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The Imbalance between Car and Public Transport Use in Urban Australia: Why Does it Exist?

by

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ABSTRACT: Public transport in urban Australia is dominated by the automobile. As we approach the end of the 20th century, there is much renewed interest in revitalising urban public transport as one way of combating the increasing levels of traffic congestion and deterioration in air quality and global warming. This paper takes stock of the situation in Australia, identifying the challenges which the urban public transport sector face in redressing the imbalance between car and public transport market share. Particular emphasis is given to the role of buses and busways in contrast to rail, and strategies to reduce the attractiveness of the car.

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Introduction

A list of the ten great inventions of the 19th and 20th centuries is likely to include the internal combustion engine (ICE). Combined with increases in wealth, the ICE heralded the massive growth in car travel in western societies and bus travel in developing nations. In contrast, we have been witnessing an absolute decline in passenger rail trends (especially after 1990 in CEE, CIS and Baltic countries, but also Western European Countries and the USA) with the exception of Austria and Germany (reported by Thompson of the World Bank, 1996).

In Australia we are observing a slight upwards trend in the absolute amount of public transport passenger and passenger-kilometre activity, but it is not keeping pace with the increased demand for car travel, resulting in declining market share for public transport (Figures 1 and 2). The automobile remains a dominating force in Australia as elsewhere, despite the substantial increase in the cost of motoring. Since 1977 real fuel prices have increased from 14.5 cents/litre to 74.9 cents/litre (in $1990) which have been only marginally offset by improvements in average fuel efficiency of all cars from 12.59 litres/100km to 12.1 litres/100km (or 12.95 to 10.25 litres/100km for new cars). Over the period 1977-96, where the consumer price index increased 3.5 fold, we have witnessed a 2.25 fold increase in real car prices, a five-fold increase in real fuel prices, a 1.3-fold increase in cars per capita, with vehicle kilometres per car per annum almost unchanged (averaging 15,469 in 1977 and 16,045 in 1997). The delays in travel time have added substantially to car travel costs, yet still the car is preferred for all travel activities. The cost of road congestion in Australian capital cities is estimated by Luk et al (1994) to be $5109m per annum, with Sydney at $2,080m the highest and Darwin at $24m the lowest. For Sydney, this is equivalent to $416 per person per annum.

The demand for car ownership and use is almost insatiable. Planners and politicians struggle to find ‘solutions’ to the imbalance between the modes; seeking ways of repositioning public transport so that the use of the car is reduced in urban environments where it is performing least effectively.

Figure 1: Train and Bus Patronage Shares

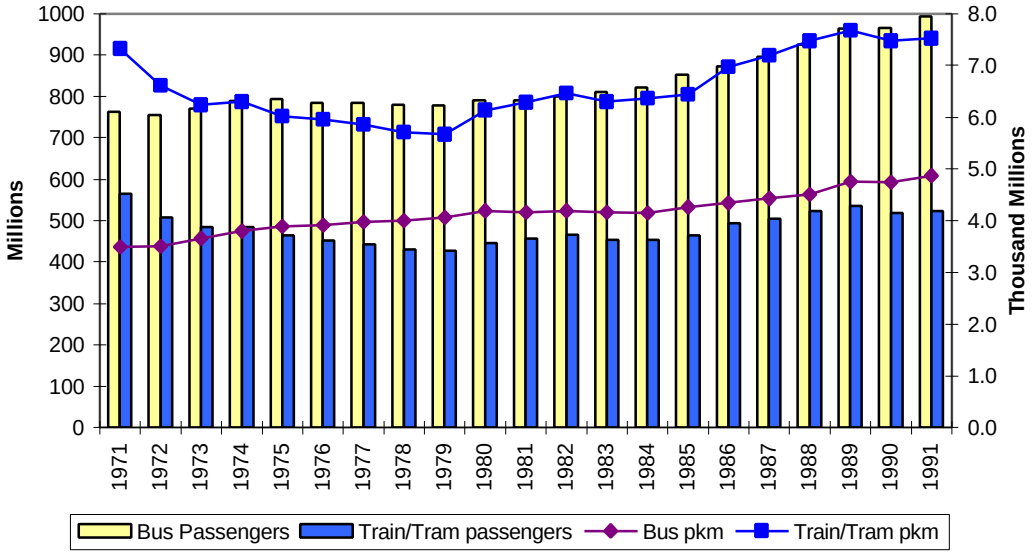
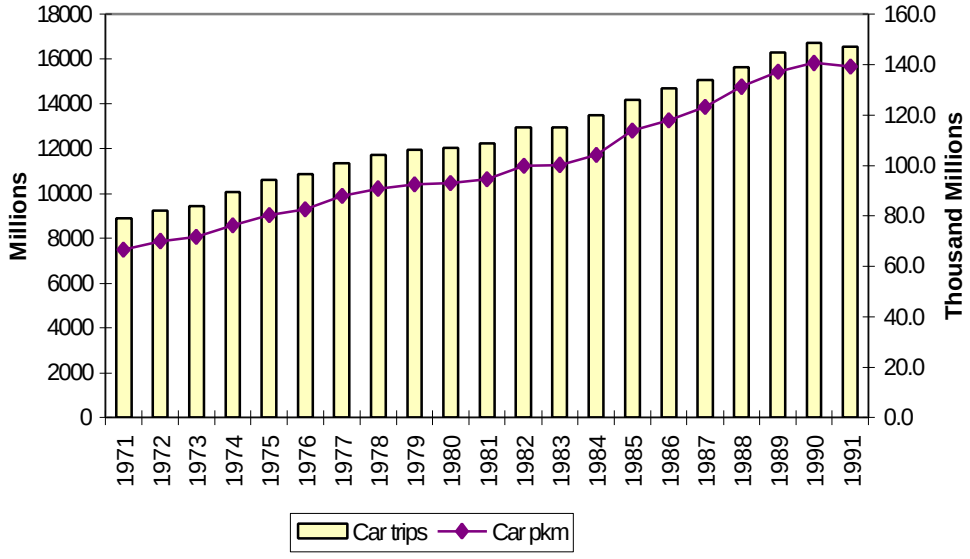


Figure 2: Trend in Car Use



While we all would like to see greater use of urban public transport - both train and bus - no public transport system within affordable political budgets is ever likely to provide a level of service of sufficient appeal to attract large numbers of car users to switch to public transport across the many travel markets. Public transport has already succeeded in attracting substantial market share where there is a concentration of activity; which in Australia is a rare occurrence. For example, 78% of all commuters to the Sydney CBD daily use trains, buses and ferries - a phenomenally high percentage given the very generous supply of parking and relatively poor road network. The road system itself is the major facilitator of this market, moving many more public transport trips and kilometres than the rail network.

Proponents of public transport increasingly criticise major road infrastructure projects which do little to assist the move back to public transport. Statements such as "the traffic will probably just go bang", and "the city will grind to a halt" if we continue to build more roads and neglect public transport infrastructure typify a view offered in support of an urgent need to stop building major new road links and invest in more rail links. The fact that road space can be allocated to busways is rarely mentioned. Opportunities exist to have significant dedicated bus priority on major freeways, something which is much more difficult to achieve on roads of lesser quality. As a rule of thumb, dedicated busways can deliver a level of service to the community which has the ability to move either 3 times the number of passengers for the same cost as the rail system or the same number of travellers for one-third the cost of a rail system.

Thus one must be careful in *always* assuming that more roads means more cars and more kilometres. Better roads can mean better use of public transport and lower costs of delivering service, if managed properly. The State Transit Authority of NSW claims that increasing average traffic speed from 20km per hour to 40 kilometres per hour can reduce bus fleet size from 350 to 180 and reduce operating cost from $4 per km to less than $2 per kilometre (personal communication, Guy Thurston, February 1997). The call to cut car dependency is well intentioned but often not well informed on the real challenges facing the public transport sector.

Induced demand or additional traffic generated by improved road infrastructure is often put forward as a bad result of more freeways. Typically in metropolitan areas we are talking about 2-3% for major roads, remembering that most of the traffic using the new facilities is diverted from other roads (including buses) and natural growth. Over time some businesses and residents relocate to take advantage of the improved accessibility offered by a specific location, but this is not induced traffic since such traffic already existed elsewhere in the city. One of the great attractions of freeways is that they get traffic off residential streets as well as helping to reduce air pollution from cars previously using roads which involved more stopping and starting due to traffic lights, stop signs and traffic congestion. A very efficient freeway system with tolls would achieve many more savings in environmental costs than are offered by a very poor arterial and sub-arterial road network unless there was massive switching out of the car to public transport. Almost paradoxically, as we improve our road network to facilitate busways we are also providing improved travel times for car use, and thus making it even more difficult to attract drivers out of their cars. The 'add one lane'

approach to busway development may be less appropriate than 'take one car lane away' approach. Unfortunately the latter is a political minefield.

The recent review by Luk et al (1998) of previous measures in Australia to redress the imbalance between car and public transport in general concludes that all forms of improvements in public transport, and especially rail, do have some impacts on the modal shares but it is quite small and often very localised (see below).

The Challenges Facing Public Transport

Figure 3 provides a synthesis of some key elements of the changing face of Australian society which are impacting on the future of urban public transport. These evolutionary changes are also applicable to countries with historically stronger urban public transport such as many Western European countries and Canada, as they are to countries such as Australia and the USA which have run down their public transport in the last 50 years and are now trying to reverse this trend. The key influences on change in the urban passenger transport sector include the changing composition of the labour force and work schedules, the suburbanisation of work opportunities and the accompanying loss of high-density mobility corridors (but an increasing number of low density corridors suitable for bus systems), the changing incidence of the population in each life cycle stage, the commitment or lack thereof from government to pricing and planning/regulatory reforms, the growing awareness and acceptance of user or beneficiary charges, and the greening of the automobile and energy sectors.

Many supporters of public transport often turn to Europe for examples of success. However, the encyclopedic account of tradition and transition in European travel patterns in Salomon et al. (1993) portrayed as a 'billion trips a day' paints a worrying picture. They show an increasing rate of growth of car ownership (in fact nearly three times that of the USA - Lave (1992)), declining household size, suburbanising residential location and the decline of the central city as the dominating focus of activity. The annual growth rate in personal mobility from 1970 to 1987 associated with private modes in Europe varies from a low of 1.7% in Sweden to a high of 6.8% in Portugal (with most countries around 3%). The use of urban public transport grew at a negative rate in the U.K. (-.9%) and Belgium (-.4%) and up to 3.6% in Denmark (with most countries between 1% and 2%) (Bovy et al. 1993). The share of mobility contributed by the private car increased from 79% to 83% during this period. Italy has one of the highest modal splits for urban public transport (26%), with a low of 4.8% in the Netherlands, and a typical percentage share of 11-19% throughout Western Europe.

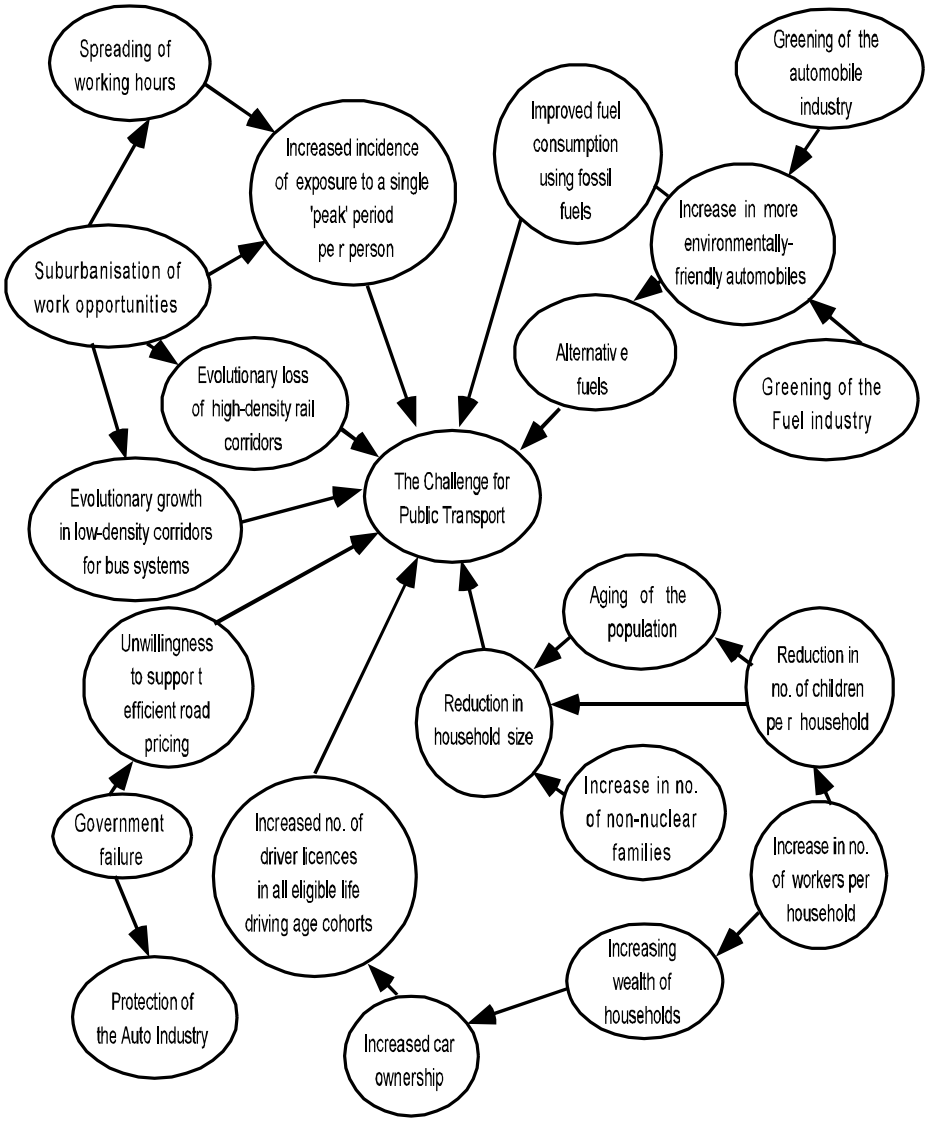


Figure 3: The Challenges for Urban Public Transport

The story in Australia is also worrying. For example, the 1991 Sydney Travel Survey shows a train share of 3.7% and a bus share of 4.3% for Metropolitan Sydney. There is no evidence to suggest this has been arrested and reversed in favour of public transport. These downward trends in use of urban public transport are aligned with the reduction in the proportion of all work trips to the central core of major urban areas. These trends are strong and consistent with global evidence that such phenomena occur as the wealth base of the population increases. If one accepts the Newman-Kenworthy density hypothesis, this is not good news for forms of public transport which require high density traffic corridors to justify both the continuation of existing services, enhancement by new investment and the

application of *justified* subsidy based on community service obligation or what might be better referred to as *urban distributive justice.*

What Does This Mean For Public Transport?

With much of Australia's urban environment already in place, the challenge is how to manage better the existing transport infrastructure and any additions at the margin. Success is not only measured in efficient transport networks and environmental protection alone, but also by the effectiveness of processes which involve the community. Better practice recognises the following issues each of which has a limiting impact on public transport opportunities, especially fixed systems such as heavy and light rail (and even very rigid fixed route timetabled bus systems):

The role of transport systems in the household sector in guiding changes to the urban form is declining

Today's urban areas are marked by well-developed transport systems. The transport system is likely to have less effective means for shaping urban form in the future because:

- the transport system in most urban areas is highly developed and so the relative impact of even major infrastructure investment will be small

- the built environment has a very long life; most infrastructure survives 50 years or more

- transport while still relevant, is of declining importance in the location decisions of households in particular and to a lesser extent firms. Transport costs make up a relatively small proportion of household expenditures, and increasingly flexible work arrangements are likely to make access to workplaces even less important in the future.

Information-based firms are 'footloose' as well as making up an increasingly large share of total economic activity. Some sectors of industry such as regional shopping centres and major entertainment complexes, however, remain heavily influenced by major transport investment.

Implication: Transport policy efforts would have to be very extreme to have a significant impact on urban form — it is a blunt instrument in the ranges contemplated given political and economic reality. The corollary is that policies directed to land use (investment incentives, pricing) will be the prime means of changing urban form. However, transport policy, especially that linked to opportunities for public transport, cannot afford to ignore the impact of changes in urban form.

The urban area of the future is likely to exhibit a particular pattern of "Compactness"

The major cities of Australia are most likely to exhibit physical forms best described as 'cities within cities', with regionalisation occurring throughout the metropolitan area. The most noticeable change is likely to occur at the urban fringe. ‘Edge cities’ will evolve as regional centres redefining density nodes and providing another point of reference for growth in employment, residential population and economic activity. These nodes are most likely to be of medium density with adjacent low density activity. The economic and social necessity for more high density urban form is unlikely to exist. Studies such as the Victorian externalities study and the work in CSIRO (eg Roy et al. 1995) provide supporting evidence for this conclusion. Flexible bus services offer the best public transport service in a setting of low density activity.

The automobile is becoming "Greener": automobile technology has a major role to play in improving environmental quality

Technological innovation linked to automobiles can alone make a significant contribution to containing and reducing local air pollution and greenhouse gas emissions. However there would be a very significant time lag in bringing the fleet in Australia up to a new standard. Achieving significant improvement in vehicle technology such as fuel efficiency gains and cleaner fuel necessitates mandated minimum corporate average fuel economy (CAFE) legislation as well as minimum corporate fuel type mixes in new vehicle sales. Very large increases in fuel excise may have the same effect, but it is politically more complex and inequitable. In the USA we now see American cars almost as fuel efficient as cars sold in Japan and Europe, despite the much lower petrol prices. Such enhancements reduce the strength of the argument in favour of public transport as more environmentally friendly; although at present the argument holds strong.

Pricing will need to be further promoted to complement technology improvements

To ensure that the level of total vehicle use is sustainable, the introduction of more severe pricing through a general fuel excise, congestion pricing and parking pricing may be required. An appeal of pricing is that it generates useful revenue which can be disbursed fairly to (a) improve road space (b) give priority to users of roads who have economic or other precedence (e.g. high occupancy vehicles, freight vehicles); (c) to improve non-road based public transport; and if less road space is required to satisfy (a) and (b) then an enhanced environment (e.g. more open space). It is also the way towards balancing the supply of road space with demand, for an economically and financially sensible outcome.

A mix of pricing and non-pricing policy tools provides a realistic way ahead, with the use of targets as a practical means of securing progress in respect of compliance with the goals of urban management. Pricing is one of a number of policy instruments which has a role in meeting targets such as a percentage reduction in greenhouse gases, percentage improvement in corporate average fuel efficiency, and absolute reduction in local air pollution; and the flow onto increased public transport share. It is inherently unlikely that any one tool alone will be as effective as complementary tools in combination. Sadly, political processes baulk at suggestions to use pricing to allocate scarce resources more efficiently and equitably. Singapore once again is to lead the 'charge' with fully integrated electronic road pricing within the central area and its approaches.

Work practices can have a significant influence on total travel by time and place

Flexible work practices both in space and time (eg telecommuting, compressed work weeks) are very promising ways of reducing the amount of travel associated with work trips, but do increase the possibility of some people living further away from their jobs and more non-work travel activity. However these instruments spread the traffic in space and time, improving the utilisation of existing road capacity (in particular) and reducing or delaying the need for more road and rail capacity (Brewer (forthcoming)).

Do not forget the growing importance of business and non-commuting travel activity in shaping our cities

Strategies for reducing vehicle kilometres should reconsider the predominant interest in commuting activity and give more emphasis to business and non-commuting travel as vehicle kilometres in this class of travel increase. More than 50% of the peak passenger traffic in Sydney is non-commuting. The Australian Road Research Board has calculated the vehicle operating cost resources consumed in the Australian road transport sector in 1991 and found that out of a total of $37.8bn spent in cities, $12.9bn is spent in business travel by car, $5.5bn in business travel by light commercial truck. This represents the single largest category of road travel expenditure, considerably larger than the traditional commuting trip to affixed destination. With this market being almost totally dependent on the use of the automobile, the gains to the environment from studying ways of making the automobile more sustainable in this market is a high priority. Public transport is unlikely to serve this market.

The air we breathe in urban Australia is not so bad

The air quality of Australian cities tends to be relatively unpolluted compared with cities in the United States and Europe There is currently no evidence that fine particles are above safe levels. The pollutants NO_X, CO and SO_2 do not currently and are not expected, within the foreseeable future, to exceed acceptable levels. There is, however, always room for improvement and efforts must continue to seek out an even higher quality for the air that we breathe. The major contributing chemicals to local air pollution, while still present, are being reduced significantly as a result of a mix of improved vehicle technology and inspection procedures. Concentrations of most air pollutants are now at 'acceptable levels', for which the evidence indicates no health risk, although there may be localised extreme problems at times. Carbon dioxide, the major source of greenhouse gas emissions is still on the rise, however. Travel demand management strategies involving financial disincentives are essential if total automobile use is to be contained to sustainable levels. It appears that there is more success in cleaning up the environment via improvements to vehicle technology and the rearrangement of patterns and timing of travel than a significant switch to public transport.

Much of our urban environment exists and adaptation will be a long-drawn out process

Integrated strategies can make a difference, but outcomes will be incremental and often slow to take effect, especially at the regional level. Key issues at the regional level are how to adapt urban regions to provide for growth and change while moving towards more sustainable and equitable cities. Key issues at the local level are how to create precincts, particularly in established areas, with a higher degree of environmental protection than they have at present. Key issues at the traffic route level are how to ensure that corridors for movement are protected while preserving the needs of adjoining owner and occupiers and adjacent communities. The potential for bus and light rail is high in each class of spatial planning.

Isolating Freeways and Toll Roads to assess their net contribution is very misleading

One of the major reasons for freeways is to eliminate much traffic from local streets and sub-arterial roads in order to make our road system safer for drivers, passengers, pedestrians and local residents - both households and firms. The idea of freeways as traffic corridors so that activity precincts can be made safer, quieter and more pleasant is a very real reason for their existence. Much of the traffic using freeways is diverted from the existing road network, with a maximum typically of 2-5% generated by the road investment. The benefits of freeways when seen in this broader network context more than outweigh the costs of their provision, including social and environmental costs. Well-defined road corridors open up

opportunities for serious busway systems (with suburban connectors) and truck routes. The UK government has recently proposed such dedicated traffic be promoted in future freeway expansion.

It is now well recognised that the evaluation of infrastructure needs must be undertaken within a framework which emphasises the full set of social costs and benefits in terms of the primary goals of urban management — economic growth/efficiency, equity/social sustainability and environmental sustainability. Murphy and Delucchi (1998) review the evidence on the social and environmental costs of car use and find that the external costs (ie congestion, noise, accidents, building damage, air pollution, water pollution) can be as high as 50% of the full costs of car travel. Positioning the financing decision within this setting will encourage a more balanced assessment of alternative ways of satisfying these broad goals, of which non-infrastructure solutions must compete alongside of infrastructure projects.

Much progress has been made in making the road environment safer

Regulatory actions in recent years have yielded significant benefits in terms of improvements in the accident rate. Improvements in vehicle safety, road user education (especially advertising linked to seat belts, drink-driving and cyclist helmets), black spot and safety audit programs have all been positive initiatives. Public transport offers the best safety profile of all land modes (Figures 4 and 5).

Figure 3: Profile of casualties and passenger kilometres by mode in Urban Australia

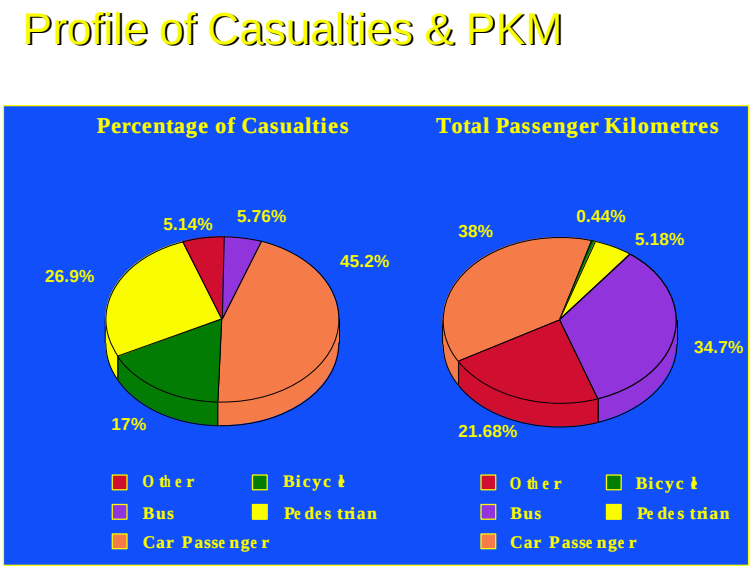
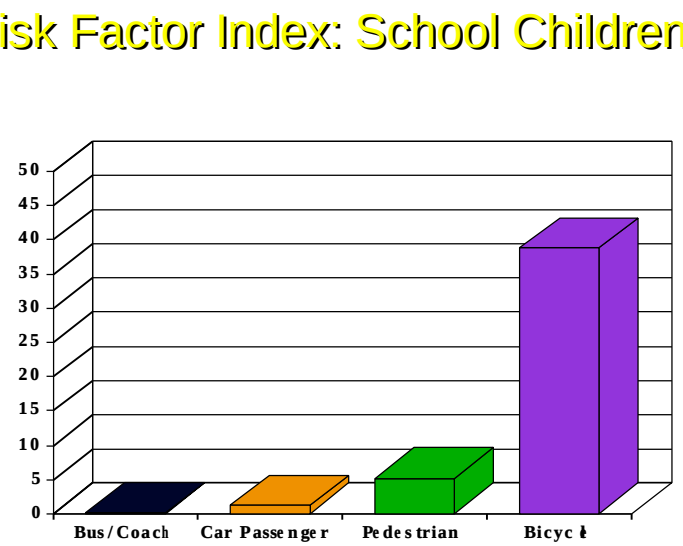


Figure 4: Risk exposure indicator by mode



Flexible public transport needs more serious consideration

There are many ways of providing improved public transport — heavy and light rail, bus systems, fixed route buses, hail-n-ride buses, taxis etc. Greater flexible public transport is required to serve deep into suburbia if we are to see any noticeable increase in the market share for public transport. Roads are used by public transport; indeed they are arguably the most flexible form of infrastructure in accommodating mass public transport, and are capable of assisting public transport in adapting to changing levels of traffic density for relatively low cost. Furthermore, the road based public transport system can cater best for the many diverse transport needs of people with disabilities, ranging from scheduled buses designed with low floors and wheelchair access to specialised taxis and community transport buses. A challenge for urban society is to find appropriate roles for bus systems and rail systems. Busway or rail systems for their own sake (the means paradigm) is not a rational way of determining compatibility with the overall goals of urban management. Remember that the road system provides the infrastructure to carry more public transport users than the rail system.

The challenge for urban society is to understand the arguments supporting bus systems relative to rail systems and to establish circumstance in which it makes more sense to support rail systems. Rail systems for their own sake (the means paradigm) is not a rational way of determining compatibility with the overall goals of urban management. We take a closer look at this in Section 6 since it is central to the future of urban public transport.

Looking for Niches: Now you are talking sense

Why do we continue to subsidise *all* urban public transport users so that we can transfer benefits to the sub-population who create the need for a community service obligation (CSO)? Or is a CSO a reflection of a broader obligation which has arisen through government failure to assist the market to operate under efficient *social* prices on all competing modes (ie competitive neutrality) and to include these efficient prices in an investment appraisal which might guide the selection of price-efficient passenger transport investments? This is not an easy set of questions to answer. The position here is that until market efficiency of the first best type is permissible the second-best competitive efficiency pricing regime is used to justify low public transport fares. Consequently we have a mixing of inefficiency and redistributive injustice in our fare structures. For urban public transport, fares as an instrument used to attract or maintain patronage has little impact, and so low fares are a formula for 'throwing good money away'.

The international evidence tells us repeatedly that individuals most likely to use urban public transport are:

- school children
- households with low household incomes (but not necessarily low personal incomes for multi-worker households)
- a declining proportion of the elderly (those without drivers licences or who are physically unable to drive and who have limited access to support networks which provide private or community car-based transport)
- those who have no automobile available in the household
- people who live in a central city and work in or adjacent to the central business district, and who live in a densely settled area,
- urban tourists (mainly central city services), and
- special events (such as the Olympics, Easter shows and Grand Prix)

In the context of the commuting trip, workers satisfying these criteria typically exhibit a public transport use in excess of 70% in many cities. Such workers however are a declining percentage of the workforce. For example, in the USA they are 4.7% of all commuters in 1980 and even less today. In Western Europe in large cities such as Paris we find that the share of commuters living in/near and working in the central city is 17% and declining, with massive growth of commuting from persons living and working in the suburbs - 48% of commuters in 1982 (Jansen 1993).

Pushkarev and Zupan (1977), a much cited book by proponents of rail systems state on pages 172-73 that "...from the transit viewpoint, it [would be] much more 'profitable' to gain riders either from restraints on automobile use or from increased density of urban development". Wachs (1993) argues that while traffic reduction by urban density increases has become increasingly popular among environmentalists and urban reformers, many scholars have demonstrated that low density development patterns do not necessarily result

in heavier traffic congestion. There is little empirical evidence which persuades many that this approach is fundamentally sound. Authors such as Newman and Kenworthy "demonstrate" that higher density cities generate fewer trips and lower energy consumption per capita than lower density cities. They show this by comparing different cities at one point in time at various stages in their historical development, rather than tracking particular cities over decades. This runs into the problem of ecological correlation or spurious causality. An ecological fallacy is the product of falsely inferring that what is true of different ecologies or groups (ie. a comparison of cities at a point in time) is true of individuals (ie a city over time):

> *"[In Newman and Kenworthy] ...Los Angeles is compared with Hong Kong or New York in order to reach the conclusion that density can make the intended difference, but there is no guarantee that the adoption of Hong Kong or New York style densities [any more than Singapore's car quota system] would result in the intended outcome. In fact, most of the high density cities which are cited as examples were major metropolises long before the coming of the automobile, and over time they are becoming less dense as lower density suburbs are added at their peripheries and as higher rates of automobile ownership occur in these cities in response to rising incomes" (Wachs 1993, 348).*

Two of public transport's most natural markets, relatively low income inner-city residents and high income commuters accessing medium-to-high density corridors leading to the central business district need niche treatment. Expanding public transport rail services far into suburban areas in contexts where we are loosing the dense corridors linked to a major destination is precisely what has the least market potential. Improving bus services however may have a more appealing role. Investing in new rail systems as *an isolated strategy* is a very expensive way of attacking the general problem. The results where this has been undertaken in urban areas with a dominating automobility have been disappointing - low ridership, and debilitating subsidies (Hensher and Waters 1994).

The blue line in Los Angeles is indicative of an outcome. The Blue Line has a taxpayer cost of $US21 per rider per day. Since few of its riders are former drivers (as opposed to bus users), the system costs taxpayers $US37,489 per year for every car it currently removes from the freeways. A comparison of the life cycle costs of providing bus services compared to light rail in Los Angeles (using the construction and budgeted operating costs of the LRT Blue Line) leads to a conclusion that for the same level of funding, Los Angeles can either afford to build and operate the Blue Line for 30 years or operate 430 buses for 33 years, including the cost of building the operating divisions to support these new buses. For the same cost, however, the buses would produce over four-and-one-half times as many passenger kilometres and carry over nine times as many passengers (Rubin 1991). This result is reached even though the assumptions made tended to favour the Blue Line on several important issues. Buses, especially bus priority systems are better value for money and if designed properly can have the essential characteristicity of permanence and visibility claimed to be important to attract property development along the route which is compatible with medium to high density corridor mobility.

The Northern Suburbs Transit System (NSTS) in Perth which opened in 1992 attracted both previous car and bus users, with 64% of its patronage coming from bus. When the impact of road traffic is calculated, we find that the vehicle volumes per week day have dropped by less than 2800 vehicles out of a total of 100,000, or 2.8% (Luk et al 1998). This is very small indeed and raises questions about the value of an expensive heavy rail system which impacts significantly on a bus system and little on car demand. A dedicated busway on the existing expressway may have been a better proposition? The Gold Coast railway is another example of a failed effort to attract drivers out of their car - its primary source of patronage is ex-bus travellers. Is this really the way to redress the imbalance?

The British Challenge to try and Redress the Imbalance

Efforts to attack the domain of the car continue unabated. Interestingly, in the UK (and often in the USA) the emphasis has been placed on the single occupant car trip with incentives to encourage ride sharing by car, rather than moves to use traditional public transport.

The journey to work has again been targeted for closer attention, since it is seen as a key area to be tackled in order to achieve sustainable transport. Commuter car trips push highway capacity to its critical limit, while providing for high volume peak direction flows better suited in theory to public transport. The increasing dispersal of workplaces away from traditional city centres has changed things. Preparing green commuter plans is seen as a way forward for major employers, through specific incentives for commuting by bike, car-pooling and bus. Incentives include organising car-sharing and car pooling schemes, installing changing rooms and showers for cyclists, and squeezing car parking provision to force the more persistent drivers out of their beloved vehicles.

There is a concern that these incentives will have limited long term effect if a substantial number of firms do not follow suit, and if senior staff do not lead by example. Employer tax concessions on investment in facilities to support non drive-alone commuting is being suggested. While this is all to be applauded, the success in the USA along similar lines can hardly be described as notable. Employer-incentive schemes have generally failed to achieve any noticeable impact on road traffic.

Taking a Closer Look at Light Rail or Trams

- *A return to the past or a genuine advance in technological-led improved accessibility?*

> *"Yet another male politician, Alliance's list MP Grant Dillon, comes out in favour of light rail as the panacea to Auckland's transport problems, overlooking the fact that a lot of relatively cheaper bus lanes are failing to eventuate, due to cost. Buses are, therefore, neither as full nor frequent as they should be in a city of over 1 million people. I wonder if these men have ever given up playing with their Meccano sets? "Jan O'Connor, Takapuna, letters to the editor, New Zealand Herald, March 7, 1997.*

Sydney (and other cities in Australia) has emotionally embraced the old idea of inflexible public transport with the return to Sydney's streets of steel-on-steel light rail. We are now seeing the mingling of trams with cars and buses as our street system struggles to cope with yet another form of old public transport which competes with walking and buses far more than it is likely to attract individuals out of their beloved cars. With such generous parking facilities in and near the Central City and at such reasonable prices (early bird specials of $6 per day), this increased accessibility offered by more public transport technology is unlikely to do much more than provide an interesting tourist attraction and satisfy the needs of those who believe in trains as the only form of public transport.

The light rail system currently between Ultimo and Pyrmont is a joint venture between government and private sector (in the sense of risk sharing); and is promoted as the beginning of the revival of the city as a residential precinct. The new Sydney casino is expected to be a major traffic generator. Indeed, so important was the Casino in early discussions with Government that a risk provision in the privatisation contract stated that "If the permanent Casino opens for trading more than 12 months after the light-rail is completed, or after 31 March 1998 if this is a later date, the Department of Transport will be liable to pay the Pyrmont Light Rail Company $8,219 per day until the Casino opens". As of late February 1998, the patronage levels are well below forecasts with a peak in the very early hours of the morning as casino staff go home.

Strong views exist on the merits of light rail as a preferred alternative to dedicated busway systems. Why did we not consider having a very flexible bus system on the dedicated alignment which has the capability of offering much better door-to-door service than a very inflexible fixed rail system? The answers are relatively simple - the adage that 'trains are sexy and buses are boring' (quoted from the Mayor of Los Angeles) says it all. I have previously described this as 'choice versus blind commitment' (Hensher and Waters 1994). When the evidence suggests that one can move 3 times as many people by dedicated busway systems for the same cost or the same number of people for one-third of the cost as light rail, one wonders about the rationality of urban planning. Wentworth (1997) concludes from a review of the proposal to extend the light rail system between Central Railway and Circular Quay, that a re-designed bus system would provide a better immediate result at a much reduced

cost. He asks "... perhaps the investors themselves may have been taken for a ride by professional promoters... Or is it just an innocent mistake? The only thing clear is that there is something fishy about the whole affair".

What about the future for bus systems? The experience of Curitiba, Porto Allegre and Sao Paulo supports the contention that, under appropriate regulation, organisation and capital investment, bus based transit systems are capable of transporting large volumes of passengers at reasonable speeds for minimal capital and operational costs. Table 1 illustrate this capacity by a comparison of the volumes achieved by busways in these cities with a number of heavy rail corridors in the Sydney metropolitan region.

Table 1. Volume Of Passengers Using Transport Corridors In The Peak Direction Of Travel During The Peak Hour

CITY	MODE	LINE	PAX/HOUR
Curitiba	**Busway**	**Pinheirinho**	11000
Porto Allegre	Busway	Assis Brasil	20000
Sao Paulo	Busway	Santo Amaro	25000
Sydney	Heavy Rail	Carlingford	400
Sydney	Heavy Rail	Bankstown	5700
Sydney	Heavy Rail	Bondi Junction	6200
Sydney	Heavy Rail	Chatswood	11900
Sydney	**Heavy Rail**	**Parramatta**	**14800**
Sydney	**Heavy Rail**	**Strathfield**	**28000**
Sydney	**Bus Lane**	**Military Road**	**6700**

Source: Smith and Hensher 1998

Busways only function as efficient high volume transport corridors where the operations are adapted from traditional bus practice and where substantial infrastructure investments are made in bus stops, terminals and vehicle types. Certain advantages of busways over rail based systems (such as the avoidance of transfers at terminals; the use of standard equipment) may correlate negatively with the capacity the busway can achieve. Certainly the most successful high-volume busways in Brazil require both passenger transfer and specialised equipment. On the other hand, where busway systems are based merely on providing road space for operators to utilise (as in Porto Allegre), this results in low operating speeds and low productivity.

Although previous research has suggested that busways on the Porto Allegre model could efficiently transport 39000 passengers/hour (Cornwell and Cracknell 1990), operating experience in Brazil does not confirm this figure. The current maximum volume carried on an efficient busway (i.e. with an average speed greater than 20km/h) is 11000 pax/h in Curitiba, and where volumes exceed this, the average bus speed drops towards that of the surrounding traffic flow. It remains to be seen whether the Curitiba "surface subway" and the proposed systems in Sao Paulo will be capable of both moving 22000 pax/hr volume and maintaining average speeds in excess of 25 km/h, as predicted.

Nevertheless, the existing busways can provide an equivalent capacity to an LRV system, at a fraction of the capital costs. As Cornwell and Cracknell concluded:

> *"The capacity of a well designed and efficiently managed busway can be equivalent to that of an LRT, on a comparable basis (for example, degree of segregation; stop spacing)" (Cornwell and Cracknell 1990, 195)*

and that

> *"... it should be noted that despite the current wave of LRT proposals, and the considerable resources which have been invested in various LRTs (Manila, Hong Kong, Rio de Janeiro etc.), the consultants know of no LRT in a less-developed country which outperforms the busways surveyed in terms of productivity (passenger volumes x speeds)" (Cornwell and Cracknell 1990, 200).*

In interpreting comparisons between LRV and busway systems, it is important to note the contrast between 'theoretical" capacity and capacity achieved.

The Brazilian experience also supports the key interrelationships that exist between successful busway operation and long term planning, land use, appropriate regulation and political stability. Where busways have been implemented in isolation from coherent planning and land use strategies, the results have been either partial, inefficient systems (as in Sao Paulo) or overcrowded systems, that cannot adequately meet demand (Porto Allegre and Sao Paulo). The outstanding feature of Curitiba is that an integrated system of bus service types has developed in response to a clear and structured urban plan. This combination of a planning driven "bus-friendly" urban form and a marketing driven, innovative bus operation has provided Curitiba with an excellent transport system. The busways are no more than an important element in this process.

Furthermore, the contrast between Curitiba and Sao Paulo is not so much in the preparation of plans, but in their consistent implementation over a thirty year time frame. Political stability has enabled the planning and innovation in Curitiba to deliver results. Similarly, the effective use of busways is also dependent on an integrated regulatory regime. The decline in the effectiveness of the Porto Allegre busways results from the removal of the "umbrella" regulation of EBTU. Although the multiple operators have effectively developed an system wide fare system, they have not been able to maintain the efficiencies of the busways. Similarly, a major restraint on the Santo Amaro busway in Sao Paulo is the presence of "pirate" bus operators, who overload the capacity. An efficient busway requires a firm and coherent system of regulation.

The busway systems in Curitiba, Porto Allegre and Sao Paulo provide an illustration of the strengths and weaknesses of this transport mode. Although these systems have operating weaknesses, and although many aspects of their operation are not transferable to other national contexts, they nevertheless provide working examples of the capacity of the bus to provide cheap and efficient solutions to major urban transport problems.

Table 2: CMTC Busways In Sao Paulo - 1994

	Paes de Barros	**Santo Amaro Avenue 9 de Julho**	**Vila Nova Cachoeinha**
Year of Opening	1980	1987	1991
Type of Bus	Trolley	Trolley & Diesel	Diesel
Length	3.4 km	14.6 km (1)	11.0 km (2)
Terminals	1	1	2
Overtaking Lanes	No	Yes	No
Busway Rtes (3)	6	27	14
Number of Buses	61	372	159
Buses/Peak Hour	30	250 (4)	75
Pax Capacity/Hr	3000	25000	8250
Peak Hr Op Speed	N/A	AM: 21.0 km/h PM: 11.2 km/h	AM: 23.0 km/h PM: 16.0 km/h

Sources : SMT 1993a and SMT 1993b.

Notes:
(1) Of the 14.6km, only 11.0km is exclusive bus roadway.
(2) Of the 11.0km, only 5.5km is exclusive bus roadway.
(3) Includes both Trunk Routes (using the corridor) and associated Feeder Routes.
(4) In addition, up to 50 illegal buses use this corridor per hour.

Concluding Thoughts: The Key Challenges Remain

The objective of this paper is to establish a series of positions in relation to the role of urban public transport in a setting which will increasingly see more emphasis placed on the social and environmental impact of all modes. The main points of the debate, summarised bleow, contain a number of very deep meanings for the future of urban public transport.

Some of the main points to debate are:

The crucial issue missing in the current debate on the future of urban public transport is the future of the automobile in the context of alternative regimes of pricing and physical planning signals. Without this context, the whole debate is lopsided and unproductive. Without a major effort to make the car less attractive, the *economic* future of public transport (especially rail), in the absence of massive public subsidy, does not look good. The value of *subsidised* public transport for all, for the common good of the environment may be a fallacy.

In the absence of a cost-related pricing strategy for all means of passenger transport, net immigration in urban areas will be a major factor in determining the levels of congestion both on our roads and within public transport (especially rail services).

All forms of transportation infrastructure and services are potential candidates for improvement. However they must be evaluated in a context of cost-related pricing (accommodating the fuller set of costs such as environmental pollution, both chemical and visual). Market forces are a very powerful feature of the process - the challenge is to establish appropriate pricing signals such that consumer preferences for transport and location result in choices being made which are socially and environmentally acceptable outcomes.

The establishment of appropriate (social) prices will, within a society of significant variations in individual wealth, produce a continuum of land use/travel bundles, accommodating the preferences of individuals for high-density/low travel requirements through to low density/high travel requirements. Low density/low travel requirements can also be included in the set, as exemplified by the decentralisation of workplaces and opportunities to reduce the commuting time while choosing a low-density residential location. *The statement "I'll have mine medium rural please " should sit comfortable next to "I'll have mine well-done central please"!*

The move to suburbanise residential and employment activities has tended to reduce average trip distances, and to increase average trip travel times. The increase in trip times, however, is also a result of under-priced and consequently inadequate capacity, in part reflecting a lack of resources to finance new investment.

The introduction of road congestion pricing, *if* it is expected to modally shift substantial amounts of traffic, must be accompanied by advanced planning for rail capacity expansion. Otherwise the congestion on the roads will be transferred to the rail network, the latter already exhibiting high levels of within-train congestion in peak periods.

Planning for the full spectrum of urban densities reflecting efficient social prices for land use and travel (i.e. a full set of spatial bundling choices) will assist in making public transport economically more attractive but not dominating the automobile except in selective market segments.

A fatal flaw in some of the contemporary debate on the future of our cities may be that healthy and vibrant cities should have a central core which is alive 24 hours a day. The brooding over downtown's *relative* demise and to plan big to revive it may have little correlation with the virtues of a socially and environmentally preferable future and may lead to over-investent in public transport in the wrong places. This perspective does not detract from the trend for some movement back to the Central city by younger people living in apartments.

One should be cautious about downtown and public transport promoters who have chosen to depend upon the downtown "solution" rather than consider the merits of the arguments that fixed-rail alone cannot compete with efficiently priced and well-managed automobile transport, sound bus systems and supplementary transit schemes like dedicated busways, transit lanes and super expresses. Some years ago Melvin Webber predicted that BART in

San Francisco " may become the first of a series of multi-billion-dollar mistakes scattered from one end of the continent to the other" (Webber, 1979, 132). We must be wary of the view that a rail system is by definition a transport of delight, a symbol of progress at which all can marvel, whatever the reality of its actual performance in enhancing social mobility, alleviating congestion, or reducing pollution (Richmond 1991).

A Final Word: "Horses for Courses" in the Reform of Public Transport

The challenge - to introduce the full set of "right price signals" so that individuals can respond in ways that ensure the best social and environmental outcome, and governments, in particular, are then placed in a financial position to respond appropriately with new transport investment and appropriate physical planning incentives. All forms of transport should be party to these developments.

For all public transport - heavy rail, light rail, busway and buses - to have a non-marginal increase in market share, governments and the private sector will have to commit themselves to massive increases in rail and road infrastructure (the latter dedicated to busways) which connect a significant number of 'almost door-to-door' locations. This requires billions of dollars of finance, and will only be forthcoming with road pricing accompanied by some rule of allocation back to transport in general and public transport in particular. Without this, we are destined to a life of 'marginal activity within public transport' and continual dominance of the car. The adage "we will only make public transport more attractive when we make car use less attractive" is as real today as it has been for many years.

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