Urban Public Transport Challenges

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ABSTRACT

This paper focuses on a number of challenges faced by the public transport industry and the prospects for resolution. Many of the issues are often shrouded in ideology, politics and prejudices that typically cloud the real merits of a solution. We argue that public transport is increasingly a niche provider of land passenger transport services, which if positioned and managed better will be capable of delivering increasingly appropriate service levels to satisfy the needs of the set of niche market segments. With this broad scene setting background designed to establish the market patch for public transport, we discuss a high agenda topic of the continuing "debate" on the role of specific technology: light rail and bus-based transitways (what I have coined "choice or blind commitment").

Keywords

Bus-based Transitways, Light Rail, Urban Public Transport

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Introduction

Public passenger transport systems (notably bus and rail) are unquestionably an important part of the transport task. A continuing challenge, however, is to protect existing market share and grow new market share in the presence of the automobile. Public transport does not necessarily have to find ways of narrowing the gap between what public transport and the car can deliver from a user's perspective, but it does have an obligation to compete where it makes good sense to do so. This is an age-old challenge that has resulted in the positioning of public transport as a niche market provider. There is nothing undesirable about niche provision in markets such as central city and regional centre commuting, the unemployed, students, special event attendance and tourists. Excluding non-local tourists, bus and train represents less than 10% of all urban passenger activity in Australia.

Why is it so difficult to gain market share? It has always been understood that the appeal of the car is characterised by its immediate availability, its predictability, flexibility and seamless delivery door to door. In contrast bus and train are characterised by relative inflexibility, unpredictability (i.e. reliability), and disconnectedness. Note the absence of a financial consideration.

This paper draws out the distinction between what has real prospects of attracting ridership (or at least servicing existing patronage more cost efficiently) and what are debates that affect the operational status of public transport but do not appear to impact in any noticeable way on growing the market. This distinction is useful, highlighting the gains that can be made in terms of operational efficiency without any significant expectation of patronage growth (what occurs is a bonus). Far too much faith is placed in a diversified set of operational improvements as ways to grow the market that often deliver higher costs and few or no net benefits. For example, the opportunities afforded by electronic technologies (e.g. ticketing, information signage) may have enabled operators to deliver a given level of service more efficiently (and this is commendable) but the impact on patronage gain appears to be negligible. The same might be suggested for low floor buses. The qualification, as always, is that we do not have the counterfactuals so inferences are to some extent judgemental, but often close to the "truth".

The paper is structured as follows. We begin by establishing the role of public transport in the passenger transport task in the Sydney metropolitan area where buses and trains have more visibility than any other Australian city (with the possible

exception of Melbourne). We then comment on some of the continuing challenges facing public transport in the presence of popular automobility. The following section accepts the market limits of public transport (except at the margin) and revisits the ongoing debate on the role of light rail and busway systems as a "panacea" for future growth. The conclusions reinforce the challenges ahead.

Changing the balance in favour of public transport

Tables 1 and 2 for the Sydney Metropolitan Area highlight the changes over the last 20 years in modal activity, travel time outlaid, distance travelled and average speeds for all person travel by motorised and non-motorised passenger modes. Most notable is the decline in the market shares for bus and train on all three dimensions despite the absolute increase in train modal activity, travel time and distance travelled. The car captures over 60% of passenger trip activity (when walking is included, the latter capturing 28% of modal share), six times that of public transport. When expressed in passenger kilometres, however, the car represents 78.7% of all travel activity with public transport 14.7%, a ratio of 5.35:1. The longer average trip length for train travellers (18.5 km) is a major influence offsetting the shorter bus trips (6.72 kms) in comparison with 10.53 kms for car driver and 9.2 for car passenger. Trains produce more than twice the number of passenger kilometres than buses although absolute passenger trips are higher for bus, 22% higher in 97/98, 32.5% higher in 1991 and 56.9% higher in 1981. Average speeds have remained remarkably stable for motorised transport.

Why is this happening to public transport? Figure 1 provides a synthesis of some key elements of the changing face of Australian society that are impacting on the future of urban public transport. These evolutionary changes also apply 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 more suitable for bus systems than rail), the changing incidence of the population in each life cycle stage producing greater wealth, 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.

TABLE 1: Transport Task 1981-98, Sydney Metropolitan Area: Average Weekday

	97-98	91	81		97-98	91	81
Mode	**Unlinked Trips[1] ('000s) per average weekday**			**Mode**	**Ave Speed (kph)**		
Vehicle driver	7,619	6,366	5,718	Vehicle driver	33.77	34.08	30.14
Vehicle passenger	3,573	2,850	2,188	Vehicle passenger	33.02	34.70	29.03
Train	*784*	*691*	*706*	*Train*	*38.26*	*40.18*	*35.29*
Bus	*960*	*916*	*1,108*	*Bus*	*19.54*	*19.46*	*18.15*
Ferry	*37*	*32*	*34*	*Ferry*	*25.51*	*27.75*	*26.77*
Taxi	99	102	94	Taxi	19.86	20.39	19.19
Walking	5,163	4,774	4,774	Walking	10.73	12.18	11.62
Other	133	137	173	Other	8.93	13.24	13.08
TOTAL	**18,372**	**15,871**	**14,800**	**TOTAL**	29.09	29.32	25.50
Mode	**Unlinked Time ('000s minutes) per average weekday**			**Mode**	**Ave Distance per trip (km)**		
Vehicle driver	142,582	112,746	95,138	Vehicle driver	10.53	10.06	8.36
Vehicle passenger	59,439	44,926	34,158	Vehicle passenger	9.16	9.12	7.55
Train	*22,745*	*20,148*	*19,824*	*Train*	*18.50*	*19.52*	*16.49*
Bus	*19,824*	*18,387*	*20,579*	*Bus*	*6.72*	*6.50*	*5.62*
Ferry	*956*	*704*	*797*	*Ferry*	*10.98*	*9.95*	*10.28*
Taxi	1,963	1,811	1,543	Taxi	6.53	6.00	5.21
Walking	44,114	44,419	40,739	Walking	1.53	1.89	1.65
Other	4,496	2,335	2,492	Other	5.00	3.74	3.13
TOTAL	**296,123**	**245,479**	**215,274**	**TOTAL**	7.81	7.56	6.18
Mode	**Unlinked Distance ('000s kms) per average weekday**			**Trip Purpose**	**Mean Car occupancy**		
Vehicle driver	80,258	64,038	47,785	HB Work	1.12	1.12	1.11
Vehicle passenger	32,716	25,982	16,524	HB Shop	1.50	1.51	1.28
Train	*14,505*	*13,491*	*11,659*	HB Education	1.13	1.16	1.16
Bus	*6,457*	*5,962*	*6,225*	HB Social Recreation	1.64	1.62	1.53
Ferry	*406*	*325*	*356*	HB Personal Business	1.38	1.40	1.25
Taxi	649	615	493	HB Other	1.97	1.94	1.33
Walking	7,888	9,015	7,890	Non Home Based	1.55	1.51	1.11
Other	668	515	543	**Total**	**1.53**	**1.51**	1.26
TOTAL	**143,550**	**119,946**	**91,478**				

Note: Distance is passenger kilometres.

Source: Transport Data Centre Household Travel Surveys (1981, 1991, 1997/98).

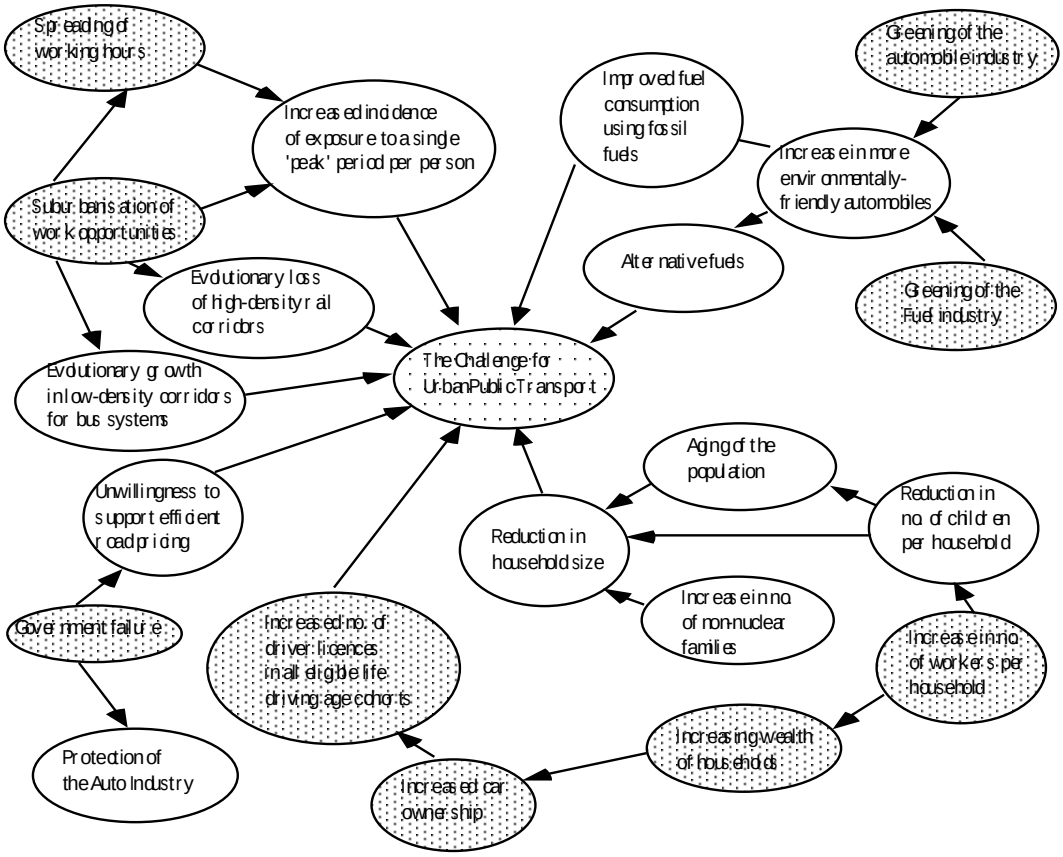
[1] An unlinked trip is a part of a full trip such as the travel on a bus in a trip that involves a bus and a train. A linked trip would be a trip where both the bus and train are linked and a modal hierarchy is used to define the trip (for a bus-train trip this is the train).

Table 2: Changes in Public Transport Shares in Sydney 1981-1997/98

	Share 97-98 (%)	Share 91 (%)	Share 81 (%)
MODE			
Vehicle driver	41.48	40.11	38.64
Vehicle passenger	19.45	17.96	14.79
Train	4.27	4.36	4.78
Bus	5.23	5.78	7.49
Ferry	0.20	0.21	0.23
Taxi	0.54	0.65	0.64
Walking	28.11	30.08	32.26
Other	0.73	0.87	1.17
Total	100.00	100.00	100.00
Public Transport (train, bus, ferry)	**9.70**	**10.34**	**12.50**
DISTANCE			
Vehicle driver	55.91	53.39	52.24
Vehicle passenger	22.79	21.66	18.06
Train	10.11	11.25	12.75
Bus	4.50	4.97	6.81
Ferry	0.28	0.27	0.39
Taxi	0.45	0.51	0.54
Walking	5.50	7.52	8.63
Other	0.47	0.43	0.59
Total	100.00	100.00	100.00
Public Transport (train, bus, ferry)	**14.89**	**16.49**	**19.94**
TRAVEL TIME			
Vehicle driver	48.15	45.93	44.19
Vehicle passenger	20.07	18.30	15.87
Train	7.68	8.21	9.21
Bus	6.70	7.49	9.56
Ferry	0.32	0.29	0.37
Taxi	0.66	0.74	0.72
Walking	14.90	18.10	18.93
Other	1.52	0.95	1.16
Total	100.00	100.00	100.00
Public Transport (train, bus, ferry)	**14.70**	**15.99**	**19.14**

Source: Transport Data Centre Household Travel Surveys (1981, 1991, 1997/98).

FIGURE 1: Challenges for Urban Public Transport



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 (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.[2] The annual growth rate in personal mobility from 1970 through to the early 1990s 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. (–0.9%) and Belgium (–0.4%) 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

[2] This is also true in Australian cities except that the loss of employment activity is being replaced by growing tourism activity and to some extent residential activity in high rise apartments, especially in Sydney and Melbourne. Despite the amount of high rise residential activity it appears to be complementary to walking and car use (with extensive basement car parking provided).

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. A recent update by Gerondeau (1997) shows how European cities are now functioning like their American counterparts and with few exceptions, urban freeways have become the mass carriers.

The accumulating evidence tells us repeatedly that individuals most likely to use urban public transport in settings with a wealth base such as Australia are:[3]

- School children,
- Low household income households (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, the Easter Show and the 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 less than 4% of all commuters 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). The question

[3] 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 1999).

remains — what can we do to reverse the trend away from public transport use (assuming this is desirable)?

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 that persuades many that this approach is fundamentally sound.

Authors such as Newman and Kenworthy (1989) "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 (i.e. a comparison of cities at a point in time) is true of individuals (i.e. 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).

Dudson (2000) in a critique of the contributions of Peter Newman and his colleagues, who like Pushkarev and Zupan promote the provision of more public transport and more intensive and centralised cities, argues that while these ideals are laudable, they are unlikely to achieve the outcomes hoped for in terms of energy and emission reductions. For example, using the much cited 40% lower energy per passenger kilometre for public transport in contrast to the car, even if we were to assume a doubling of the share in favour of public transport use, the amount of energy saved would be no more than 2-3%. This is minuscule compared to the expected gains from improvements in automobile technology (both in respect of fuels and vehicle design), even allowing for the ensuing growth in vehicle kilometres.

Estimates ranging from 20-75% gains are not uncommon with the latter end of the range associated with non-fossil fuels. Another way of stating this is that if governments intend to effect a 40% reduction in energy used by all urban passenger transport, it would have to introduce legislation for all motorised trips in cities to be by public transport!

The ongoing debate on technological forms of public transport: Bus systems and light rail revisited yet again!

> "I have changed my mind. I wasn't convinced about light rail systems, which can be expensive, but I think in some cities they are the way forward" John Prescott, U.K. Deputy Prime Minister *Local Transport Today* (22 June 2000) commenting on the report on *Bus or Light Rail: Making the Right Choice* (Environmental and Transport Planning 2000) which states that:
>
> "…the high cost and inflexibility of light rail — often considered to be drawbacks — actually turn out to be its main advantages." The report states that "… Inflexibility becomes redefined as security — the population is confident that a change of political power or financial situation will not result in the new system being taken away from them, and can therefore plan their lives knowing that the system will be there in the future" (Environmental and Transport Planning 2000).

I wonder what happened to the tram system in Sydney that disappeared in the 1960's? Are the quotes above indicating that the changing financial situation guarantees further subsidy? So the sorry saga continues and creates more emotion than sensible review and assessment.[4] Apparently in the U.K. light rail systems meet the key criteria to attract motorists out of their cars — reliable, frequent, efficient, safe and clean with affordable fares. Well why not busway systems which are less costly to provide?[5] Why suddenly the turnaround and implication that busway systems cannot covet this great prize? The U.K. turnaround appears to be more a case of a desire to be seen to be taking firm action on an issue that will generate positive headlines (until it is known what cost over-runs are likely to occur and the escalating subsidy) (Mackett and Edwards 1998). The old adage that "buses are boring and trains are sexy" is alive and well.

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[4] Hutchinson (2000) provides an interesting commentary of the role of rational debate.

[5] The latest critic of busway systems in favour of light rail (Carmen Hass-Klau, lead author of "Bus or light Rail: Making the Right Choice") states that the infrastructure costs are closer together than has often been assumed and quotes busways at 526,000 pounds per kilometre and light rail (and guided busways) at $561,000-702,000 per kilometre. One would hardly suggest from this evidence that light rail is more favourable!

Mr Prescott has announced that people who won't use buses *will* go by light rail (Prescott 2000). This is based on the false premise that there is something inherently more attractive about light rail. The evidence is rather that people overwhelmingly choose on the basis of time and price (Hensher and Brewer 2001). Replace the bus system with a more frequent, faster light rail service, and of course more people will use it! But the report that 20 per cent of Manchester light rail users had previously driven is hardly an achievement, given the money spent. All the evidence from cities which have invested in enhanced bus systems, with similar prioritised rights-of-way and travel times, is that they are just as effective in attracting riders, and often more so, but cost much less (see Hensher 1999 and Richmond 1998 for the evidence).

Not only does light rail, which is often slower than revitalised bus systems, have the potential to interfere with existing road traffic, but the "park and ride" lots featured in the USA, and which the Government wishes to emulate in the U.K., encourage people to drive to stations.[6] Many individuals who previously took the bus all the way to work in light rail cities such as Denver, St Louis and Buffalo, now take the car part of the way, adding to pollution and congestion (Richmond 2000). Because light rail provides direct service to fewer places than buses, moreover, those who lack the cars to get to the light rail stops often lose out because they must change more often, in many cases with resultant longer journey times.

Buses, especially bus-based transitway systems are arguably 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. To achieve this, however, the bus industry needs a "wake-up" call. The opportunities are extensive but the industry is far too traditional (often complacent), often lacking lateral thinking and not pro-active enough (with very few exceptions). Despite the appeal of bus-based transitways, there is still a lot that can be achieved by simple bus solutions such as adding more buses, adjusting fare schedules, improving information systems, integrating ticketing, all of which is lost in the debate over whether special rights-of-way for buses as against light rail are better.

The ongoing debate on Busway systems versus light rail may well have sent us off in the wrong direction. Technology fixation focuses the mind in ways that can be counterproductive. Hensher (1999) reviewed this debate under the banner of choice or blind commitment and concluded that we should distance our thinking from an obsession with technology and move to study needs as a starting point of inquiry. A more in depth analysis of the arguments for and against light rail are set out in Hensher (1999) and are not repeated here. Do not ask if light rail is feasible, but ask

[6] A noteworthy piece of Australian evidence is that the new parking lots at Sydney suburban stations are tending to attract individuals who already use the rail system, but who now drive and park rather than use the local bus service to and from the station.

who the stakeholders are and proceed to investigate how they may best be served.[7] Hutchinson (2000) is response supports Hensher's specific conclusions and states that:

> "Hensher's paper…is certainly an excellent starting point for those studying transport decision-making. It has something about the principles, some case studies, something about the wider planning issues, and something about the obstacles to rationality. I hope that the paper will also be an inspiration, and that it may signal that better decisions and better process are coming to the fore again" (page 68).

There are at least three major issues that have to be constantly addressed in the current climate: firstly, how to counter arguments about the very expensive "image benefits" bestowed by a brand new light rail system that a bus-based system cannot provide, secondly, how to amend funding mechanisms so that the maximum benefit is obtained from the investment of public money in urban transport, and thirdly, how to amend the analytical process so that it does not over-estimate the benefits of a new public transport system.

The first two issues are related. The usual procedure in many countries is for local planners and politicians to promote and design a scheme, and then to secure funding from government (and/or private sources). It remains easier to make the case for a "high-tech" discrete rail-based system rather than upgrading an existing bus system.[8] What we should be more serious about is a needs assessment driven by a number of well-articulated questions:

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[7] 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 (Hensher 1999). 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.

[8] The Liverpool-Parramatta Transitway is the first effort in Sydney to develop a bus-based corridor that is clearly emulating the imaging offered by a rail system, if this is really what it takes to deliver value for money. The issue of whether light rail or a bus based transitway is best value for money is clear but whether the location of this specific transitway is indeed appropriate (especially given its demonstration role) has been questioned.

1. What are the set of criteria used to evaluate and justify (or not) a specific proposal?

2. What are the commercial and social consequences of the proposal?

3. How broadly based should the evaluation of the proposal be? This includes geographical coverage, forecasting period, market segments, and the set of alternatives to evaluate.

4. Is there a market for the proposal?

5. What is the risk profile of the set of alternatives?

6. What specific outcomes does each stakeholder seek from the proposal?

7. What role might government play in the evaluation process?

8. How might one develop and execute a marketing strategy to reinforce the forecasted market potentials between the point at which forecasts are established and the commencement of the project?

The two most critical issues from this set of questions are the coverage of the needs study and the risk profile of the outputs. The other issues, while important, are incorporated as interpretations of the information delivered from the market study. For example, the governments commitment to social obligations can be provided via output measures such as improved accessibility, reduced traffic congestion and improved air quality, which are associated with a forecast of changing traffic on the network in the presence of a specific infrastructure scenario. A range of scenarios can assist in establishing the degree of risk attached to a specific traffic forecast as well as pinpointing the preferred infrastructure scenario, given the set of criteria for measuring performance. Let's not get off on a technology binge yet again!

Concluding thoughts

While public transport is here to stay, what is uncertain is its future role and its ability to be more responsive to the needs of the markets of the future in contrast to the past. We might say that public transport has not done a very good job in securing its future, and has relied too much on government support (explicit or hidden) to get to where it is today. The winds of change centred on institutional reform and cost efficiency have revealed many of the weaknesses of the arrangements of the past and have resulted in some changes that show potential in the long run (but not immediately); however we have to be patient since the *repair job* has only just begun. As we come to appreciate the gains from less direct interference from government (and the price being paid by ongoing inefficient interference) but better incentive-

based economic regulation, we can start to focus more sharply on the opportunities that exist to position public transport to perform at its peak in niche markets. This is where its future lies. The Operators know this but are often limited by external interferences in achieving this objective.

Consistent with a greater consumer-focus is the performance assessment regime (PAR) proposed in NSW for commercial bus contracts. It offers an the opportunity to move away from the current strictly supply-side focus on spatial coverage and minium frequency that is not consistent with what actual and potential users may really want as a best service (taking into account commercial and social obligations). A re-focus that emphasises the passenger (in particular) and the community in general means that the market can be the effective arbiter of whether a service is meeting the needs of the contract area. A value for money formula proposed by the author that is linked to a service quality index (SQI)[9] can provide the formal mechanism for establishing whether an operator is serving the community in terms of delivering appropriate levels of service quality that are consistent with a value for money indicator. This re-orientation provides greater incentives for operators to deliver appropriate services to the market than the somewhat rigid and incentive incompatible standards associated with the 1990 NSW Passenger Transport Act. This new direction is incentive compatible. Importantly we must recognise that the market is very powerful and customers will provide the richest information of the value of a service. The role of the regulator is to ensure that we take advantage of this market information. Value for money would be calculated under the PAR regime by relating the SQI and patronage levels to the costs of service delivery. Specifically we can apply a very simple but powerful formula to measure Patronage Service Effectiveness per dollar outlaid:

$$\text{Value for Money} = \frac{\text{Number of Passenger Trips} \times \text{SQI per Passenger}}{\text{Total Cost of Service Provision}}$$

The greater this ratio the greater the value for money. We could also modify the formula to define it as Patronage Service Effectiveness per dollar of government support outlaid:

[9] SQI has been developed by Prioni and Hensher (2000) and Hensher and Prioni (in press). It is an index derived from the estimation of a discrete choice model in which a sample of bus passengers are asked to evaluate new packages of bus attributes in addition to the current levels as perceived by them and choose one of them. The packages are defined by a fractional factorial experimental design in which we systematically vary the combinations of levels of the selected attributes to ensure that the passengers evaluate as rich a set of packages as possible. The estimation of a logit choice model provides the weights to attach to each attribute that together with the currently assessed attribute levels form the service quality index. The importance of an SQI weighting of passenger trips in the calculation of value for money is that it recognises the strengths of preferences rather than treating all passenger kilometres as homogenous in customer satisfaction.

$$\text{Value for Money} = \frac{\text{Number of Passenger Trips} \times \text{SQI per Passenger}}{\text{Non - farebox and other Non - concessional Reimbursement Cost}}$$

As a closing thought we must continue to recognise that all urban passenger transport is under-priced. Public transport is subsidised heavily by taxpayers while car users impose significant external costs on the community including adverse impacts on air quality as well as on road trauma and energy security.[10] Were prices to be increased for both private and public transport, it is very likely there would be some reduction in travel across the board and that more efficient land use and transport combinations would result. To this extent, many economists would be aligned with those in the community who consider there is too much mobility. However, we should not forget what conditions were like before the mobility revolution began; we owe much of what we regard as "quality of life in urban areas" to our ability to travel. We must remain aware of the benefit side of the equation and not view a reduction in mobility as an end in itself. Policy makers need to be aware that the policy instruments at their disposal to effect a reduction in vehicle emissions involve complex trade-offs and they need to be equipped with tools that help them identify the optimal mix of actions.[11]

Would higher prices necessarily benefit public transport? Consider what impact an increase in fuel tax (directed primarily to the automobile) would have on household travel decisions. The increase in unit operating cost would have an immediate and direct influence on the use of each vehicle for particular trips such as the commuter trip. The outcome might be a shift in the mode of travel, but it could involve substitution within the household's vehicle park. Also, it might affect the timing of the commuter journey. The end result would be a change in the overall and non-commuting use of each automobile available to a household. Given the opportunity to adjust, the household would be likely to consider how many and what types of vehicles to own. Further impacts arise over time as changes in residential location affect the total use of each automobile, as well as the mix of urban (commuting and

[10] Economists have advocated congestion pricing for decades and technology has developed to a stage where it is a viable option. The problem is not that it would not work; only a few jurisdictions such as Singapore and Hong Kong have felt the case is sufficiently compelling to take the political risk of introducing it. Traffic congestion itself is a rationing device and one of the known problems is that there is such a latent demand for travel in peak periods that any measure to shift some of the traffic has to cope with the generation of new trips. Despite this, economists consider that road pricing is likely to have a significant impact where traffic congestion is severe. The payoff is a more efficient transport system, but in addition there is evidence it would result in less energy consumption and reduced emissions. Economists argue that efficient road pricing would result in the highest prices on inner urban roads. This is precisely where land is scarcest and where it is relatively costly to allow for car use. The effect would be to encourage more employment in outer areas and a reduction in car travel.

[11] The Institute of Transport Studies Transport and Environmental Strategy Impact Simulator (TRESIS) is an example of such a decision support tool (Hensher and Tu 2000).

non-commuting) and non-urban kilometres. The adjustment in commuter travel also may affect non-commuting car use if a vehicle previously used for commuting is released for use by another non-working member of the household. The sum effect of the decisions by individual households is a change in the equilibrium levels of traffic congestion, residential densities, total kilometres of travel by automobiles and various forms of public transport, fuel consumed and greenhouse gas emissions. The evidence however is that most of the behavioural response is in rearranging travel in order avoid the loss of accessibility offered by the car. Public transport is unlikely to be a beneficiary (Hensher and Ton 2000). This is public transport's greatest continuing challenge.

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