Determinants of urban travel in Australia

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1 Introduction

Urban transport in Australia could once again be due for change. It has happened before. Beginning in the late 1940s, our public transport-dominated cities gave way to today's car-oriented cities. Some argue that the need to reduce both oil consumption and greenhouse gas emissions could again make change necessary, others that the new Information Technology can make much urban travel redundant.

It is important to know the determinants of urban travel for several reasons. One reason is that Australia's capital cities are now in the process of implementing TravelSmart programs, with Perth leading the way (TravelSmart Australia 2005). TravelSmart is a voluntary program designed to encourage people to shift some of their trips, presently made by car, to alternative modes. Understanding why people travel by various modes is thus important if these programs, or any others with broadly similar aims, are to have any lasting success in shifting urban residents to more environmentally-friendly modes. Another, related, reason is that forward planning for Australia's cities require estimates of future travel by various modes, which in turn requires an understanding of the factors determining travel levels.

This paper analyses the factors determining personal travel levels in each transport era, and its change over time, in Australia's capital cities, and then looks at the likely future for urban travel. We find that in the public transport era, the different levels of personal travel in the various cities can be largely explained by the different average distances the urban population lives from the central business district (CBD). In the late car era, personal travel levels are several times higher than in the previous era, but similar for all cities, despite big differences in urban size and structure. These higher travel levels result from both the psychological benefits of car travel, and the ability to access activities at diverse locations with higher speed car travel. Finally, we argue that the future is likely to see public transport once again accounting for most urban vehicular travel, but with the car retaining an important niche for specialised trip types.

2 Travel past: the public transport era

The first post-war census in Australia was held in 1947, so data availability is much better than in any other early post-war year. In 1947, all six state capitals had suburban rail systems, with the extensive systems in Sydney and Melbourne electrified. These six cities (along with all the main provincial cities in Australia) also operated tram or trolley bus networks. Furthermore, each city had numerous bus routes to supplement the fixed-rail systems, and in Sydney, Melbourne, and Perth, ferries (Australian Bureau of Statistics (ABS) 2005). Public transport was at its peak in terms of per capita travel and, in some cases, even total patronage.

Consider a very simple model for a city, in which all activities requiring *vehicular* travel are located at or near the CBD—workplaces, retail, sales, major entertainment and sports venues and so on. (Vehicular travel includes car, van and truck, and all public transport modes.) Clearly, total vehicular travel in such a city is the product of the average number of vehicular trips each person makes, weekly say, to the centre, and the average distance the

Table 1 Transport and land use data, Australian capital cities, 1947 (sources: ABS 1949, 2004a, 2005; Manning 1984; Moriarty 1996)

	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart
Pop. (000)	1632	1228	402	383	278	77
Urban density (persons/km^2)	2900	3210	1700	1500	1300	N.A.
Median density (persons/km^2)	3160	3060	2350	2050	1400	N.A.
Av. household size	3.9	3.6	4.0	3.8	4.1	4.1
Av. resident CBD distance (km)	10.4	8.4	5.6	6.5	7.4	3.5
Retail sales % in central LGA	50.3	44.3	N.A.	61.4	70.4	N.A.
Route-km rail/tram per 1000 pop.	0.22	0.31	0.45	0.54	0.53	0.52
Cars/1000 pop.	66	75	65	99	75	72
Per capita veh. pass.-km.	4190	3630	2780	2510	2320	1400

NA: not available

population lives from the CBD. We further assume in this model that the average number of vehicular trips per year for each resident is the same for all cities. Hence if two cities have the same population density distribution then *ceteris paribus* the city with the higher population will have higher per capita travel, simply because the average resident lives further from the CBD. We would therefore expect that more populous cities would have higher personal travel levels.

There is evidence that the six state capital cities approximated this model up to the beginning of the post-war era. First, trips requiring vehicular travel were concentrated in (or near) the CBD. Table 1 shows that the central Local Government Area (i.e. containing the CBD) had a share of total metropolian retail sales for 1947-48 varying from 44.3% for Melbourne to 70.4% for Perth. For jobs, the position was similar. In Melbourne in 1951 for example, the CBD alone still contained 28% of all metropolitan jobs, and the central six LGAs with an area of only 65.5 km^2, nearly 60% of all workplaces (MMBW 1954). Partial data suggest that the percentages for the other cities were even higher, as was the case for retail sales. (Canberra is excluded from both the table and this section generally, as its population was only 17,000 in 1947 and no 1947 transport data is available.)

But as Table 1 makes clear for retail sales, not all trip destinations were in the central area; in fact most weren't. There was much local shopping, working, visiting friends and socialising, but probably most of this trip-making was done by *non-motorised* means, defined here to include walking and cycling. But *vehicular* travel was largely centralised—especially when considered on a passenger-km basis. The actual travel patterns for Melbourne in 1951 (MMBW, 1954) are evidence of this centralisation, and such centralisation might be expected given the radial nature of the fixed rail networks. Vehicular travel was largely centralised, even if non-motorised travel was strongly decentralised.

Second, actual personal travel was a linear function of average resident distance from the CBD. Figure 1 plots per capita vehicular travel against average distance of the population from the CBD, using data from Table 1. Each of the six capitals is indicated by its initial in Figure 1. The fit of the points to a straight line is good, with the line of best fit having an R^2=0.84. The slope of the line is highly significant ($p < 0.01$). Average CBD km cannot be the sole explanatory variable, since Table 1 and Figure 1 show that in 1947, Perth, with a larger CBD distance than Brisbane, had lower levels of personal travel. Other factors affecting vehicular travel levels included the geography of the cities, for example the presence of wide rivers, estuaries, bays and hills. The extent of the fixed rail public transport network was also important: Brisbane in 1947 had a much more extensive network than Perth. Income differences between the five cities was small (ABS 2005), so average resident distance to the CBD best explains the observed travel levels, with fixed rail network extent (and service frequency) and urban geography of secondary importance.

Travel levels also grew steadily over the public transport era. Vehicular travel per capita in both Melbourne and Sydney was very roughly 1000 pass-km in 1901, and 2000 pass-km in 1921 (Moriarty 1996, ABS 2005). Such travel growth is readily explained by increases in the average resident CBD distance (as in Figure 1), as well as some growth in real incomes (about 20% between 1921 and 1947 (Meredith and Dyster 1999)). Higher incomes enable increased outlays for both out-of-home activities and public transport fares.

What about overseas cities? Data is difficult to obtain: the urban data collected by Newman and Kenworthy (1989) starts from 1960, when car travel was well-established everywhere in the US, and to a lesser extent, in European cities. However, 1965 travel data is available for Japan's three largest cities (Tokyo, 21.0 million; Osaka, 13.1 million; Nagoya 6.3 million in 1965). Car ownership in Japan overall at 65 per 1000 population was in 1965 similar to Australia's in 1947. As for Australian cities, per capita travel (here measured by annual vehicular trips per capita) increased with city size, being 318, 457, and 543 for Nagoya, Osaka, and Tokyo respectively (Statistics Bureau 2004).

In summary, in the public transport era, travel levels were largely driven by necessity, with the work trip dominating vehicular travel. Vehicular travel was strongly oriented toward the centre, resulting in residents of larger cities on average travelling further. Larger cities could also support a more extensive fixed-rail public transport system with more frequent services, so that vehicular travel was also more convenient than in the smaller capitals.

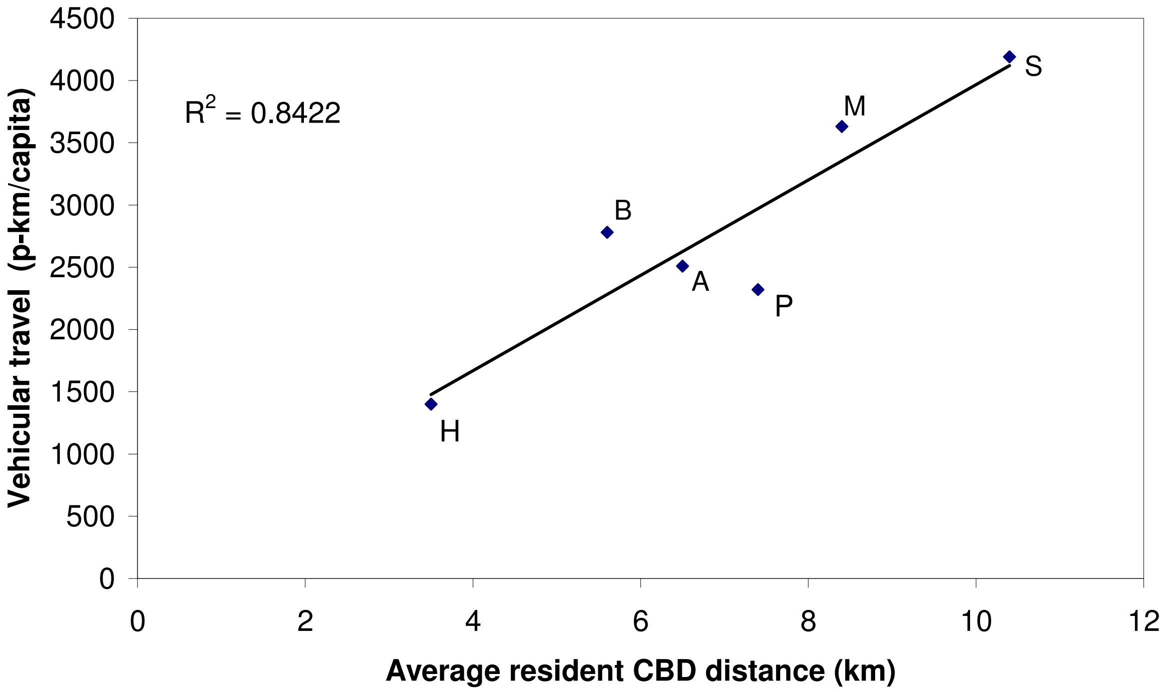

Figure 1 **Vehicular travel vs average resident CBD km for six Australian cities, 1947 (sources: Moriarty 1996, ABS 2005)**

3 Travel present: the car era

3.1 Travel and land use patterns

The late 1940s saw not only the lifting of petrol rationing, but also the full establishment of car manufacturing in Australia. The changes to transport were profound. The data in Tables 1 and 2 together show that overall per capita vehicular urban travel increased over the period, with falling public transport travel levels more than offset by rising car travel. Compared with 1947, household size and urban densities were all much lower in 2001, while city population, average distance of residents from the CBD, and, of course, car ownership, were much higher. Except for urban density, all data in Table 2 refer to the 2001 Statistical Division boundaries of these capital cities.

As in 1947, the higher-population cities today still have higher urban densities, average resident CBD distances, and share of travel by public transport than the smaller cities. Urban densities have fallen in all cities, partly as a result of falling household sizes (Tables 1 and 2). However, Table 2 shows that in contrast to 1947, personal travel levels are now similar for all cities, even though average resident CBD distances for the various cities vary by a factor of three, and urban density by a factor of two.

So several questions must be answered. Why did car travel replace public transport as the dominant urban mode? Why are personal travel levels in the car era so much higher than in the previous public transport era? Finally, why are personal travel levels now similar in all cities? The following two sub-sections address these questions, by looking in turn at non-instrumental and instrumental motives for both choice of travel mode and higher personal travel levels.

Table 2 Transport and land use data, 2001 (sources: Apelbaum Consulting Group 1997; ABS 2000, 2004a,b,c, 2005; Moriarty and Honnery 2002; Newman and Kenworthy 1999)

	Syd.	Melb.	Bris.	Adel.	Perth	Hobart	ACT
Pop. (million)	4.128	3.472	1.650	1.108	1.393	0.197	0.311
Household size	2.68	2.63	2.61	2.41	2.54	2.43	2.58
Urban density (persons/km^2)	2115	1542	942	1355	1135	961	897
Median density (persons/km^2)	1850	1880	1330	1625	1235	900	1500
Av. resident CBD distance (km)	24.8	21.5	18.4	12.8	15.6	7.6	8.6
Veh. pass.-km per cap.	12 650	13 250	13 360	11 060	11 860	11 000	11 360
Cars per 1000 pop.	543	635	594	632	657	625	619
Annual income per capita ($A)	23 450	21 580	20 120	19 340	20 330	18 360	26 420
Veh. pass-km/$ income	0.539	0.614	0.664	0.572	0.583	0.599	0.430

3.2 Non-instrumental reasons for travel

Researchers have long hypothesised that car travel, particularly driving, produces psychological benefits, and that these are important in explaining the high popularity of car travel. An earlier argument for such psychological benefits was put forward by Marsh and Collett (1986) in their book *Driving Passion*. They saw the thrill of driving as involving the mastery of speed and acceleration, and its associated controlled risks, and acceleration as producing psysiological changes in the human body. They further argued that cars provide their owners with a powerful means of self-expression, as witnessed by the popularity of personalised number plates and the customisation of cars (Moriarty and Kennedy 2004a). Their analysis was, however, short on empirical evidence for the psychological benefits of car travel, as distinct from car ownership.

More recently, empirical evidence for such non-instrumental motives for car travel has been published, including a special double issue of the journal *Transportation Research Part A (*Mokharian 2005). In one study in this issue, Steg (2005) surveyed several hundred driver's licence holders in the Dutch cities of Groningen and Rotterdam. Her studies found that several motives for car use can be distinguished. 'Instrumental motives may be defined as the convenience or inconvenience caused by car use, which is related to, among other things, its speed, flexibility and safety. Symbolic or social motives refer to the fact that people can express themselves and their social position by means of (the use of) their car, they can compare their (use of the) car with others and to social norms. Affective motives refer to emotions evoked by driving a car, i.e. driving may potentially affect people's mood and they may anticipate these feelings when making travel choices' (Steg 2005 pp 3-4). In this paper we will group symbolic and affective motives together as non-instrumental motives.

In the US, Mokhtarian and Salomon (2001) explored the concept of travel for its own sake, or travel affinity, as they termed it, in a 1900-strong sample of San Franscisco residents. All modes of travel were found by at least some of these urban travellers to provide a positive experience, but as expected, the proportion liking car travel (nearly 60%) was far greater than for rail (30%), or bus (less than 10%). More generally, their survey found that nearly half of their sample agreed with the statement that 'getting there is half the fun'. In the U.K., a recent study by Anable and Gatersleben (2005) found that the relative importance of instrumental and affective (non-instrumental) factors varied by purpose of trip. Specifically, instrumental aspects were found to be much more important for work trips as compared with leisure trips.

Given that private motoring provides intrinsic benefits, travel would be expected to rise as the car progressively replaced earlier modes, as the share of licenced drivers in the population rose, and as the proportion of work-related trips in total travel trips decreased. It thus seems clear that to an unknown extent, non-instrumental motives have contributed both to the replacement of public transport by car travel and to the rise in overall personal travel levels.

3.3 Instrumental reasons for travel

In contrast to psychologists, transport modellers, often engineers or economists, usually assume that travel motivation is almost entirely instrumental, or in economist terms, a derived demand. Travellers, in other words, are viewed as being prepared to outlay time and money only to access desired destinations. This view is incomplete, given the importance of 'symbolic-affective' motives in car use discussed above, but such a simplification may be needed to make the problem mathematically tractable (Moriarty and Kennedy 2004a).

The replacement of public transport and non-motorised modes by car travel has greatly increased door-to-door travel speeds (Intstat 1988, Newman and Kenworthy 1999). (The speed data in these studies under-represent car's inherent speed advantage, since they refer to *actual* travel. If public transport replaced the car for more inter-suburban trips—for which public transport is presently ill-suited—its city-wide average speed would be even lower.) Hence a possible reason for personal travel growth is that people can participate in extra activities, since they now have available a higher speed mode. For example, with public transport or walking, many trips—those too long for walking, or those requiring a modal change—simply cannot be made during a restricted time frame such as an employee's lunch hour, but they can be done by car. These extra activities made possible may well be regarded as worth an increase in travel, even if total time (and money) outlays for travel also rise.

How did ever-rising car travel manage to maintain its speed advantage over public transport? In contrast to the radially oriented fixed rail public transport network, the ever-expanding road network made non-radial travel easy. The progressive suburbanisation of activities meant that most trips were less and less oriented to the centre than was the case in the public transport era. Such a dispersion of destinations meant that car travel speeds could be kept high even as car ownership rose to about one vehicle for every two residents. Only for work trips to the CBD could public transport, especially rail, compete with car travel on speed.

Figure 2 shows average car speeds against average annual car travel for 37 cities in Europe, North America, Asia, and Australia in 1990 (Newman and Kenworthy 1999). If a linear fit is assumed, the correlation coefficient is 0.62, and the slope of the line is highly significant ($p \ll 0.001$). It is likely that non-instrumental benefits of car travel also rise as average car speeds rise and traffic congestion is reduced. Travel distance and speed data from a 1985/86 national Australian survey (Intstat 1988) support this argument, since, again, higher daily travel levels are correlated with higher average speeds. For example, female pensioners averaged only 15 km daily travel by all modes—motorised and non-motorised—at an average speed of 23 km/hr, whereas males working full-time averaged 52 km of travel at 35 km/hr. Interestingly, higher average speeds resulted in more, not less, travel time: female pensioners spent only 40 minutes per day travelling, compared with nearly 90 minutes for males in full-time work.

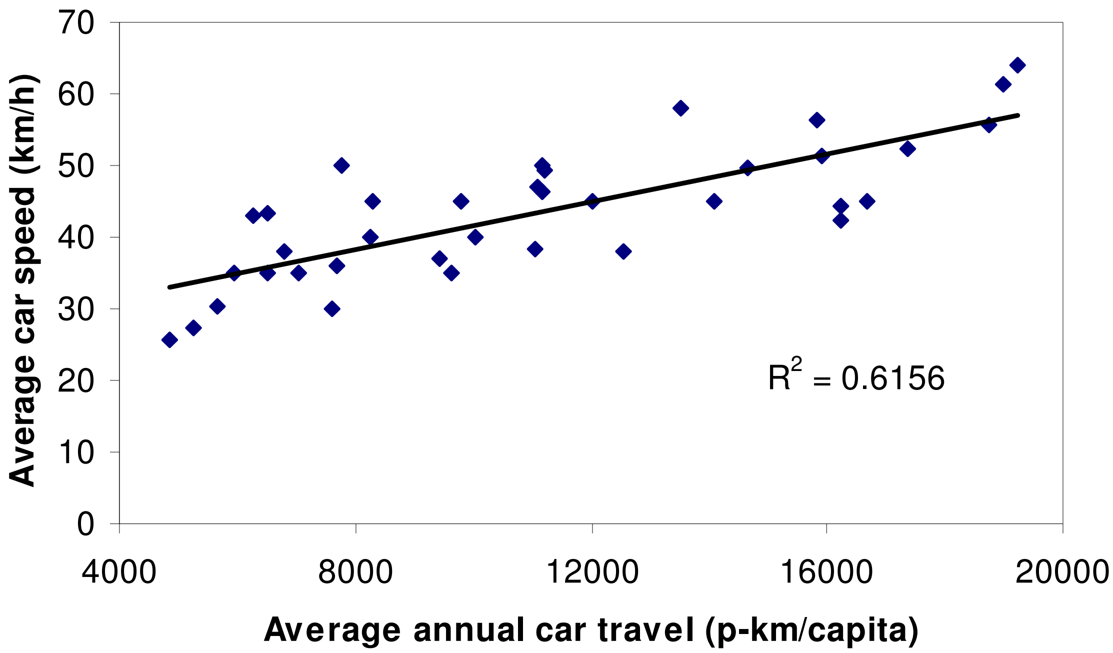

Figure 2 **Average car travel speed vs average per capita travel, 37 world cities,1990 (source: Newman and Kenworthy 1999)**

Car travel is not only faster than alternatives, but is regarded as having a number of other instrumental advantages. These additional perceived advantages include greater security and privacy, all-weather protection, and ease of transporting young children or goods. These advantages vary little from city to city. Along with car air-conditioning and stereo systems, they both increased the attractiveness of car travel over public transport, and encouraged increased trip making. Another change that has increased travel is the rise of chauffering of both children and the elderly. Consider the case of a parent chauffering a child to school, (replacing the child's former walking or cycling trip) and then returning home. In terms of passenger-km, three vehicular trips have replaced the former non-motorised trip—one for the child and two for the parent driver.

We can now answer the question: Why is travel per capita similar in all Australian cities? For cities of a given population, car travel speeds will generally be lower in the more densely populated cities, as a result of greater congestion (Newman and Kenworthy 1999, The Public Interest 2004). It is thus possible that the rough equality in car travel in Australian cities is the result of two opposing trends. The denser Australian cities, on the one hand, might have their travel levels reduced because of lower car travel speeds. On the other hand, any reductions because of greater congestion could be offset by their larger size. City size is still an important factor for some trip lengths. Trips made to the city centre, for example to watch a major sporting event or for specialist shopping, are longer on average in Sydney and Melbourne simply because the average resident lives further from the CBD than is the case for smaller cities (Table 2). Similarly, trips made to any unique destination in the metropolitan area (for example, the Tulip Festival held annually in an outer Melbourne suburb, or the international airport), will necessarily be on average longer in the larger cities.

It is relevant to ask what all this increased travel has been for. Nearly all the increase in urban travel since 1947 was for discretionary trip making, since per capita growth in work and education trip frequency (and their average trip lengths) has been modest (Moriarty 1996). As already mentioned, in 1947, most non-CBD oriented trips were probably made on foot, and were necessarily very short. Most of these trips were also discretionary—visits to friends, local shops, churches, cinemas, and pubs. With rising car ownership, this natural constraint on trip length was lifted, with the result that discretionary travel expanded far more rapidly than non-discretionary travel. A*verage* travel per capita in capital cities has stagnated over the past decade or so. Two factors together probably explain this stagnation. One is saturation in car ownership and use in the inner and middle suburbs. The other is increasing spatial inequality, with lower-income households increasingly found in outer suburbs. Given their higher travel needs, they would travel more if their incomes were higher (Moriarty 2000).

Neither the patterns found for Japan's largest three cities, nor those for the 13 US major cities analysed by Newman and Kenworthy (1999) fits this Australian pattern of vehicular travel per capita being independent of city size and density. In Japan, vehicular trips per capita in 2001 still show a small increase with city size and population density (Statistics Bureau 2004), perhaps reflecting the continuing importance of public transport in these cities. In the US, there is a weak trend for cities with higher densities to have lower per capita vehicular travel—the opposite of Japan's experience, but more in line with the general world trend of per capita travel falling as urban density increases (Newman and Kenworthy 1999).

In summary, in the public transport era, urban densities were high, but activities requiring access by vehicular transport were more concentrated in the centre. Travel motives were predominantly instrumental. In the present car era, urban densities are much lower than in the first era, but suburbanisation means that residences, workplaces and services of all kinds are now intermingled. The *potential* for the low travel levels of 1947 is present, but the instrumental and non-instrumental benefits of the car result in actual travel levels today being several times greater than in 1947. Of course, just as travel per capita was higher in 1947 than in 1921, some travel increase would have occurred even without cars, because of real income increases and falling household sizes, for example. Travel increases can also occur because people wish to participate more in out-of-home activities, as happened when married women entered the workforce in greater numbers.

4 Travel future: remembering the past?

Many people see car-oriented cities as the ultimate historical endpoint for urban transport. Business corporations, governments, and the majority of the urban population are happy with this solution to urban travel. So why even consider change? One reason is that several researchers who are far from hostile to the auto have done so. In a series of papers, Schafer and Victor (see for example, Schafer 2000, Schafer and Victor 2000) argue that in all countries, people have a fixed travel time budget. They argue that the shift from slower modes—public transport and non-motorised modes—to car travel has allowed people to travel further for a given time outlay.

In order to accommodate their projected large rises in personal travel levels out to 2020 and 2050, they foresee absolute declines in the level of car travel for present car-oriented countries, and huge increases in high-speed travel (air and very fast train travel). Car travel—particularly in cities—will in future be too slow for a fixed time budget of an hour or so per day, they argue. A variant of this approach is provided by Ausubel, Marchetti and Meyer (1998), who foresee maglev trains travelling at high speeds in evacuated tunnels displacing car travel for both urban and longer-distance trips. (The authors did not address the question as to whether passengers would be prepared to spend many hours underground.)

Air travel within urban areas is not an option. It is also unlikely that short or even medium length urban trips can ever be made at high speeds, even by rail, given the physiological limits to acceleration/deceleration of the human body. It is, possible, but unlikely, that long-distance rapid travel, either inter-urban or overseas, could *displace* urban travel. But it is doubtful that people do in fact have constant travel time budgets, even when aggregated at the city-wide or even national level (Moriarty 2002). Further, different sub-groups have very different average travel time outlays, as shown above by the more than two-fold travel time difference between female pensioners and full-time working males. Further, as Lyons and Urry (2005) stress, the increasing ability to use travel time for other activities argues against individuals having fixed travel time budgets.

Other researchers who see future reductions in travel take a very different approach. They argue that advances in the new Information Technology (IT) will make much travel, including urban travel, redundant. Mitchell (1999, 2003), an urban planning specialist, is one who has developed this idea in detail. He uses the term ‘demobilization’ as a general term for the substitution of work, shopping, and other trips by networked computers. Pelton (2004) has a similar view, but sees security as an additional driving force for radical changes to urban form and hence transport.

But arguments to the effect that IT will radically reduce urban travel needs have now been made for almost three decades. Actual results so far have been disappointing (Moriarty and Kennedy 2000). As Westfall (2004) asks, if teleworking is so good for productivity, why aren’t more employers encouraging it? Teleshopping, or e-commerce, similarly has not fulfilled its early predictions: in the first quarter of 2005 e-commerce accounted for just 2.2% of US retail sales (US Census Bureau 2005). And even if (say) 10% or even 20% of retail sales were done over the Internet, it does not follow that shopping travel itself would be much affected, since a large variety of purchases are usually made on each shopping trip—there are few single-purpose shopping trips. Household shopping trip frequency may remain unchanged. And given the child-minding functions of school education, tele-education is even less probable. Even for tertiary education, initial enthusiasm for IT-based 'virtual universities' has waned. As Noble (1998) points out, they are really just a fancy term for the old correspondence colleges.

Nevertheless, recent developments in IT could have some indirect impact on future urban travel, by reducing the perceived psychological benefits of the car. The development of 'intelligent' air bags has in turn led to the development of an Electronic Data Recorder, similar to an aircraft's 'black box'. This device can continuously record data on steering wheel angle, engine speed, acceleration/deceleration etc, and will consequently be of great value in both accident reconstructions and the design of safer vehicles. The data for the last five seconds of a crash have also been used in court cases. Further, a simplified black box, now on sale, will allow parents to monitor the driving behaviour of their teenage children, or car-rental companies to monitor their customers' use of their vehicles (Moriarty and Kennedy 2004a, Randerson 2004). Should such devices become widespread, the surveillance they enable could profoundly affect the psychological benefits that adolescents, particularly, obtain from driving. In other words, for urban residents, car travel could lose much of its non-instrumental value.

Global climate change and Australian and global oil depletion are two major challenges, both demanding solutions in the near term. If not resolved they will have profound implications for travel in urban Australia—and elsewhere. A large number of technical fix solutions to these two problems has been proposed. These include hydrogen fuel cell vehicles (with the hydrogen ultimately being derived from renewable energy), liquid fuels derived from biomass, and major increases in vehicle fuel efficiency, as in the Rocky Mountains Institute concept vehicle, the Hypercar (Lovins and Cramer 2004). These technical fixes, the technological optimists argue, will permanently answer any resource/environment challenges to the car.

Increasingly, however, doubts are being expressed about the efficacy of the proposed solutions (Hammerschlag and Mazza 2004, Northeast Advanced Vehicle Consortium 2003, Romm 2004). Hydrogen fuel cell vehicles, once promised for 2004, are now not expected for another 10-20 years, and possibly never. Not only are their costs still very high, but there are problems with noble metal catalyst availability, durability of fuel cells under automotive conditions, on-board hydrogen storage, safety, and fuel availability (Moriarty and Kennedy 2004b). Biomass-based fuels are already being produced in US from corn and in Brazil from sugar cane, but there are clear limits to the production of fuels from food crops.

If these two problems are serious, and not capable of speedy technical resolution, the present urban transport system is likely once more to change dramatically. It is probable that some features of the public transport era will reappear, with alternatives to the car having a far greater role than today. If motoring costs rise, or if motoring is restricted, urban residents will adapt in a number of creative ways. In the short term, they can increase vehicle occupancy rates and access closer destinations for many of their discretionary trips. They can also change their mode of travel to existing destinations, or change to ones more suited to public transport. Australian cities—particularly Sydney and Melbourne—are fortunate in having extensive fixed-rail electrified networks. Use of local destinations could well lead to a rise in the relative importance of existing local shopping centres (many of which are today under-utilised) compared with free-standing ones. Over time, work and education trips could also be more localised.

Of course, police and ambulance services will still use road vehicles, as will most local goods delivery and even some longer-distance road freight. Priority may also be given to non-metropolitan populations, who have fewer opportunities to use alternative transport. Non-electric street public transport and freight trains also require oil-based fuels. So any reductions in oil consumption or greenhouse gases are likely to fall most heavily on private urban passenger travel.

Eventually, the ‘logic’ of urban travel could change once more. Once it is realised that for most destinations, car travel will no longer be the main means of access, both destinations and even the timing of activities will change to reflect the new transport realities. Car travel will still occupy important niche roles for trips unsuitable for other modes because of location, time of travel, or the need to carry goods, but the automatic choice of car travel for all urban trip-making will no longer prevail. Exactly how travel will change depends on government policy. If transport fuels are subject to general rationing—as presently with water in Melbourne—what car travel remains will be spread more evenly over the urban population, with the car used selectively by all. If, on the other hand, transport fuels are rationed by price, car travel will mainly be restricted to higher income urban groups.

5 Conclusions

Beginning in the late 1940s, Australia’s public transport-dominated cities gave way to today’s car-oriented cities. In the public transport era, levels of personal travel in the various cities were found to vary linearly with the average distance the urban population lives from the CBD. This fits well with a simple model in which all *vehicular* travel destinations are at or near the centre, with residents making a constant number of weekly vehicular trips to the centre. The denser cities, being larger, will have a higher per capita travel. In the public transport era, travel was largely driven by necessity, with the work trip dominating vehicular travel.

In the present fully-developed car era, personal travel levels are several times higher than in the previous public transport era, but similar for all capital cities, despite big differences in urban density, populations, and average resident distance from the CBD. These much higher travel levels can be explained as resulting from the benefits—both non-instrumental and instrumental—that car travel has compared with alternative modes. Car travel not only provides a variety of psychological benefits to motorists, but also enables access to activities at diverse locations and at times not possible with alternative modes. This enhanced access results both from the higher speed of car travel compared with alternatives, and the complete urban coverage of the road network compared with public transport.

Different researchers provide conflicting views on the future of urban transport, both here and overseas. Some see urban personal travel levels continuing at their present levels, or even growing, but with super-efficient vehicles, together with alternative fuels, replacing both present vehicles and petroleum-based fuels. Others in contrast, see much urban car travel replaced by high speed-rail, or urban travel, and its associated outlays of time, displaced by air travel. Yet another group of researchers think that use of the new Information Technology will substitute for most urban travel.

Even if, as we argue, Information Technology does not substitute for much urban travel, it is still likely that urban personal car travel levels will decline. This result, is, after all, the desired end-result for the various urban TravelSmart programs. Official support for these programs will likely intensify as evidence for global climate change and Australian and global oil depletion increase. Some features of the public transport era may reappear, with alternatives to the car having a far greater role than today. Urban car travel could eventually be confined to travel unsuited for alternative travel modes.

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