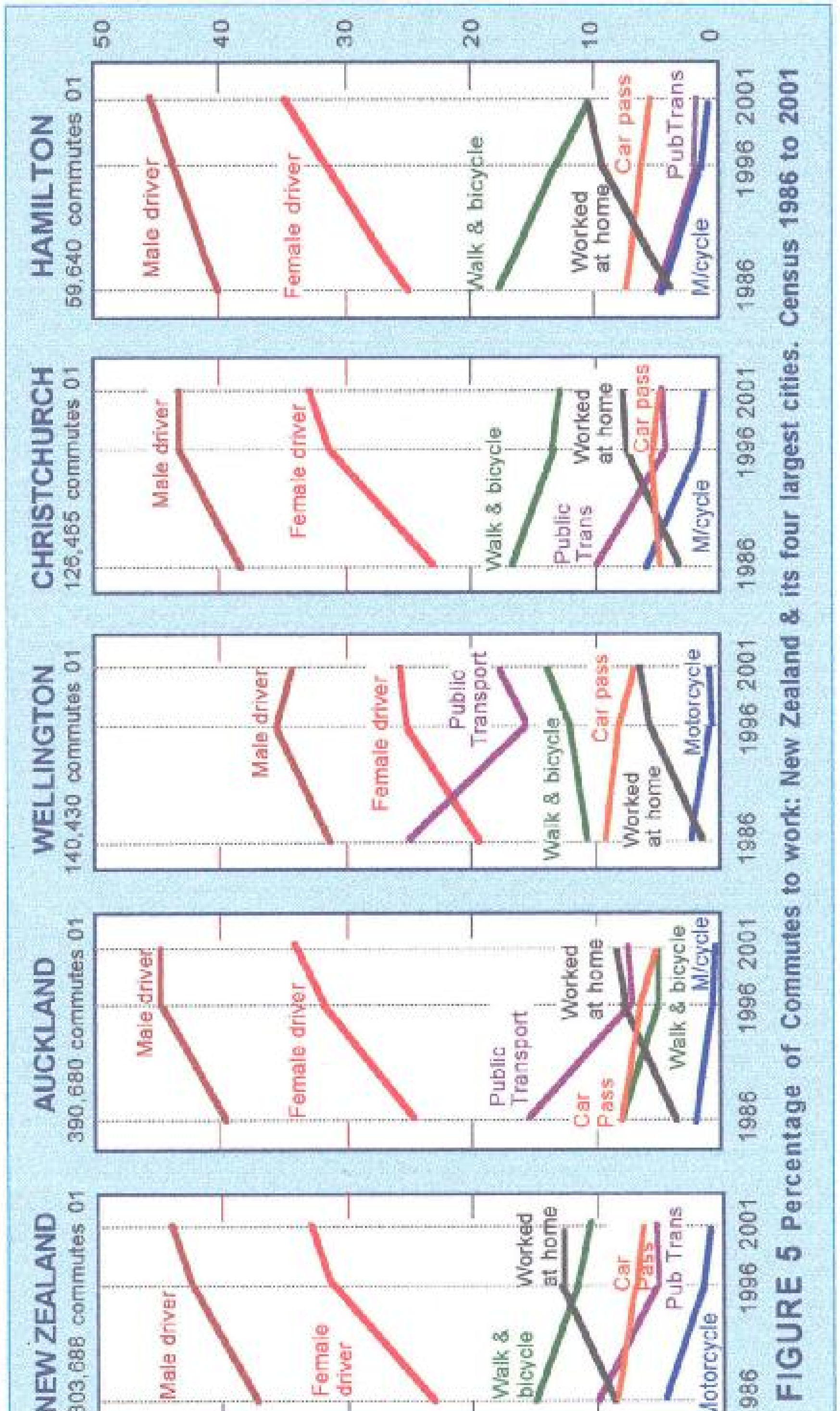


FIGURE 5 Percentage of Commutes to work: New Zealand & its four largest cities. Census 1986 to 2001

Perth has the highest proportion of single occupant car commutes and the lowest proportion of commutes by public transport. However the percentages of non-motorised car passenger and motorcycle commutes and the proportion of those who work at home is remarkably similar in all five Australian cities between 1996 and 2001.

The modal share of single occupant car commutes in N.Z. is high in all cities except Wellington where it is much lower by both male and female drivers, with more 17.8% of commutes by public transport.

Hamilton and Auckland have the highest proportion of single occupant car commutes and much less public transport than the other cities shown in Figure 5. The percentage of motorcycle commutes is much higher in all cities (except Auckland) than in the Australian cities but is declining. Non-motorised commutes all the way to work vary a great deal with Wellington, Christchurch, and Hamilton having much higher levels than the Australian cities and Auckland. The proportion of those who worked at home is remarkably similar in all New Zealand cities between 1996 and 2001 and is far higher than in Australian cities.

3.1 MAKING BETTER USE OF CAR FLEETS

Another means of reducing congestion is to make better use of the commuter car fleet by car-pooling or informal car sharing, road pricing and congestion pricing. The percentages of car passenger commutes in all five cities shown are down from 1986 to 2001, (Figure 4) and are unlikely to improve by the 2006 Census. Similar trends apply to the four N.Z. cities (Figure 5).

In Australia "travel smart" schemes are being introduced in all the state capital cities. The travel smart scheme in Perth has been in operation the longest and has reduced car use generally by around 10% but it was not successful in reducing male driving commutes. Some "travel smart schemes" now target companies and large institutions so as to reduce the level of car commuting but it is predicted that travel smart schemes will only impact on 2.5% of households in Australia by 2008. . Similar schemes are being introduced into N.Z. (EECA 2003A).

In Europe 'car clubs' are being developed which make better use of cars, reduce demand and have great potential. Car clubs provide access to motor vehicles for club members when they really need it and enable them to use alternative means of transport at other times with significant cost savings to themselves and society. They greatly reduce the extent of household multiple car ownership and the demand for car parking spaces in city centres (Meaton et al 2003). The negative effects of salary packaging could usefully be removed.

The decline in car occupancy is unlikely to be stopped or reversed because there are no federal tax incentives or state financial incentives to make better use of cars. No Australian state government has an effective demand management strategy that encourages car pooling, car sharing or Swiss style car shared ownership schemes although such strategies have the potential to shift at least 10% of all drive alone commuter trips to multiple occupant trips.

There have been recommendations for congestion pricing in WA to reduce oil consumption and road pricing is under consideration by the National Road Transport Commission in Australia (WA-DOPI 2003). The Wellington Region Land and Transport Strategy recommends road pricing to reduce road congestion. In Australasia there have been reports but no introduction of congestion pricing. The introduction of congestion pricing in London in February 2003 has already produced a 40% reduction in congestion; by Feb 2004 it will have been in place for 12 months and it will then be possible to fully assess its relevance other cities.

Around the world the quest to replace fossil fuels with hydrogen is gaining momentum. But despite the billions of dollars pouring into hydrogen research there are still many technical, economic and social hurdles to be overcome before a hydrogen economy becomes a reality. Until that happens oil conservation is the only 'fail safe' risk management option.

3.2 MOTORCYCLING AND THE POTENTIAL OF ELECTRIC BICYCLES

Motorcycling has declined in all Australian capital cities and this will probably continue due to the very high accident rate. By 2001 the proportion of motorcycle commutes was only 1.0% of trips in Brisbane; 0.5% in Sydney, Perth and Adelaide; and 0.4% in Melbourne. Nevertheless, there are some excellent opportunities for a safer and more sustainable future for some types of powered two wheelers.

New engine technology has created a new generation of very efficient, clean and quiet engines for low powered scooters and mopeds that could use bike lanes on main roads and back street routes. The Chinese are now mass-producing such machines that are powered by engines designed by the Sarich engine company in Perth. Mainland Australian cities near the coast all have favourable climates for the operation of these relatively clean and fuel-efficient two wheelers.

There is also a new generation of electric power assisted bicycles (E-PAB). In Japan the market for E-PABs has grown steadily in the last five years and around 2 million people now own them. The group who buys most of the electric bicycles that are around 230 watts are females over 50 years of age and the second largest group is males over 50 years. Unfortunately the world safest and most energy efficient electric bicycles are not available in bicycle shops in Australia and N.Z. because they are inappropriately classified as motorcycles or mopeds (Parker 2002 B)

In 2003 a new type E-PAB with a higher power output of around 400 watts is being sold in the U.S., Canada and China. They E-PAB's were legally classified as bicycles in the U.S. and Canada in 2002. These machines are suitable for use in Australia and N.Z. because they can be used in the hilly areas, particularly in cities like Sydney and Auckland. They are suitable for use on bikelanes and shared footways. These should also be classified as bicycles in Australia and N.Z. (Parker 2003).

3.3 URBAN PUBLIC TRANSPORT AND BIKE/RAIL COMMUTING

Figure 4 demonstrates the decline in the use of public transport between 1986 and 1996 in all Australian cities and then an increase during the last inter census period. This was the result of public transport operators in these cities making their services more user friendly and better integrating bus and rail systems. The worst decline in public transport was in Melbourne between 1986 and 1996. This was partly due to the increase in crime on the rail system and the perceived lack of personal security in accessing stations. This contributed to the 7.6% increase in female car commutes between 1986 and 1996, however female car commutes reduced from 1996 to 2001 as crime levels were reduced.

In Australia and in Auckland public transport infrastructure has been starved of funds relative to roads since the 1950s and private property developers have been allowed to build housing outside established public transport corridors. Road authorities have taken advantage of unsustainable urban development policies that create low-density urban sprawl to build roads that will generate more and more traffic and congestion. There is an urgent need for constraints on car parking and for land use planning policies to ensure that urban public transport's share of trips to work increases.

In Melbourne only 12% of the employed are within convenient walking distance of a railway station but 70% are within easy cycling distance of a rail station or modal interchange. In the capital cities the greatest potential for the use of the bicycle is as a fast and convenient means of access to rail stations, trunk bus routes and modal interchanges (Parker 2002) (Welleman1999). Bike rail commuting is suitable for large urban populations and has been implemented with great success in many European cities with populations of over 1 million.

Since 1980 cycling as an access mode to public transport has been constrained by theft and vandalism that have discouraged bike rail travel. In Brisbane Queensland Railway's recent experience with 1,800 bicycle lockers demonstrates that growing rail patronage by cyclists is feasible where secure bicycle storage is provided at rail stations, (Parker 2002)

Figure 5 shows that commuting by the public transport system is a far more variable experience in New Zealand, than it is in Australia. In Australia the bigger cities are more reliant on trains than in New Zealand. Auckland, Christchurch and Hamilton are far more reliant on buses. Wellington has a better bus and train system with 7.3% of commutes by train.

The potential for bike/bus travel is very high in Auckland but the rail system only carried 0.6 % of all commuters in 2001, which is very low for a city of this size. The existing tunnels and easements of the Auckland rail network have the potential to become a highly efficient light rail system using European style articulated vehicles, which could be far more accessible than the existing narrow gauge rail system. Articulated light rail vehicle could go round the tight corners of the narrow gauge system and take to the roads. New tram type tracks would be needed and possibly some elevated sections. If cyclists could access such a new system and have secure bicycle parking the catchment areas of the rail corridors could be greatly increased as is done in many European cities (Parker 2002) (ECNT 2000).

3.4 WORKING AT HOME IS ON THE INCREASE

Another means of reducing congestion is to make it possible for more people to work at home. Figure 4 shows that Brisbane had the highest percentage of those working at home at 5.1 % and Adelaide the lowest at 4.2%. N.Z. cities had a high of 10.3 % in Hamilton, 8.1 % in Auckland, 7.1% in Christchurch and 6.0% in Wellington (see Figure 5).

It has been suggested that car commuting could decline because more people will work at home but this has not happened. In 1976 8.6% of those who worked on census day worked from home; by 2001 this had declined to 6.5%. This has probably been because small family businesses such as corner shops or farms where people live on the premises have been wiped out by supermarket developments or by the rural recession. However since 1991 there has been an increase in the number but not the proportion of people working at home (see Figure 1). In 2001 7.9 million

Australians used a computer at home, which suggests that there is the potential to greatly increase the proportion of persons who do not need to travel to work. Auckland is well ahead of Australian cities with 8.1% of employed of people working from home. It is appears reasonable to assume further increases in N.Z.

3.5 FEW COMMUTERS CHOOSE TO WALK OR CYCLE ALL THE WAY

The healthiest and most sustainable commutes are walks or bike rides. Any city that is going to survive in the oil scarce world of tomorrow will need to make it a lot safer, more convenient and more fun to walk and cycle.

Figure 4 shows that the percentage of non-motorised commuters (walking plus cycling all the way to work) in 2001 in Australian cities is very low being only 3.4% of all commutes in Perth and 5.2% of all commutes in Sydney. Compare this with 13.2% of non-motorised commutes in Wellington and 12.4% in Christchurch. (See Figure 5) The problem with the big cities is that most workplaces in 2001 are located beyond convenient walking distance however perhaps 20% to 40% of people are within easy cycling distance of their work place. Apart from Auckland N.Z. cities are reasonably accessible.

Walking commutes contribute towards physical fitness (World Health Organisation 1999). When the non-motorised commutes shown on Figures 4 and 5 are broken down the proportion of walking commutes all the way to work is much lower in Australia than in New Zealand with only 2.2% in Perth and no more than 4.5 % in Sydney. These proportions are much lower than in New Zealand, which has 10.9% walking commutes in Wellington and 7%, in Christchurch. This is to be expected given that Australian cities are much bigger than those in New Zealand. Even if transport priorities are changed to favour walking and cycling it will take ten years more of planning and construction to create a bicycle and pedestrian friendly infrastructure in the Australian capital cities and in Auckland.

3.6 DECREASE IN INCIDENTAL EXERCISE CONTRIBUTES TO OBESITY

The health benefits of walking to and from public transport also contribute towards physical fitness. This applies to walks to railway stations and to multi-modal trips that involve walking. These account for around 5% of all multi-modal trips in all Australian cities, except Sydney where 8% of all commutes are multi-modal. Table 3 aggregates walking commutes with public transport commutes that involve walking which results in a very different picture of the level of incidental exercise. Figures 1 show that in Australia commutes in involving walking and cycling all the way to work or to access public transport decreased from 27% of all commutes to 15.6% of all commutes in 2001. In N.Z. the decrease was from 28% to 15.2%. These trends are both unsustainable and unhealthy.

In Table 3 Wellington is the leader of the walking pack with Sydney the runner up. The above Figures understate the health benefits because they do not include bicycling. Bicycle commutes all the way to work and to access public transport are added in Table 3. This increases Wellington's lead over Sydney and shows that Christchurch has proportionally more incidental exercise than Auckland, Perth and Adelaide. Table 3 represents a reasonable estimate of the extent of incidental exercise in urban commutes.

Table 3 Commutes involving exercise in 2001

City ....% walks......%+bikes

Sydney...........25.9 ....26.6......
Melbourne......16.1 ... .17.2
Brisbane.........16.1 ....17.4
Perth...............12 0 ....13.2
Adelaide.........12.3 ....13.5
Auckland........ 11.6 ...12.8
Wellington.......28.7.....31.0
Christchurch... 9.8 .....16.8
Hamilton...........8.1 .....12.3

3.7 DETERRENTS THAT CONSTRAIN BICYCLE COMMUTING

There are some significant minor differences in the level of bicycling when separated out of the non-motorised category, which are shown below; these are indicative of the future difficulties in using the bicycle for commuting or for more conveniently accessing public transport. The Australian bicycle commute Figures are very low, particularly for Sydney, compared to many European cities and are lower than those for N.Z. cities.

Table 4 shows the male to female ratio of bicycle commutes. There are many more males commuting by bicycle in Australia and N.Z. whereas in most Dutch cities there are just as many females (male to female ratio of 1.0). The problem with our big cities is that they are not bicycle friendly and most women are choosing not to cycle.

Our cities lack the Dutch close knit bikeway networks on which it is much safer to ride (Welleman, 1999) Dutch women choose to cycle on local roads with 30 kph speed limits, on bikelanes on roads with a maximum 50 kph limit and on separate bikepaths alongside high speed main roads and freeways because it is safe to do so (Parker 2001) (ECMT 2001). Similar safe riding conditions exist in many Danish, Swedish and German cities.

Table 4. % of Bicycle Commutes in 2001 and the ratio of males to females
City..............% ......M/F ratio...
Sydney.....0.7 %...5. 2.
Melbourne.1.1 %...3.3
Brisbane...1.3 %...5.1
Perth.........1.2 %...4.6.
Adelaide...1.2 %...4.7

N.Z. all of....3.1 %...3.4

The failure to provide sufficient funding for bicycle infrastructure, as is done in most of Northern Europe, is a long-standing problem in Australia. This prevents the much greater use of the bicycle to substitute for car trips of less that 5 km. (Welleman 1999) Another problem is the failure to collect data that shows how far people walk and cycle, as is done in northern Europe. The ABS and SNZ. need to improve this area of data collection in order to show planners that slight reductions in walkers' road deaths do not mean that walking is getting safer. Available data suggests that walking is not getting safer per 1000 km walked but that people are actually walking much less (Parker 2001).

4. CONCLUSION AND RECOMMENDATIONS

It is concluded that changing commuter transport behaviour is very difficult and that transport behaviours are likely to change favorably if measures needed to make commuting more sustainable are rigorously implemented. Such measures need to be implemented in a way that reflects the serious risk to energy security of allowing the growth of car dependence to deplete national oil resources and to deplete the wealth available for other essential services as oil prices rise.

It is necessary to set commuting targets for all levels of government and to monitor and evaluate sustainable initiatives. It is recommended that behavioural change programs are implemented which target the following specific commuter behaviours:

- Reduction in drive alone car commutes by women,
- Reduction in drive alone car commutes by men,
- Increased use of public transport,
- Increase in walk and bicycle commutes all the way to work,
- Increased intermodal access to the public transport system,
- Reduced household car ownership via car-pooling, informal car sharing or the development of car clubs to reduce size of the car fleet, and

Monitoring and evaluating of the behavioural changes should incorporate the use of the census data for 2006, 2011 and 2016. It is recommended that the role of the ABS and SNZ in evaluating and monitoring the changes should be enhanced.

To support the above behavioural changes fiscal measures are needed to greatly reduce oil consumption through:

- Increased purchasing of fuel-efficient hybrid petrol electric vehicles to gradually replace the existing car fleet.
- The introduction and subsequent wide spread use of hydrogen powered public transport vehicles.
- The introduction of electric bicycles

REFERENCES

Akehurst, J. (2002), "World Oil Markets and the Challenges for Australia", ABARE Outlook Conference March 2002, Canberra.

Australian Energy News (2001), "Oil Production Curve Cause for Concern", Federal Department of Industry Tourism and Resources, December 2001.

BTE (1999) "Congestion costs 1995 – 2011" BTE Information Sheet 14. Canberra, Bureau of Transport Economics.

Laherrere, J., (2003), "Forecast of Oil and Gas Supply to 2050", Petrotech 2003, New Delhi. See www.hubbertpeak.com.

ECMT (2001) "National Peer Review: the Netherlands; implementing sustainable urban travel policies". European Conference of Ministers of Transport, Paris, OECD Publications Service.

Economist (2003) "Hydrogen power: these fuelish things" p 73 & 74 Feb 15th 2003

EECA (2003 A) "Smart travel in demand" EnergyWise News guide to hydrogen as an energy carrier and what it means for New Zealand, Issue 81Apr/May 2003, N.Z. Energy Efficiency and Conservation Authority.

EECA (2003 B) "All aboard the fuel cell bus?" special EnergyWise News guide to hydrogen as an energy carrier and what it means for New Zealand, Issue 82 June 2003, NZ Energy Efficiency and Conservation Authority.

Foran, B. and Poldy, F. (2002) "Future dilemmas; options to 2050" Canberra, CSIRO Sustainable Ecosystems, 2002.

Lovins (2003) "Twenty Hydrogen Myths", White Paper by the Rocky Mountain Institute, at www. rmi.org and summarised at www.rmi.org/sitepages/art7516.php

Meaton, J. Starkey, R. & Williams, S. (2003) "Stelios – the accidental environmentalist? The potential impacts of the Easycar Club in the UK", World Transport Policy & Practice, Volume 9, Number 1, (2003) 31–36 36

NEPP 3 (1998) "National Environment Policy Plan 3" English Language version (264 pages, Ministry of Housing, Spatial Planning and the Environment, The Netherlands.

Parker, A. A. (2001), "Making Walking and Cycling Safer: Lessons for Australia from the Netherlands Experience, 24th Australasian Transport Research Forum, Hobart Tasmania, 17-20 April 2001.

Parker, A.A. (2002) "A case study of bicycle parking at selected Brisbane rail stations" 25th Australasian Transport Research Forum, incorporating the Bureau of Transport and Regional Economics' Transport Colloquium, Canberra 2002

Parker, A.A. (2003) "The power assisted bicycle: a clean vehicle to enhance the mobility of the able bodied, the elderly and the lame and disabled" NZ cycling conference2003 North Shore City, Auckland NZ October 10 2003.

Robinson, B. (2002), "Global Oil Vulnerability and the Australian Situation: a Background Paper for WA State Sustainability Strategy", June 2002 Dept. of the Premier and Cabinet, http://www.sustainability.dpc.wa.gov.au/docs/background papers.htm

WA-DOPI (2003) "Transport Energy Strategy Committee; interim report June 2003". Report published by the WA Department of Planning and Infrastructure on future transport energy supplies for Western Australia.

Welleman, A. G. (1999), "The Dutch Bicycle Master Plan: Description and Evaluation in a historical context", (English language version) Ministry of Transport and Public Works and Water Management, the Netherlands.

World Health Organisation (199) Charter on Transport, Environment and Health. Adopted by Ministers and representatives of the European Member States of the WHO and members of the EC responsible for transport, environment and health. 1999. http://www.who.dk/London99/transporte.htm