ARE PUBLIC TRANSPORT, CYCLING AND WALKING THE ANSWER TO THE ANTICIPATED GROWTH IN MOTORIZED TRAFFIC?

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ABSTRACT

It is widely accepted that the traditional (supply-side) approach to provision for motor vehicle traffic – predict and provide – is no longer tenable. The conventional response is to invest more heavily in public transport, and perhaps walking and cycling. However, most of the increase that has been observed in car travel has not come about at the expense of public transport, walking or cycling, but from 'new' kilometres being generated. Furthermore, the expectation that better public transport might be able to compete with the private car ignores the fact that many of these new trips are now so spread out geographically that public transport would be difficult to operate economically, that travel times using public transport are far higher than those of car (or sometimes cycle or walk) and that certain types of trip are not suitable for transfer to public transport.

This paper considers the increase in (local) travel in recent decades and the projected growth. It considers the type of trips being made, their potential for transfer to other modes and hence how the transport sector's contribution to greenhouse gases might change.

Keywords: growth, public transport, cycling, walking, household travel surveys, patterns of travel

1 INTRODUCTION

It is well accepted that there are problems associated with the use of the private motor vehicle (PMV). They include (Whitelegg 1993):

- pollution (both air and noise);
- contributing to other health problems, including obesity, stress, injury and premature death;
- depletion of scarce resources, including fuel; energy and materials for manufacturing; land for infrastructure; road space; and individuals' time;
- financial implications for both the public and the private sphere, including the cost of imported materials and operating costs for both vehicles and the associated infrastructure;
- inequities in mobility between those who have access to a PMV and those who don't.

Nevertheless, PMVs are an attractive mode of transport. They provide independence in travel, personal control (of travel and the immediate environment of the vehicle), convenience and flexibility and allow transport of more articles than can be carried by an individual and several people in one vehicle.

They are widely available: for example, in 2005, there were enough PMVs in Sydney to provide about 1½ per household (Transport Data Centre 2008a). It is not necessary to own a PMV to be able to use one: for example, almost 84% of the population of NSW aged 16 and over at June 2008 (Roads and Traffic Authority 2009) had a driver's licence and therefore permission to operate PMVs.

Cars have a slightly more dominant role in New Zealand: in 2006 around 89% of the (eligible) population had a licence to operate a car and there were about 1.9 vehicles per household (NZ MoT 2006; Statistics New Zealand 2009).

Section 2 discusses the current attitudes to urban travel. The remainder of the paper concentrates on urban travel in Australia. Section 3 discusses current patterns of personal travel, particularly in Sydney and the reasons for growth. Section 4 discusses the potential for transfer of travel by PMV to other modes in Sydney while section 5 discusses the projected demand for travel. Section 6 offers some conclusions.

2 CURRENT ATTITUDES TO TRAVEL

The concept that public transport is the answer to car-dependency is so commonplace that it's easy to give examples. For example, the Garnaut report (Garnaut 2008) gives, as the way that the transport sector will be transformed by an emissions trading scheme:

> "a shift to lower-emission modes, such as rail and public transport (sic), accompanied by changes to the structures of towns and cities (urban form)"

The media agrees (Besser 2008a; Dowling 2009). Not surprisingly, the public also see public transport as the answer (Arbury 2009; Besser 2008c).

Many authors also see public transport as the centrepiece of sustainable transport. Authors with a particular focus have variously emphasized public transport in general (Atherton,

Riedy & White 2006) or a particular form of public transport (Lowson 2002). Nevertheless, some authors believe that the attitude that 'public transport is the answer' is an inadequate response (e.g. Brindle 1998; Hillman 1994; Tudge 2003), both because of the influence of individual behaviour in the demand for travel and because the current and projected use of the PMV is more than could be catered for by public transport. It is also common to see public transport, cycling and walking together presented as the solution to the current transport problems (Moriarty & Honnery 2008; O'Fallon, Sullivan & Hensher 2004; Rees 2003; Verplanken et al. 2008). In many cases there is an implicit assumption of 'public transport good, cars bad' (Anable 2005; Corpuz 2007; Cullinane & Cullinane 2003; Harris 2007; Stradling 2002).

3 CURRENT PATTERNS OF TRAVEL

3.1 Distance

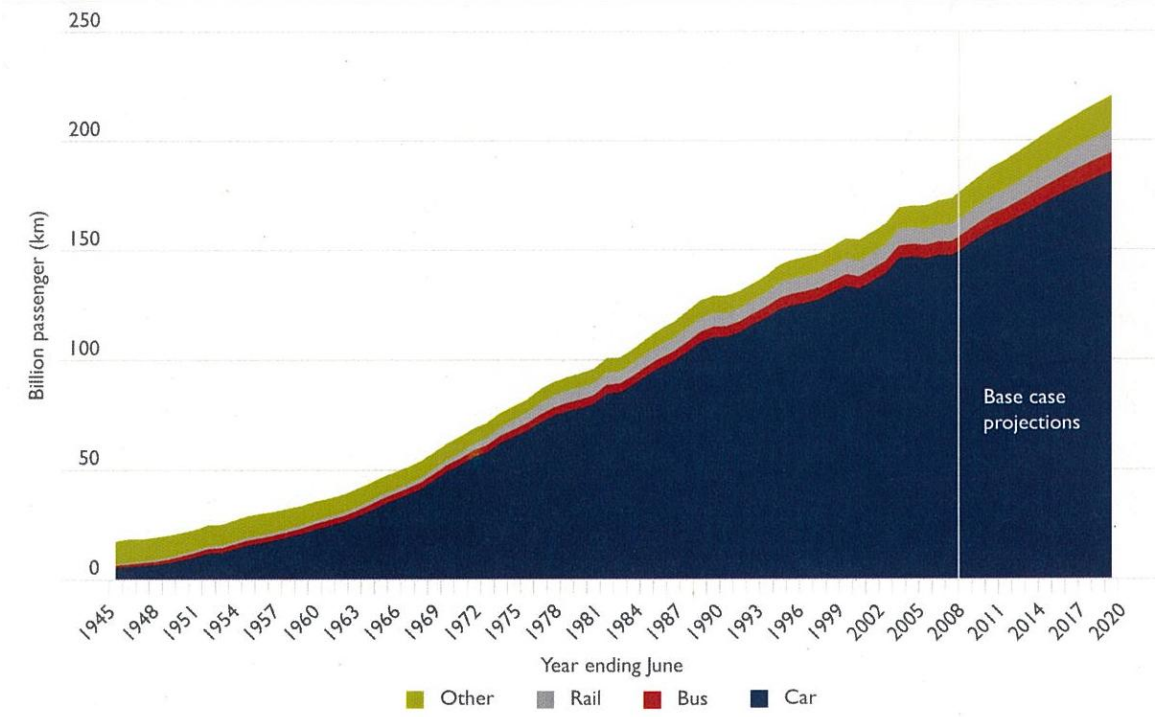

Figure 1: The eight Australian capital cities' motorized passenger task, 1945-2008 and projected to 2020
Source: (Cosgrove, Gargett & Mitchell 2009)

Figure 1 is a graph of the travel undertaken by motorized modes (private motor vehicles (PMVs – cars, motorcycles, light commercial vehicles used privately), and urban public transport (UPT - ferries, buses and rail) in the eight Australian capital cities (that is, Adelaide, Brisbane, Canberra, Darwin, Hobart, Melbourne, Perth and Sydney) in terms of billion passenger kms, over the years 1945 to 2008, with projections to 2020, produced by the Bureau of Infrastructure, Transport and Regional Economics (BITRE) (Cosgrove, Gargett & Mitchell 2009). It is easy to see that over this period, PMVs have carried out the largest single part of the motorized passenger transport task, in absolute terms, with an almost tenfold increase in passenger kms predicted by 2020, and are projected to continue to do so. In 2008, PMVs represented about 90% of the motorized passenger traffic in the capital cities

and UPT the rest. In Sydney (statistical district (SD) unless otherwise specified) in particular, PMVs made up about 86% of the motorized passenger km in 2008.

Motorized traffic is only part of the traffic stream in Australian cities. Active transport - cycling and walking - also contributes to personal transport. BITRE does not collect statistics about cycling and walking and no Australia-wide figures for the use of active transport could be found, apart from the census, which only gives information of the journey to work and is thus not representative of active trips as a whole (for example, in absolute terms in Sydney, trips for social/recreational purposes form the greatest number of cycling trips, with commuting second in terms of importance (Transport Data Centre 2008b)).

Therefore, it is necessary to make an estimate for the distances covered by cycling. The average length of a bicycle commuting trip has been calculated to be 7 kms (Bauman et al. 2008). It is estimated that in 2006, Sydney residents made over 114,000 cycle trips each weekday, which is less than 1% of the total 16,608,000 trips made each weekday. The figure of 7 km/trip gives an estimate of 798,000 km for the distance contribution of cycling to passenger travel on a weekday in Sydney in 2006 (Transport Data Centre 2008a).

There is more information available about walking. In 2006 unlinked (not part of a trip chain) walk trips constituted 17.7% of a total of approximately 16,608,000 trips on a weekday in Sydney, or 2,945,000 trips. The average duration of a walk trip was found to be 11 minutes (Transport Data Centre 2008a).

However, trips by UPT (and sometimes PMV) often involve an element of walking to access the train, bus or ferry. These linked walking trips provide a substantial proportion of the total distance walked each day. In fact the household travel survey suggests that more walking is done when accessing other modes than as an independent form of transport (Transport Data Centre 2008a). Hence it follows that if the use of UPT increases, so will the distance walked.

Nevertheless, the figures suggest that the total contribution of walking and cycling to the distance travelled on a weekday in Sydney is less than 10 million km. Therefore it is likely that, in spite of the not inconsequential contribution to the number of trips undertaken, neither walking nor cycling contribute more than a very modest share of the approximately 150 million km distance travelled, by all modes, on an average weekday in Sydney (Transport Data Centre 2008a). Table 1 summarizes the share of the travel task in Sydney by mode and distance in 2006.

Mode	**Distance ('000 km)**	**Proportion of total distance**
PMV - driver	84,080	56%
PMV - passenger	31,598	21%
Train	16,124	11%
Bus	6,641	4%
Cycle	798	0.5%
Walk	9130	6%
Other	1,891	1.5%
Total	**150,263**	**100%**

Table 1 Estimated distance travelled by mode, 2006, Sydney
Source: based on 2006 household travel survey (Transport Data Centre 2008a)

3.2 Travel time

Stage bus, rail and ferry operate by drawing potential passengers to designated stopping points, where the passengers are collected for onward transport to other stopping points, where they discharge themselves. This means that these three modes require an element of access (which can be by any mode) and frequently an element of waiting. At the public transport destination there will be an element of egress time to cover travel, often by foot, to the journey destination. There may be a further element of waiting if interchange is required during the course of the journey. There will also be delays (dwell time) at every stop along the route. Thus, delays are inherent in public transport in order to collect passengers.

Although an element of access and egress time may be necessary for all modes (except walking), and all modes are subject to congestion, the element of waiting (at around half the elapsed time) is unique to public transport in Australia by virtue of its public nature. Thus, when several modes share the same network, the private ones (PMV, cycle) are likely to have a greater proportion of the journey time in motion than the public one, by virtue of the latter's very nature. A variety of measures can be introduced to speed the public modes, including limited stop (express) routes, dedicated service space (including bus lanes and reserved track (e.g. guided bus track or light or heavy rail track)) and priority at traffic signals.

Table 2 shows a calculation of the apportionment of time between in-vehicle time, walking and waiting time (based on Manning 1984, p. 7). Cycling is not included, but could be expected to have a high in-vehicle component. While the specific values of time for each stage of the journey are no longer accurate (e.g. walking trips in Sydney were shorter in 2006 than in 1971), the figures are still indicative of the variation in journey time between modes.

Mode	**PMV**	**Train/ferry**	**Bus**	**Walking**
In-vehicle time	20	28	22	
Walking time	4	18	11	14
Waiting and others	3	14	6	
Total	27	60	39	14
In-vehicle time as a % of total	**74%**	**47%**	**56%**	**na**

Table 2: Average apportionment of time on journeys to work in Sydney 1971 (minutes per trip)
Source: based on Manning 1984, p. 7

The disparity in the time taken by the various modes can be seen in 'commuter races', where the different modes are pitted against each other, over the same origin and destination, generally in the morning peak period. The PMV usually comes out faster than UPT and the cyclist often wins (e.g. Besser 2008b; Ramadge 2008).

3.3 Growth

It can be seen from Figure 1 that the number of km travelled by UPT in Australia has increased over the 60+ years between 1945 and 2008, although at a rate which is not comparable to the growth in the use of PMVs.

As a result, UPT's share of the total motorized passenger distance travelled has reduced substantially, from about 60-65% in 1945 to about 10% in 2008. These gross figures tell us

that over the last 60 years, while there has been movement from UPT to PMV, overall the situation has arisen because there has been more travel – that is, greater distances being travelled (Battellino & Raimond 2000), in conjunction with an increase in population from 7 million to 21 million over the same period (Australian Bureau of Statistics 2008) rather than UPT km being lost for PMV kms which have been added (Cosgrove, Gargett & Mitchell 2009).

Some of this greater distance is longer trips: required because cities have been transformed from compact centres where high density housing predominated, to sprawling areas where low density housing predominated. The change has catered for an increase in population, aided by an increase in the speed of available transport, which has allowed greater distances to be covered for a given amount of time (first, in the nineteenth century by train, then cycling (Perry 1969) and then, in the twentieth century, PMVs). In NSW it can be seen in the greater vehicles kilometres travelled (VKT) levels per person for inhabitants of the statistical local areas (SLAs) far from the major employment centres of the Sydney CBD and (further north) Gosford (Transport and Population Data Centre 2005).

The other contributor to the greater distance is more trips. The number of trips made has increased at a greater rate than the population has expanded. This is partly due to increasing rates of car ownership (Battellino & Raimond 2000) although calculations from BITRE (Cosgrove, Gargett & Mitchell 2009) suggest that Australia is approaching saturation in travel growth per head of population (as opposed to growth in travel because of an increase in population).

4 POTENTIAL FOR TRANSFER OF PMV TRAVEL TO OTHER MODES

It is not practicable to remove all PMVs from our cities. For example, some destinations may be inaccessible to regular UPT (e.g. industrial estates out of peak hours) either because of the lack of alternatives or the high cost of alternatives (e.g. taxis); in some cases, such as tradespeople, it is necessary to carry equipment – the vehicle is a travelling workshop. Furthermore, it would not be possible for the city to function without cars, because of insufficient UPT capacity to cater for even those trips which could be transferred (Tudge 2003).

Indeed, serious economic damage can be done by a blanket ban on motor vehicles. This is why some classes of vehicles are only banned under certain circumstances. For example, delivery vehicles may be banned from pedestrianized areas after 10 a.m.

Nevertheless, as stated previously, transferring PMV trips to other, more environmentally friendly modes, is widely seen as a major way forward to reducing some of the problems associated with the current transport situation.

In order for a transfer to these modes to take place, the trip must be feasible by one of the substitute modes – that is, the same trip or an acceptable (usually closer) substitute (e.g. visiting different shops selling the same goods), thus reducing the need to travel and providing more choice of practicable modes.

That is, worthwhile destinations must be conveniently accessible by the alternative modes.

From household travel surveys, it can be seen that there is a pattern to the use of the various modes of transport. Table 3 has been generated using data from Sydney household travel surveys:

Mode	**Dominant trip purpose**	**Average length (km)**	**Average time (minutes)**
Rail	JTW/recreational (Transport and Population Data Centre 2003)	19.8[6]	33[6]
Ferry	JTW/recreational (Transport Data Centre 2009)	-	24[6]
Bus	education/JTW (Transport Data Centre 2002)	7.2[6]	23[6]
PMV – driver	serve passenger/work related business (Transport Data Centre 2008a)	10.5[6]	19[6]
PMV – passenger	social/recreation (Transport and Population Data Centre 2005)	8.9[6]	16[6]
Cycle	recreational/JTW (Transport Data Centre 2008b)	7[+]	17[5]
Walk	change modes (Corpuz, Hay & Merom 2005)	1.5[6]	11[6]

Table 3: Characteristics of passenger transport modes, weekdays, Sydney
(the figures in the table relate to in-vehicle time. Therefore waiting time must be added to arrive at total journey time). JTW = journey to work (commuting)

Sources: Sydney household travel surveys (HTS), as follows: [5]=2005 HTS; [6]=2006 HTS; [+]=average distance for commute, from census figures (Bauman et al. 2008)

It can be seen that rail journeys represent the longest trips: in fact, only 2% of rail trips are under 10 km (Transport and Population Data Centre 2003). PMV trips are next, with an average trip length of 10.5 km. Bus trips average 7.2 km. Cycle trips are slightly shorter at 7 km. Walking is only used for short trips.

Rail is predominantly a mode for commuting to work or school in the peak and social/recreation purposes off peak (Transport and Population Data Centre 2003). Similarly, ferry is mainly used for commuting and social/recreation (to a greater degree than rail and bus) (Transport Data Centre 2009). Buses are predominantly used for commuting or education and on average, take longer than driving or cycling to do shorter or similar-length trips.

Ferries are very limited in their geographical coverage and are therefore only suitable for replacing a very limited number of PMV trips. They will not be considered further.

Rail is also limited in terms of its geographical spread. Changing the rail system is not a task that can be undertaken at short notice, or cheaply.

Because these two modes are restricted in where they can be used, they cannot compete with PMVs in terms of flexibility. They are important for commuting and therefore important in tackling congestion, which is at a maximum during commuting periods, but the journey to work is not the most important reason for travel by PMV. That is serving passengers and work related business (Transport Data Centre 2008a).

In essence, the urban area is characterized by its network of roads. Only PMVs, buses, cycles and walking can penetrate a conurbation sufficiently to provide a comprehensive passenger transport system. Therefore, it is to road-based modes it is necessary to look to significantly modify the urban transport situation.

5 PROJECTED DEMAND FOR TRAVEL

Figure 1 shows BITRE's projected demand for motorized passenger travel in the eight Australian capital cities until 2020 (Cosgrove, Gargett & Mitchell 2009). It is based on the premise that current and future demand is largely a function of that segment of the population that is of an age and condition able to hold a driving licence, and the activities in which that population engages. Hence, during times of economic downturn, when unemployment rises and construction declines, travel in connection with paid employment decreases. Anything which affects the cost of travel, such as an increase in the cost of petrol or petrol rationing, also affects the amount of motorized travel.

However, there are also several unspoken assumptions which lie at the heart of the projections for demand for travel.

The first assumption is that the population, and hence the associated travel demands, can go on increasing and that these demands must be met (albeit in a less environmentally damaging way) because people have an inalienable right to have their travel demands met - if not by PMV, then by some other mode. Rationing of travel in Australia is currently only imposed to a limited, indirect, extent, by means of parking controls and UPT vehicle capacity.

In other areas of public life this is not the case. Curbs are put on the exploitation of some resources. For example, sometimes quotas are imposed on fishing, in order to preserve the resource and let it recover from over-exploitation. As another example, when the level of water in dams becomes dangerously low, restrictions are placed on how the remainder of the water can be used (see also Moriarty 2008).

The second and associated assumption is that demand for development, which requires transport for its operation, must be met, wherever it is decided that development should go. While developments in some areas can be stymied because of traffic and parking concerns, there appears to be an assumption that there is no limit to how much development can take place in the centre of the city, because UPT (and perhaps cycling and walking) can be invoked to deal with the transport demand and subsequent (potential) congestion.

This is not to say that it is futile to encourage the other modes. Walking and cycling have health benefits to the individual; travel time on buses and trains can be used for reading, relaxing and other productive activities (Lyons & Urry 2005) so these modes represent opportunities to enhance the productivity of an individual's travel time. They cater for people without access to a PMV or parking at the destination, or who prefer not to use a PMV for a particular journey. They also cater for occasions when large numbers of people are expected, including commuting and public events such as football matches, in order to minimize congestion.

Nevertheless, it is clear from Figure 1 that even if the use of these modes doubled within the next decade, the projected increase in PMV travel would overtake any benefit.

Similarly, if additional trips are undertaken by UPT, then we can assume that this will cause a rise in greenhouse gases. The nature of the rise will depend on the pattern of the new trips and the pattern of new provision for UPT, both mode and location.

This paper has not considered new technology – in particular, electric road vehicles. However, there is scope here to reduce emissions of greenhouse gases for both PMVs and UPT.

6 CONCLUSION

The graph in Figure 1 indicates that the increase in the share of trips by PMV over the last 60-65 years has not been at the expense of UPT. Rather, the use of PMVs has increased at a much greater rate than that of UPT, both because people have been making more trips and also because the trips have become longer. Walking and cycling only represent a minor proportion of the distance travelled (and their contribution to the alleviation of current transport problems is likely to be swallowed up by growth in PMV use).

One way to tackle some of the problems created by the current systems of transport is to reverse this trend - i.e. to reduce the amount of travel by PMV. This could be done in two ways: either by reducing the number of trips (reduce the need to travel) or reducing the distance travelled. To achieve this, it may be necessary to challenge the mindset which says that people can travel as much as they like, where they like. To reduce the distance travelled, it may be necessary to reorganize the structure of the urban area so as to reduce the need to travel long distances; in particular, reorganized to suit the modes of transport it is desired to encourage, as was done for the car city. However, it has taken decades to produce the current urban form and is likely to take many decades more to alter to any substantial degree.

Until this can be done, it is necessary to attempt to alleviate the symptoms of the problem; for example, all forms of non-PMV transport are valuable in combating peak hour congestion. However, only road based modes of transport have the flexibility to penetrate all parts of an urban area and it is therefore the road based modes (buses, cycles, walking) that are likely to be most useful in providing substitutes for PMVs in urban areas.

Nevertheless, it must be appreciated that UPT is not appropriate for all trips and the simple equation “public transport: good, car: bad” is not a realistic approach to urban passenger transport. UPT is not “the answer”; it is a tool, just as walking and cycling are tools. Like any tool, they are at their most effective when used in the appropriate way in the appropriate situation.

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