INTRODUCTION

This study of journeys to work focuses on Australia and New Zealand using data from the 2001 Population Census which were released in 2002 in both countries, and other census data going back to 1976. 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 (see definitions below) but common unsustainable trends are clearly discernible in both countries.

This study measures the 25-year growth of car dependent commuting and the decline of overall market share of walking and public transport nationwide and in the larger cities. Since 1976 the large and rapidly growing number of female car commuters is the dominant element in the growth of urban passenger transport. There are some minor differences between Australasian cities, some of which have a better record than others in providing for train travellers and bicyclists. All the cities have increasing levels of unsustainable motorisation; the census is the most accurate means available of evaluating and monitoring the growth of car dependency.

Abbreviations, definitions and different national categories

- NZ =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 NZ 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 NZ 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, comparison of unsustainable trends in New Zealand and Australia is still relevant
- In Australia the “commute” is the journey to work by any one method or an inter modal journey to work using two or three transport methods. What is counted is the complete journey 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.
- A sustainable city is a place where the quality of life is improved while the per capita use of fertile land, fresh water and oil are incrementally reduced by an integrated planning effort by all levels of government and the private sector. The word unsustainable specifically applies here to increased per capita oil consumption by single occupant car commuters who produce the most air pollution, green house gases and road congestion.

Census trends by state, capital city, urban regions, municipalities and shires are the only accurate measures of the changing pattern of male and female commutes and the growth of unsustainable car dependence. Accurate comparisons are possible for the minor modes (bicycle and motorcycle) 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.

METHODOLOGY

1. Proceed from the general to the particular by first analysing the overall national trends for both Australia and NZ for the 25 year period from 1976 to 2001 and to highlight the salient features of the growth in car dependency and the decline of the more sustainable transport modes at a national level.

2. Analyse the overall national trends for Australian oil dependency and increasing congestion costs projected to the year 2011,describe the underlying changes to the working and urban environment and suggest that similar trends may apply to NZ. Draw some conclusions about the unsustainable consequences of the current trends towards greater oil and car dependency.

3. Chart the particular modal trends for the 15 year period from 1986 to 2001 for five Australian capital cities and the four largest NZ cities and 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.

4. Tabulate and rank all the nine cities for the percentage of all walking trips to work by all methods and the percentage all non-motorised trips by all methods for the nine cities. Establish male to female ratios for bicycle commutes in the cities.

5. Recommend that targets for modal substitution be established by government to reduce car and oil dependence and then monitored and evaluated using the census data for 2006 and 2011.

A GROWING CAR DEPENDENT AUSTRALIAN WORKFORCE

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 census 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 but shows those who worked at home as this is a sustainable that reduces peak hour congestion.

Figure 1. the journey to work ABS 1976 to 2001

Females accounted for 45% of employed people in 2001 compared to 33% in 1976. The most dominant trend on Figure 1 has been the increase of female car commuters followed by male car commuters. Public transport, walking, and care passenger commutes all declined from 1976 to 1996 but had improved a little by 2001. The number of bicycle commutes in 2001 is almost the same as 1981and only one in five bicyclists are women.

The proportion of people who worked at home and did not commute decreased from 421,000 in 1976 to 370,000 in 1986 and then increased 438,000 in 2001. There were slightly more women (53.5%) than men working at home in 2001.

The number of commuters driving to work increased by 1.8 million from 3 million in 1976 to 4.8 million in 2001. As a consequence commutes by persons driving has increased from 51.6% to 71.8`% and most of them were women (1.17 million). The number of female drivers has nearly tripled but male drivers only increased by one

fifth. The upward trend of both male and female car commutes clearly indicates that further increases to at least 5.3 million car commutes are likely by 2006.

The poor utilisation of the car fleet for commuting over 25 year is also indicated by vehicle occupancy ratios dropping from 1.21 passengers in 1976 to 1.11 in 2001 with only 513,220 car passenger commutes compared to 629,100 in 1976. In 2001 there were more female car passenger commutes 277,900 (54%).

The most interesting trend since 1976 is the use of cars as means of accessing public transport or 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 tabulated as follows.

Table 1 dual mode commutes involving cars > than 3000

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

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.

Public transport trips decreased from 920,250 commutes in 1976 to 742,300 in 2001 by which time the number of male and female 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, even though the number of public transport commutes increased marginally between 1996 and 2001.

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. There were slightly more male walk commutes in 2001 (54%). These figures greatly underestimate the contribution of walking because walking as an access mode to public transport is not counted. When walking is added in 2001 1,058,900 or 15.6% of all commutes involved walking. However this under estimates walking because there is another I% 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 walking.

This is a useful measure of the value of incidental transport in contributing 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.

The male dominated transport commutes

Commuting by motorcycle or motor scooter has steadily declined from 81,000 (1.5%) in 1976 to 48,100 (0.7%) in 2001. By 2001 it had become a mostly male activity with 44,400 male commutes but only 3,700 female commutes.

Taxi commutes also halved from 36.700 (0.6%) taxi trips in 1976 but only 21,150 (0.3% of all commutes) in 2001. Only 38% of taxi commutes were made by women.

In 2001 the ABS Community profiles included commutes by truck for the first time. These had risen to a significant 134,100 commutes (2.0% of all trips). This also again is an almost exclusive male commuting mode with only 3% being female truck commutes.

Bicycling all the way to work decreased from 426,000 in 1976 to 287,900 in 1996 but then increased to 316,600 in 2001. This represents a decline from 8% of all commutes in 1976 to 4.7% by 2001. This is a male dominated activity with only 19% of bicycle commutes being made by females in 2001.

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 1986 this went down to 78,200 (1.15%) however there were also 12,400 multimodal bicycle commutes which increased the bicycle commutes to 1.34% of all commutes.

A GROWING CAR DEPENDENT NEW ZEALAND WORKFORCE

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. This is the same proportion of census day commuters as in Australia. The other 430,000 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. Note that figure 1 only shows the pattern of 1.3 million commutes to work; it excludes commutes to school or educational institutions.

Even though persons who worked at home did not commute to work these data are superimposed on Chart 2 because it is a positive trend that reduces peak hour congestion.

Figure 2. The journey to work SNZ 1976 to 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 had improved a little by 2001. There has been 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 only sustainable trend is for those who worked at home and did not commute; this increased from 42,400 in 1976 to 166,000 (12.6%) in 2001 with the trend clearly projecting an increase by 2006. This is nearly double the percentage of those who worked at home in Australia.

The number of commuters driving to work increased by 382,450 in 1976 from 614,150 to 996,600 in 2001. As a consequence commutes by persons driving has increased from 53% to 76%; females accounted for 44% of employed people in 2001. The most dominant trend since 1986 has been the increase of female commuters who drive i.e. from 18.5% to 25% of all commutes. In comparison male driving decreased from 39% to 37% of all commutes despite the increase in the total

number of commutes. 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 and was mostly women. Women drivers have been the dominant growth element in the market for passenger transportation. The upward trend on figure 2 shows that both male and female car commutes indicate that further increases are most likely by 2006.

The unsustainable trend in the utilisation of the car fleet for commuting over 25 year 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 (12.3% of all commutes) in 1976 to 64,250 (4.9% of all commutes) in 2001.This indicate 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 some cities have a much better public transport systems than others which are compared later.

Walking all the way to work decreased from 142,500 in 1976 to 92,200 in 2001 However when expressed as percentage it represents a decline from 12.3% of all commutes in 1976 to 7.1% by 2001 and 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 commutes means that walking trips to other modes (and between modes) are ignored in New Zealand. Even so we can add the walking all the way commutes to the public transport commutes and this indicates that walking was involved in 23.1% of all commutes in 1976 and 12 % of all commutes in 2001. This is a useful measure of the value of incidental transport in contributing to the general fitness of the population. This is a useful indicator.

Commuting by Motorcycle or moped has also steadily declined from 47,950 (4.1%%) in 1976 to 17,300 (1.3%) in 2001. This is mostly a male transport mode as only 2,400 females commuted by Motorcycle or moped. Taxi commutes are not counted by the SNZ and commutes by truck are included in category for driving.

Bicycle commutes all the way to work increased in number from 38,050 in 1976 to 40,700 in 2001. However when expressed as percentage it represents a decline from 3.3% of all commutes in 1976 to 3.2% by 2001. This is a male dominated activity with only 30% of all bicycle commutes being made by females in 2001. The number of multimodal bicycle commutes is not known

Changes to the working and urban environment.

Since 1976 there were complex changes to patterns of employment that impact on commuting travel patterns in both Australia and New Zealand. In both countries there are now far fewer secure full time jobs and a large increase in part time work and casual employment. In addition there has been the changing role of women in the work force, the decline in manufacturing industry and the growth of service industries.

Table 2 Proportion of the population aged 15 and over in the employment

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

. Source ABS

Table 1 shows the proportion of male full-time jobs dropping from 81% in 1973 to 68% in 2003 and the number of female full-time jobs had increased from 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 male jobs increased from 690,000 to 1,773,000 jobs in 2001.There were also other changes in the working lives of Australians that contributed to need for better access to jobs:

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1. the growth of unemployment amongst the over fifties.
2. the large increase the proportion of long term unemployed.
3. higher levels of under-employment by those in the workforce.
4. proportionally more young people in education and postponing employment.

In Australian the overall unemployment rate fluctuated from 4.7% in 1976 to 9.9% in 1983 down to 5.7% in 1989, up to a high of 11% in 1993 and the slowly dropped back to 7% in 2001.In the 1990s the consequences of these high unemployment rates were much worse than in the 1976 when the average duration of unemployment was 4 month which increased to 13 months by 1989 and by 2001 and there were 200,000 Australians retrenched in the previous 3 years, who had still not found a job. Of the nearly 500,000 full time workers retrenched or made redundant only 57. % had found another full time job. In 2003 the number of long term unemployed had greatly reduced. However the fear of unemployment has not.

The above changes in the working lives of Australians coupled with increases in the size of cities, the failure to provide public transport and bicycle facilities in new growth areas and large increase in the average weekly wage generated more car dependence. Cars were perceived by most workers as a necessity in keeping employed and being able to pay the mortgage etc. Public transport orientated land use planning and provision of public transport services generally has not kept up with these major drivers of car dependence and that has increase the comparative advantage of the car in accessing employment.

The transport data for New Zealand cities is very similar to that of Australian cities and suggests that very similar changes in workforce have also taken place in New Zealand.

Commuting and road congestion in Australia

What is generating most congestion, from the Australian car fleet is the increase in the total resident population and its ongoing concentration in large urban areas were

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 but 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 most congested so they make a large contribution to air pollution and greenhouse gas emissions due to cold starts and stop start driving conditions.

Figure 3 Unsustainable Australian commutes 1976 to 2011

Figure 3 shows the actual growth of the human and car populations since 1976 and the costs of unsustainable road congestion are shown to the year 2011. The projected growth of passenger car fleet the number of commutes by all modes and "single occupant" car commutes. Also shown are estimates by CSIRO of improved car fleet fuel efficiency in terms of litres of petrol consumed per 100 km driven from 1976 to 2001. The decreasing fuel efficiency from 2001 to 2011 is due to the growing proportion of large cars and four wheel drive vehicles in the Australian car fleet (Foran & Poldy 2002) Given further reductions in car occupancy rates shown the commuter car fleet in 2001 will be much less energy efficient in terms of energy per passenger km than it was in 2001.

Figure 3 shows an almost parallel increase in the resident population and car fleet size. (LHS) Clearly, population growth is what drives the overall increase in car fleet size. Indeed 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 from to 2011 will be even more concentrated in and around the existing capital cities.

Figure 3 also shows that the number of commuters by all modes on Census day increased by 1.6 million from 1976 to 6.8 million in 2001; which is one third of the population increase and less than the 2 million increase in 'single occupant' car commuters. Figure 3 shows that there will be a parallel increase of 'total commutes' and "single occupant car commutes" to the year 2011.The 'single occupant car commutes' also drive up the costs of road congestion. Since 1976 the car occupancy rates for the commuter car fleet has dropped from 1.21 to 1.1 and percentage of car passenger commutes has dropped from 11% of all commutes to 7.6% of all commutes and will reduce even further. The reduction in commuter car occupancy rates cancels much of the benefits of improved fuel consumption from 1976 to 2001.

The concentration of a greater percentage of the population in the major cities, coupled with a higher proportion of commutes by drivers of single occupants cars will drive up congestion costs, as predicted by the BTE, and shown on the RHS of figure 3. However the reversal of the 1976 to 2001 trend for higher fuel efficiencies from 2001 to 2011 was not predicted by the BTE and will increase car fleet fuel consumption and oil dependency in a period of rapidly depleting Australian and world oil reserves.

The reality of the Australian consumer car market is that the car fleet will continue to use 10 litres of petrol (or more) per 100 kms driven to at least 2011 no matter how many energy efficient hybrid cars Australians choose to buy. Indeed the demand for bigger cars with more luxury features and high performance, combined with the demand for cars with four wheel drives will increase fuel consumption and negate any improvement in engine design that would otherwise produces increases in car fleet fuel efficiency (Foran & Poldy 2002). The practice of subsidising car use as part of the salary package of an increasing number of people in the 1990s has grown to

such an extent it now significantly reduces discouraged commuting by public transport and encouraged the purchase of larger cars.

The introduction of the GST in 2000 has reduced the cost of cars generally and the absence of import duty on 4WDs has provided an incentive to drive them in urban areas. The failure to introduce tax incentives to buy small energy efficient cars in the absence of tax disincentives on "gas guzzlers" further exacerbates this.

There are no state or Commonwealth policies in place, or in the process of development, that can significantly reduce the growing concentration of population in the major cities, reduce single occupant car commuting or the purchase of bigger cars and 4 4WDs. The transport system will become even more unsustainable as Australian and world oil reserves dry up.

The unsustainable future of oil production

There is a growing recognition that the world is close to the 'Big Rollover" when the current buyer's market becomes a seller's market as oil production begins to fall.

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 general view within the oil industry is that Australia has low oil prospectivity and fields yet to be discovered are of small to medium size and 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, cost rise and quality tend to decline.

Australia 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 2003 and by the latest by 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 will 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 is predicted to import 70% of its oil by 2020). Currently five-sixths of the world's population uses comparatively very little energy per capita.

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 hence needed in developed countries like Australia, including an all-of-government approach to decouple per capita economic growth from per capita oil consumption.

The necessary change processes will have to emphasise conservation, as there appear to be no technical panaceas to allow the current high-energy consumption patterns to persist. These changes will involve lifestyle changes, oil and transport demand management measures, new "energy-lean" technologies, land use and transport planning to reduce car dependence particularly for personal travel and the commute to work.

Unsustainable consequences

Unless there is a major recession with very high levels of unemployment, congestion costs, greenhouse gas emissions car dependency and oil dependency will increase by 2011 and the passenger transport system will become more unsustainable.

Any policy of decreasing population growth to a much lower level or locating population increase away from the existing capital cities would probably take till 2011 to implement. Decreasing the number of 'drive alone car commuters' is the only practical option for making urban passenger transport more sustainable in the short term.

In the following section we examine the transport trends in five Australian cities to see if any of them are making progress in encouraging the more sustainable transport modes so as to reduce the level of single occupant car commuting.

COMMUTING TRENDS IN NINE AUSTRALASIAN CITIES

Figure 4 compares the five largest Australian Capital cities ranked from right to left in terms of population size. Figure 5 compares NZ with four cities ranked in terms of population size. The percentage share of commutes by the main modes are measured as a percentage of all trips. Male and female car driver commutes are shown separately and bicycling and walking are grouped together for clarity of presentation.

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

motorised, car passenger, motorcycle commutes and the proportion of those who work at home is remarkably similar in all five cities between 1996 and 2001.

The modal share of single occupant car commutes in NZ is high in all cities except Wellington which has a significantly lower percentage of commutes by both male and female drivers and a higher proportion of commutes by public transport and walking. Hamilton and Auckland have the highest proportion of single occupant car commutes and the lowest proportion of commutes by public transport. The percentage of motorcycle commutes is much higher in all cities (except Auckland) than in the Australian cities. The proportion of those who worked at home is far higher than in all the Australian cities and remarkably similar in all four NZ cities between 1996 and 2001. Bicycle commutes are not shown separately on Figure 5; they are very high in Christchurch (7.0%) compared to around 1.1% of commutes in Auckland, Melbourne, Brisbane, Perth and Adelaide and the 0.7% of commutes in Sydney.

Urban public transport.

Figure 4 shows that the decline of public transport between 1986 and 1996 in all cities has been arrested and there has been an increase in its use 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 1986/96 decline in public transport was in Melbourne and was perhaps due to the increase in street crime and the lack of personal security on the public transport system. This was probably a major factor in Melbourne having the largest increase (7.6%) in female car commuters between 1986 and 1996. However the growth of female car commuting was reduced from 1996 to 2001.

In Australia 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 use and parking and for land use planning policies to ensure that urban public transport's share of trips to work increases.

Figure 5 shows that commuting by the public transport system is a far more variable experience in New Zealand than it is in Australia, where the cities are so much bigger and are all heavily reliant on rail infrastructure. The NZ cities of Auckland, Christchurch and Hamilton are far more reliant on bus networks. Wellington clearly has a far more serviceable public transport system with 40% of commuter trips by train.

In Auckland the rail system needs upgrading and only carries 0.6 % of all commuters. The existing tunnels and easements of the Auckland rail network have the potential to become a highly efficient light rail system using 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 as system and have secure bicycle parking the catchment areas could be greatly increased as is done in many European cities.

Making better use of cars

Another means of reducing congestion is to make better use of the commuter car fleet by car-pooling or informal car sharing. The percentage of car passenger commutes for all five cities is shown on figure 4. It is down from 1986 to 2001,and unlikely to improve by the 2006 Census. Very similar trends apply to the four NZ cities (see 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 has not been 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.

In Europe "car clubs' are being developed which make better use of cars and 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.

The decline in car occupancy is unlikely to be stopped or reversed, because there are no federal tax incentives or state financial incentives to use the above approaches to making 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.

The decline of motorcycles and motor scooters?

The decline of motorised two wheelers is much the same in all Australian capital cities and will probably continue due to the very high accident rate. By 2001 the proportion of commutes was only 1.0% of trips in Brisbane, 0.5% in Sydney, Perth and Adelaide and w0.4% in Melbourne; even so there are some excellent opportunities for safer and more sustainable future for some motorised two wheelers.

New engine technology has created a new generation of very efficient, clean and quiet engines for scooters and mopeds which could use bike lanes on main roads and back street routes. The Chinese are now mass-producing such machines, 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 clean two wheelers as well as the new generation of electric bicycles.

In Japan the market for electric bicycles has grown steadily in the last five years and around 2 million people own them. The group who buy most electric bicycles are females over 50 years of age and the second largest group are males over 50 years. Unfortunately the world safest and most energy efficient electric bicycles are not available in bicycle shops in Australasia because they are inappropriately classified as motorcycles in Australia or as mopeds in New Zealand.

Working at home

Another means of reducing congestion is to make it possible for more people to work at home. Figure 4 shows Brisbane had highest percentage of those working at home at 5.1 % and Adelaide the lowest at 4.2%. NZ 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).

Australian commentators have suggested that in future car commuting will decline because many more people will work at home. What has happened since 1976 in Australia is the opposite of that. Small family businesses such as corner shops or farms where people live on the premises have been wiped out by supermarket developments or the rural recession. The growth in new businesses run from home by computer had not matched the 1976 percentage of working at home until the middle of the last inter census period. 7.9 million Australians used a computer at home in 2001. This has the potential to greatly increase the proportion of persons who do not need travel to work by 2011.

Few commuters choose walking or cycling all the way to work

The healthiest and most sustainable commutes are walks or bike rides and any city that is going to survive in the oil scarce world of tomorrow is going have to make it a lot safer, more convenient and fun to walk and cycle. The problem is that it will take ten years of planning and construction to create a bicycle and pedestrian friendly infrastructure, particularly in the Australian capital cities and in Auckland.

Figure 4 shows that the percentage of commuters walking and cycling all the way to work in 2001 in Australia is very low being only 3.4% of commutes in Perth and no more than 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 Australian capital cities is that most workplaces have been located beyond convenient walking distance; only 12% to 25% of the work force is within convenient walking distance of a railway station. Possibly 20% to 40% are still within easy cycling distance of their work place and 60% to 90% are within easy cycling distance of a rail or modal interchange station. These figures are indicative only but it is clear that the actual potential of walking and cycling has never been realised in Australia; nor will it ever be unless some basic changes are made.

The health benefits of walking to access public transport

When the data for walking all the way to work are separated out from the non-motorised commutes it is even lower with only 2.2% of commutes in Perth and no more than 4.5 % of all commutes in Sydney. These figures are much lower than the 10.9% walking commutes in Wellington and the 7%, in Christchurch. However given the much greater size and population of the Australian cities that is not a meaningful comparison. If the health benefits of walking are to be quantified it would make far more sense to recognize that walking to and from public transport, particularly railway stations, contributes towards the fitness of those who travel to work this way. The proportion increases when two forms of public transport are used; n Sydney 8% of all commutes are multi mode. Table 3 aggregates walking all the way commutes with public transport commutes that involve walking.

Table 3 All commutes involving walking.
Source Census 2001

City	...% commutes
Sydney	.....25.9 %.
Melbourne	...16.1 %
Brisbane	.....16.1 %.
Perth	.....12 0 %
Adelaide	.....12.3 %
Auckland	...11.6 %
Wellington	...28.7 %
Christchurch	.... 9.8 %

Hamilton.....8.1 %

Wellington is the leader of the pack with Sydney the runner up. The above figures do tell the full story because they do not include bicycling. Table 4 below includes bicycle commutes all the way to work and to access public transport

Table 4 All commutes involving bicycling and walking.
Source Census 2001
City ...% commutes

Sydney.....26.6 %.
Melbourne...17.2 %
Brisbane.....17.4 %.
Perth.....13 2 %
Adelaide.....13.5 %
Auckland...12.8 %
Wellington...31.0 %
Christchurch.16.8%
Hamilton.....12.3%

Deterrents that constrain bicycle commuting particularly for women
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. Note that data for bicycle commutes in Canberra and Darwin have been added.

Table 5. 2001 % of Bicycle Commutes
Ratio of males to females = M/F ratio

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.
Canberra...2.3. %...3.0
Darwin.....3.7 %...2.8

The Australian bicycle commute figures are very low, particularly in Sydney, compared to many European cities and lower than the N Z cities. Wellington had 2.3%, Christchurch 7.0% and Hamilton 4.2 %. Auckland had only 1.2 %. which is to be expected because of it hills and hostile road conditions, which also apply in Sydney

The most interesting statistic in Australia is that there are far more males than females commuting by bicycle and that the ratio of males to females varies a great deal. The existence of 1200 km of bicycle lanes in Melbourne and of many safe back routes and shared footway routes into the Melbourne CBD is perhaps the reason for the low male to female ratio of 3.3. The extreme hills and dangerous kerb lanes in older established areas, where the main roads are 1 metre narrower than in other cities, is certainly responsible for the high 5.2 M/F ratio in Sydney. The high male to

female ratio in all location is also due to women cyclists being less tolerant of busy traffic than male cyclists; many women cycle mainly on local roads or for recreation on shared footways.

The problem with Australian cities generally is that they are not bicycle friendly. They lack the Dutch type of close knit bikeway networks which are coupled with low urban speed limits on shared use roads on which it is much safer to ride (Parker 2001). Australian cities, with the exception of Canberra, are not bicycle friendly; it is easy to see why the trips to work and the M/F ratio in Canberra is so much better. In Darwin only 43,000 commuted on Census day; this is similar to the small provincial cities in Australia where the average commute is much shorter than the larger cities and traffic is much more relaxed. (Parker 1998)

Canberra is a car-orientated city with a separate shared footway network like the New Town of Milton Keynes in the UK; in both these cities there is not a high level of bicycle use because they do not give cyclists and pedestrians priority as many Dutch cities do. The future of commuter cycling in Australia is not very promising because bicycle infrastructure hardly exists. There are no safe and continuous urban bikeway networks and low urban speed limits as there are in Dutch, Danish and Swedish cities.

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). This has been done with great success in many European cities with over one million population so we know it is suitable for large urban populations.

The government's failure to recognise the need for Commonwealth funding of bicycle infrastructure, as is done in most of Northern Europe, is a long standing problem in Australia that prevents the much greater use of the bicycle for car trips of less that 5 km. Since 1980 there has been a plague of bicycle thievery and bicycle vandalism at rail stations in the capital cities which has discouraged bicycle access to rail stations, except in Brisbane. Queensland Railway's recent experience with 1,800 bicycle lockers in Brisbane demonstrates that growing rail patronage by providing secure bicycle storage at rail stations in Australia is a practical proposition (Parker 2002)

The unsustainable and negative role of the Commonwealth

The Commonwealth does not see a legitimate role for itself in locating new immigrants away from existing urban areas in regional centres and fails to support the states in funding land use planning measures to reduce urban sprawl. It has a policy of not intervening in the market place which actually plays an extremely negative role by distorting the market for passenger transport. For all these reasons most of the initiatives mentioned herein to increase the use of all the more sustainable commuter modes will never be initiated. The increase in car dependence from 1976 to 2001 is likely to continue to 2011.

State government initiatives to Improve public transport will marginally reduce car dependence. However current planning suggests that they will fail to actively constrain single occupant car commuting, car parking provision, provision of better facilities for cyclists and encouragement of walking to public transport and schools as a necessary health and fitness measure. New forms of shared car ownership and informal sharing of cars will not increase because of lack of research and tax incentives. So long as the Commonwealth government refuses to "green" the tax system so that unnecessary single occupant car use is discouraged and all the

unsustainable trends revealed on figures 1 to 5 are addressed in an integrated way little will happen.

SETTING OF TARGETS, MONITORING AND EVALUATING FUTURE UNSUSTAINABLE TRENDS

Census data in 2006 and 2011 provide an accurate means of measuring commuter transport trends which are a critical indicator of intra urban passenger trends in general. Changing commuter transport behaviour is very difficult, more so than changing other transport behaviours. Indeed other transport behaviours will change favourably if the difficult measures needed to make commuting more sustainable are implemented. Changing commuters transport behaviour has to be taken out of the 'too hard basket'. A joint state commonwealth effort is needed before permanent and worsening oil shortages ruin the national economy, some time after 2006 in the worst case scenario or just after 2011 in the best case scenario.

What is needed are behavioural change programs directed at specific targets groups with the following indicators from the census used to evaluate the effectiveness of the change during each census period

1. reduction in drive alone car commutes by women.
2. reduction in drive alone car commutes by men.
3. increased use of public transport.
4 increased sharing of cars.
5. increased walk and bicycle commutes all the way to work.
6. increase intermodal access to the public transport system.
7. Reduced household car ownership.

For both Australia and NZ it would be useful to use the census data in this way as other transport surveys are on their own incomplete and make comparisons between cities and the minor modes very difficult. It is suggested that commutes to work by all methods be recorded in NZ so as to make the two national data sets more compatible. The production of data similar to the Australian "Census Classification Counts" would be very useful. The NZ practice of distinguishing between travel by company vehicles and private vehicles could also be useful in Australia.

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.

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

Hubbert petroleum production peak modeling can be referenced at http://www.hubbertpeak.com/

Parker, A.A. (1998), "Commuting to work 1976 to 1996: unsustainable trends in the Australian & Melbourne Census data". Community Planning Bulletin, Newsletter of the Peoples Committee for Melbourne May 1998.

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), "The Power-Assisted Bicycle: a Green Vehicle to Reduce Greenhouse Gas Emissions and Air Pollution", 25th Australasian Transport Research Forum, Canberra, 2002.
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/backgroundpapers.htm)