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Public Transport Costs in Adelaide: Assessment and Implications

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Abstract

The paper describes the recent derivation of the total long term cost of providing public transport in Adelaide, and of unit costs for each mode (including individual train lines, the tram line, the O-Bahn, and on-street bus services). Data from a recent revaluation of public transport assets, and recurrent costs in 1997/98, was used in the analysis.

The analysis shows that the cost of carrying passengers by train in Adelaide is high. This occurs primarily because of low levels of patronage. By contrast, the cost of carrying passengers by O-Bahn is considerably lower. Moreover, the cost of the O-Bahn is the same as for on-street buses, with the cost of O-Bahn fixed infrastructure offset by lower operating costs.

A comparison with similar cost data for 1985/86 shows that the technical efficiency of public transport in Adelaide has improved. However, service efficiency has declined, especially for bus. There appears to be scope for continuing improvement in the technical efficiency of public transport, and for gains in service efficiency.

While other factors must necessarily be taken into account in decision-making on public transport, costs cannot be ignored. The analysis suggests that there is a potentially greater role for the use of buses, in particular O-Bahn, in situations where passenger numbers are below the level needed to justify the use of rail services, and where funding is constrained.

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Introduction

Reviews are being undertaken into a number of aspects of public transport in metropolitan Adelaide. One of these, which is part of a continuing program, is to formulate a Ten Year Investment Plan for public transport. The Plan addresses service strategies and investment needs for public transport. The work reported in this paper was undertaken to support this work.

The status quo is a powerful situation in public transport. In accordance with Pareto optimality, there is a reluctance to modify current public transport systems, and a preference instead to seek opportunities for new facilities and services. The status quo provides the community with the comfort of a system with which they are familiar. Asset management systems tend to be predicated on sustenance of current infrastructure. Finally, short term Government budget planning may not take account of the long life of public transport infrastructure. As a result, there is commonly an underlying acceptance of the status quo, and investment planning is related to supporting sequential decisions to reinvest in individual elements of current infrastructure as they reach the end of their economic lives. This may not lead to the most effective long term solution.

A reasonable starting point for investment planning is to consider reinvestment needs for current infrastructure and desired additional infrastructure. In Adelaide, the structure of public transport was largely established over a century ago when train lines were first developed. Changes in urban structure, community lifestyles and preferences, employment patterns and practices, income levels, retailing and entertainment, and transport and communications technology and practices have had a dramatic effect on travel demand in recent decades, let alone the last century. Sound transport planning therefore needs to go beyond such a simple status quo situation.

This paper describes recent work undertaken to:

(i) Identify all infrastructure used for the provision of current public transport services in Adelaide, assess the condition of the infrastructure, and estimate future investment needed to sustain the infrastructure.

(ii) Estimate the current cost of providing public transport in Adelaide. Costs were derived for individual groups of bus service (by contract area), for individual train lines, and for the Glenelg tram line. Costs included the long-run costs of asset replacement as well as the recurrent (operating and maintenance) costs for current services.

This paper focuses on the second of these activities. This necessarily involves addressing the first of the activities. The current cost of providing public transport also provides insights into the potential performance of alternative concepts for the public transport system, although this aspect is not considered in detail in the paper.

Derivation of the Current Cost of Public Transport

Methodology

The current cost of providing public transport in metropolitan Adelaide was derived by:

- using the value of all depreciable assets used for the provision of public transport to derive the equivalent annual capital cost of providing assets;
- deriving the total recurrent (operating and maintenance) cost of providing public transport; and
- determining overhead costs related to the management of public transport in Adelaide and other joint costs related to the provision of services.

Until 1994 the State Transport Authority (STA) was responsible for all aspects of the provision of public transport in Adelaide. A management accounting system (ROSIS) developed for the STA by Travers Morgan Pty Ltd (Travers Morgan 1986) provided analysis of recurrent costs for public transport by mode, corridor/route, and time period. However, institutional changes since that time have made the derivation of these cost breakdowns more difficult.

In July 1994 the SA Passenger Transport Board (PTB) was established to regulate public passenger transport services and to ensure the provision of regular public transport services in metropolitan Adelaide through contracts with service providers.

TransAdelaide (TA) was formed to undertake the remaining functions of the STA. It was initially established as a government department, but was corporatised at the beginning of 1999. TA was initially contracted by the PTB to provide all public transport services in Adelaide. Some services were subsequently subject to competitive tendering. Tenders have recently been invited for all regular bus services in Adelaide. In addition to receiving income from the PTB for its service contracts, TA receives direct funding from the Government for some expenditures, including capital expenditure for the train and tram systems, and generates some revenue from sources such as land it owns and advertising.

Ownership of the bus fleet was initially divided between TA and Transport SA (TSA), with the latter having broad asset ownership and management responsibilities for public assets in the transport sector. TA's bus assets were transferred to TSA in October 1998. All service providers now lease their bus fleets from TSA, which seeks to operate this function as a business. TSA also owns the Adelaide O-Bahn track, and is responsible for its maintenance. However, ownership of the train and tram systems continues to be vested with TA.

Accordingly, the derivation of the costs of providing public transport in Adelaide has required the assembly of data from a number of sources. The assistance of those parties involved is gratefully acknowledged.

Asset Base and Capital Expenditure

Sustaining current infrastructure requires reinvestment in the components of infrastructure that deteriorate over time - these components are described as replacement assets in this paper. The deterioration may occur because of weathering, wear and tear from use, and technical obsolescence. Costs incurred for items such as land and earthworks are excluded from the analysis of the current cost of providing public transport services as they will not be re-incurred.

The approximate cost of replacement assets used in public transport in Adelaide was previously estimated by Bray (1995) at $1,150 million. (All costs in this paper are in January 1999 prices, unless noted.) This estimate was refined using a recent revaluation of most assets used for the suburban train, tram and bus systems. The revised data indicated the value of replacement assets to be $1,171 million, and the current depreciated value of the assets to be $627 million (see Table 1). The relativity between these two figures (with the depreciated value marginally higher than half of the replacement cost) indicates that on average assets have been replaced at a rate sufficient to avoid long run deterioration of the asset base.

Investment required to sustain the current public transport system was estimated by taking into account the remaining life of existing assets and the cost of replacing them. It is estimated that total reinvestment of $886 million will be required between 1999/00 and 2019/20 (see Table 1). Of this, $846 million is needed to replace existing assets that reach the end of their respective economic lives during this period. The remaining $40 million is for improvements that are vital to sustaining current public transport operations, covering improvements to the current ticketing and information systems and to redress deficiencies in the quality of some existing interchanges and stops. Some two-thirds of the total investment relates to vehicles (for new vehicles and for major overhauls of trains and trams that are typically required every 15 years), and the remaining one-third is for fixed infrastructure and facilities.

Table 1: Summary of Public Transport Assets in Adelaide in 1998[1] ($ million, January 1999 prices)

Component	Replacement Cost			Depreciated Value			Reinvestment (1999-2020)[2]		
	Fixed Infrastructure	Vehicles	Total	Fixed Infrastructure	Vehicles	Total	Fixed Infrastructure	Vehicles	Total
Train System	443	241	684	275	167	442	182	167	349
Tram System	23	33	56	14	0	14	15	45	60
O-Bahn	74	45	119	56	13	69	14	58	72
Remaining Bus System	47	247	294	30	71	101	15	320	335
Ticketing & Information	18	-	18	1	-	1	70	-	70
Total	605	566	1,171	376	251	627	296	590	886

(1) Depreciable assets only. Excludes items for which re-investment is not required.
(2) Re-investment needed to sustain current infrastructure and to make small improvements

Annualised Asset Costs

The assets used in public transport have substantially different economic lives, ranging from about 5 to 100 years. The equivalent average annual cost (EACC) is used to present the cost of assets on a comparable basis. The EACC was established using the valuation and life of assets (for some 3,000 individual items, including about 1,000 public transport vehicles) and a real opportunity cost of capital of 7 percent. Data used to determine the EACC for rolling stock is shown in Table 2. In the case of fixed infrastructure, the residual value was taken to be zero at the end of the life of the assets.

The EACC for the existing public transport system is described in Table 3, together with the average economic life of assets. About half of the total EACC is attributable to depreciation of assets, and the remainder to the opportunity cost of capital.

The data presented so far is based on costs that are incurred by those responsible for providing public transport. In the case of the train, tram and O-Bahn, these include the cost of their own track. However, buses also impose costs on the road system that need to be taken into account for a complete estimation of the cost of providing public transport. It is assumed in the current analysis that fuel taxes are a form of general taxation rather than a road use charge, and hence additional road costs needed to be attributed to buses.

The cost of bus priority measures can be directly attributed to buses, but these are a minor cost. Buses account for a very small proportion of the traffic flow, and so are unlikely to generate the need for additional road space. Conversely, it may be argued that buses avoid the need for additional road space that would be required if bus passengers used cars.

Table 2: Cost of Public Transport Vehicles (January 1999 prices)

	Length (m)	Capacity[1] (seats)	Capital Cost Per Vehicle ($'000)	Disposal		Equivalent Annual Capital Cost ($'000/year)			
				Age (years)	Residual Value (%)	Initial Capital	Rehabilitation[2]	Total	Total Cost/-Seat
Bus (Diesel)									
Mini	8.0	22	240	17	10	23 8	0 0	23.8	1 08
Midi	10 0	29	275	17	10	27 3	0 0	27 3	0 94
Rigid (standard)	11.7	39	326	17	10	32.4	0.0	32.4	0.83
Rigid (long)	14.5	47	383	17	10	37.9	0.0	37.9	0.81
Artic. (min cost)	18 0	67	530	17	10	52 6	0.0	52.6	0 79
Artic. (max cost)	18.0	67	663	17	10	65.8	0.0	65.8	0.98
Light Rail									
Rigid	16 0	50	2,601	30	5	208 2	22.8	231.0	4.62
Articulated	25.0	80	3,570	30	5	285.8	31.3	317.1	3.96
Heavy Rail									
Diesel Power Unit	25.0	110	2,550	30	5	206.8	22.3	229.2	2.08

(1) During the peak period, peak direction maximum loadings on public transport in Adelaide are on average approximately equal to the seating capacity of vehicles.

(2) Buses are usually retired before major body overhaul become necessary Other bus maintenance is covered through operating costs. Allowance is made for a major overhaul of trains and trams after 15 years, with the cost of the overhaul being equal to about 30 percent of the initial vehicle cost.

Bus passengers account for about 7 percent of person trips using the road system during the morning peak 1.5 hours in Adelaide: if bus passengers were to use car instead, the quantity of road traffic during the morning peak would rise by about 6 percent. This, taken alone, would require some additional road space. However, this need would be moderated by the availability of spare road capacity at present, and the removal of the disruption caused to traffic flow by stopping buses.

The current paper has not quantified this matter, which is a topic in its own right Moreover, the focus of the current paper is on financial, rather than economic, costs. It is concluded that there is little evidence for a substantial financial capital cost to provide capacity on public roads in Adelaide to accommodate bus traffic.

However, buses, like other large vehicles, cause tangible damage to roads. After reviewing evidence from Australia and New Zealand, a marginal cost of maintenance to compensate for this damage of $0 07 per bus-kilometre was adopted. This results in a total marginal cost of road damage attributable to urban public transport buses in Adelaide of $2.80 million per annum.

Table 3: Equivalent Average Annual Cost for Public Transport Assets in Adelaide

Item	Replacement Cost ($ million)	Depreciated Value ($ million)	Average Economic Life (years)	Equivalent Average Annual Cost ($ million)
Existing Infrastructure				
Tram System:				
Tracks	14.5	9.2	28	1.2
Platforms and Stations	1.3	1.0	36	0.1
Signals and Communications	1.8	0.9	21	0.2
Bridges and Culverts	2.7	1.9	39	0.2
Depots	2.2	1.5	41	0.2
Rolling Stock	33.2	0.0	30(1)	2.9(2)
Subtotal (Tram System)	55.7	14.4	30	4.8
Train System:				
Tracks	146.8	115.5	60	10.5
Platforms and Stations	141.3	60.5	57	10.1
Signals and Communications	66.1	42.3	20	6.2
Bridges and Culverts	80.4	51.8	56	5.8
Depots	8.8	4.5	34	0.7
Rolling Stock	240.7	167.3	30(1)	20.8(2)
Subtotal (Train System)	684.0	441.9	44	54.1
Bus System:				
Depots	51.6	33.3	46	3.8
O-Bahn Fixed Infrastructure	67.0	52.0	48	4.9
Bus Stops	1.7	0.8	20	0.2
Bus Fleet	292.2	83.6	17	27.6
Subtotal (Bus System)	412.5	169.7	23	36.4
Support Infrastructure:				
Current Ticketing System	18.0	0.6	15	2.0
Information Infrastructure	0.1	0.0	10	0.0
Subtotal (Support Infrastructure)	18.1	0.6	15	2.0
Total (Existing Infrastructure)	1,170.4	626.7	35	97.3
Minimum Incremental Investment				
Ticketing System Enhancement	6.2	-	15	0.7
Information Infrastructure	7.1	-	12	0.9
Interchanges, Stops and Stations	13.3	-	29	1.1
Total (Min. Incremental Investment)	26.5	-	18	2.7
Grand Total				
Total	1,196.9	626.7	35	100.0

(1) The value shown is the average life of assets between purchase and disposal. The effective average life of the initial investment in trains and trams is less, however, because additional expenditure is required to rehabilitate rolling stock after about 15 years for their full life to be achieved

(2) Includes allowance for periodic rehabilitation of rolling stock.

Recurrent Costs

The recurrent costs for each mode and corridor/route group were derived for the 1997/98 financial year, using data from a number of sources:

- Contract payments (excluding capital leasing and other asset charges) – from PTB records.
- Supplementary information provided by TA on the breakdown of its direct and overhead costs by mode.
- An earlier (1995/96) breakdown of costs from previous ROSIS management reports.

The total direct recurrent costs were estimated at some $168 million pa, as shown in Table 4: $123 million of this relates to bus services; $39 million to train services and the remaining $6 million to the Glenelg tram services. These costs exclude the marginal cost of road maintenance that is attributable to buses.

In addition to these direct costs, a further $7 million of administration and joint costs has been identified: this covers the PTB (and TSA) costs of administering the public transport system, including contract management costs and some joint mode costs for ticketing and information systems.

Total Costs

The total long term annualised cost of providing the current public transport system is estimated at $276 million per annum (see Table 4). This cost includes all renewal/replacement capital costs, the opportunity cost of capital, public transport operating, maintenance and administration costs, and the cost of wear to roads caused by buses. It does not include the cost of capital items that were required when facilities were first developed, but which need never be re-incurred.

Review of Current System Costs

Table 4 shows total annualised costs broken down by:

- Bus – split between O-Bahn corridor services and all other services
- Tram
- Train – split between the four main line groups.

These total costs have then been divided by total passenger boardings and average trip lengths for each bus, train and tram service group to derive average cost per passenger-km.

Table 4: Public Transport Patronage and Costs (1997/98, in January 1999 prices)

Mode	Total Annual Cost ($ million)				Annual Boardings (mill.)	Average Trip Length (km)	Average Unit Cost ($/passenger-km)			
	Capital Cost		Recurrent Cost	Total			Capital Cost		Recurrent Cost	Total
	Fixed Infra.	Vehicles					Fixed Infra.	Vehicles		
Bus:										
O-Bahn(1)	5.70(2)	3.62	14.81	24.13	6.1	11.1	0.08	0.06	0.22	0.36
Other Bus	7.51(2)	23.96	107.91	139.38	41.3(3)	7.5	0.02	0.08	0.35	0.45
Total Bus	13.21	27.58	122.72	163.51	47.4	7.9	0.04	0.07	0.33	0.44
Glenelg Tram Line	1.90	0.53	6.19	8.62	1.9	7.3	0.13	0.04	0.44	0.61
Train:										
Noarlunga	9.64	8.02	12.57	30.23	3.6	18.6	0.14	0.12	0.19	0.45
Gawler	10.76	6.19	12.46	29.41	3.2	21.2	0.16	0.09	0.19	0.44
Outer Harbor	7.67	5.04	9.24	21.95	2.4	11.7	0.28	0.18	0.33	0.79
Belair	5.50	1.83	4.46	11.79	1.0	14.8	0.38	0.12	0.31	0.81
Total Train	33.57	21.08	38.73	93.38	10.1	17.4	0.19	0.12	0.22	0.53
Total Direct Cost	48.68	49.19	167.64	265.51	59.4		0.08	0.09	0.30	0.47
Administration and Joint Costs			7.40	7.40						
Total Cost	**48.68**	**49.19**	**175.04**	**272.91**		**9.5**				

(1) Includes associated on-street operation of bus services that use the O-Bahn.

(2) Includes damage to roads caused by on-street buses ($0.18 million for O-Bahn services and $2.62 million for other on-street buses).

(3) Includes City Free services.

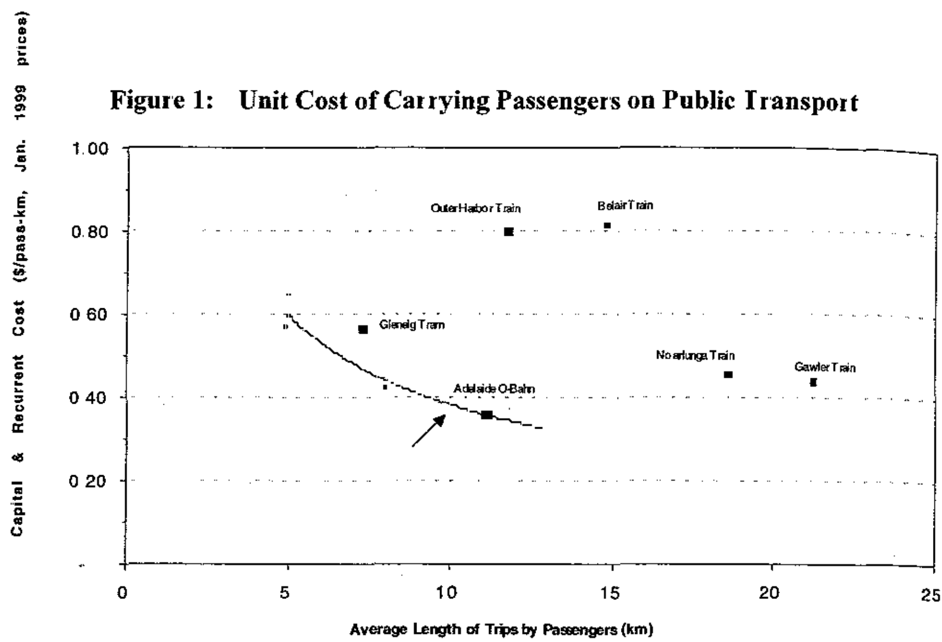
Additional analyses have been undertaken to break down the costs of the on-street bus services into their separate contract areas, and these costs have been expressed per passenger kilometre in each case. Figure 1 shows total annualised costs per passenger-km against average trip lengths for each bus, train and tram service group. We comment on the main results from Table 4 and Figure 1, as follows.

Bus Service Costs:

- The cost/passenger-km declines with increasing travel distances (usually associated with longer routes), because of the efficiencies associated with the provision of longer-distance services: these efficiencies include higher average operating speeds and a lower proportion of non-productive vehicle and driver time.

- More detailed analysis of data for seven major bus contract areas has been used to derive the regression curve shown (with R^2=0.86) relating average costs/passenger-km to average trip length. This shows typical costs varying from $0.60/passenger-km for 5 km trip lengths down to about $0.35/passenger-km for 12 km trip lengths.

Figure 1: Unit Cost of Carrying Passengers on Public Transport



- While there is no data for longer trip lengths, it is judged that the regression curve would flatten out to a cost level of $0.20-$0.30/passenger-km when average trip lengths exceed 15-20 kilometres.
- The average cost of carrying passengers on the O-Bahn is very similar to that for street buses given a similar trip length (the overage unit cost for O-Bahn is on the regression curve for on-street services). This result occurs because the lower operating costs that result from the favourable travel conditions on the O-Bahn (eg high speed and smooth operations) are sufficient to offset the replacement capital cost of the track: this is evident from Table 4. The outcome is assisted by the large number of passengers who use the O-Bahn, which reduces the unit cost of fixed infrastructure per passenger (the result would be different if O-Bahn volumes were much lower).
- The cost of road maintenance attributable to on-street buses is equal to only $0.006 per passenger-km, and hence has little effect on the results of the analysis

Bus v Tram v Train Comparisons:

There are substantial differences in the capital intensity of the various public transport modes, and in the distribution of costs between fixed infrastructure, vehicles and operations (ie recurrent costs). The cost distribution by mode is as follows:

	Recurrent	Vehicles	Infrastructure
On-Street bus:	78%	17%	5%
O-Bahn bus:	61%	15%	24%
Tram:	72%	6%	22%
Train:	41%	23%	36%

- The Glenelg tram costs shown reflect the current costs for this aged facility. The capital costs for vehicles relate to the rehabilitation of the 70 year old tram cars. An analysis of the cost of using new tram cars suggests that the total cost would not change substantially, with higher capital charges incurred for new tram cars being offset by lower operating and maintenance costs.

- The Glenelg tram costs, at about $0 61/passenger-km, are some 20-25 percent higher than the costs for bus services at similar trip lengths.

- The average cost of carrying passengers by train is higher in all cases than by other modes. This is especially so for the Outer Harbor and Belair train lines, with costs over $0.80/passenger-km; and rather less so for the Noarlunga and Gawler lines with costs of about $0.45/passenger-km.

- The high cost of train services occurs primarily because of the high capital cost of fixed infrastructure and rollingstock, and the low level of train patronage in Adelaide. The fixed infrastructure costs by train line vary from $0.14/passenger-km for the Noarlunga line up to $0.38/passenger-km for the Belair line: the corresponding figure for the O-Bahn is $0.08/passenger-km and for on-street buses $0.02/passenger-km. The train rollingstock annualised capital costs average $0.12/passenger-km, compared with $0.07/passenger-km for bus services.

- The recurrent costs for the train lines vary from $0.19/passenger-km on the Gawler and Noarlunga lines up to $0.33/passenger-km on the Outer Harbor line. The recurrent cost for the Gawler and Noarlunga lines are slightly lower than for O-Bahn bus ($0.22/passenger-km): however, if adjustment was made to account for differences in the average trip lengths, it is likely that the unit recurrent costs in these three corridors would be similar. Recurrent costs for the Outer Harbor and Belair lines are significantly higher than for on-street (and O-Bahn) bus services with similar trip lengths.

- The graphical results for the four train lines indicate, prima facie, that train system costs fall rapidly as trip lengths increase. However, this interpretation is misleading as the unit costs for the Noarlunga and Gawler lines are lower in part because of the higher average trip lengths, and in part because of the higher patronage on these lines (refer Table 4).

- The results for train mode relative to bus mode are consistent with findings from other studies both in Australia and internationally. Such studies into the appropriate role for urban public transport modes (eg UITP 1994) generally conclude that heavy rail is not economic at volumes of below 10-20 million passengers per line per year. Current patronage on individual rail lines in Adelaide of between 1.0 million and 3.6 million passengers per year are well below such an economic threshold.

- A considerable feeder network to the train lines in Adelaide already exists. There is limited scope to extend this network in ways that could benefit passengers or reduce the cost of providing public transport. Hence, it is not possible to reduce unit costs significantly by feeding more public transport users to the train system.

Efficiency Trends and Prospects:

It may be asked whether changes in the operating efficiency of the different modes are likely to materially affect the above discussion on the relative modal costs.

In part to address this question, we analysed trends in average recurrent costs by mode over the last 15 years, using data from the ROSIS management accounting system, and adjusting all cost rates for inflation (using the consumer price index). The main findings were:

- **Bus.** Average costs per vehicle-kilometre were almost constant until the last 5 years, since when they have fallen by around 15 percent (this fall appears to be mainly associated with the implementation of competitive tendering of services). However, passenger boardings and passenger-km have also fallen quite substantially over the last 5 years, with the result that real recurrent costs per passenger boarding and per passenger-km have increased. Thus while the technical efficiency of the services (costs/vehicle-km) has improved significantly, the service efficiency (utilisation) has deteriorated.

- **Tram.** The results show a broadly similar pattern to those for the buses as described above. Recurrent costs/vehicle-km have declined since the early 1990s, but utilisation has declined faster, resulting in slight increases in recurrent costs/passenger and costs/passenger-km.

- **Train.** Again costs/vehicle-km have declined quite substantially (around 25 percent) since the early 1990s, in a situation with no direct threat of competition but nevertheless with general pressure to achieve savings. Utilisation levels have fallen at a lower rate, resulting in some overall reductions in recurrent cost/passenger and costs/passenger-km.

While technical efficiency has improved for all three modes to a broadly similar extent over the period 1985/86-1997/98, recurrent costs/passenger-km for bus have increased from $0.29 to $0.33; for tram have increased from $0.34 to $0.44; and for train have declined from $0.32 to $0.22. These are quite pronounced changes over a twelve year period.

The decline in the overall performance (cost/passenger-km) of the bus system can be attributed in part to the spread of the bus network to serve new and outlying areas that generate lower patronage levels than the 'core' network. The decline in the recurrent cost/passenger-km on train services can be partly attributed to a considerable increase in the average length of passenger trips made by train. Population growth in the outer suburbs served by train lines, and the introduction of more feeder bus services to the train lines and the operation of more express trains to improve services to these outer suburbs, have contributed to this increase in average trip length. The average length of trips made on buses has risen also, but by a lesser amount.

If the analyses of the relative modal performance presented in Table 4 and Figure 1 had been undertaken in the mid-1980s, the results would have shown train even less favourable with buses. That is, train services have improved their relative performance.

In the present context, it is more useful to look forward to conjecture how the relative level of recurrent costs of the modes may move in future. A recent indicative assessment for the PTB of how the current technical efficiency of the Adelaide services compares with 'best practice' benchmark cost rates indicated scope for future efficiency improvements. Broadly, the conclusions were that efficiency improvements in the order of 10-20 percent could be achievable for bus services and 20-30 percent for train services if experience elsewhere can be applied to Adelaide. Substantial improvements should also be achievable for tram services if a substantial investment was made to upgrade the tram fleet. However, as noted previously, the total cost of carrying passengers by trams would not change substantially with this investment because savings in operating costs would be offset by higher capital charges.

The other aspect affecting future costs (per passenger-km) is the utilisation rate of each mode (ie passenger-km per vehicle-km). In this regard, it is likely that a marked change in service policy will be required to offset the trends of the last 10-15 years. Otherwise, the utilisation rate for bus is likely to decline more rapidly than for train.

The overall result of the above factors is that, in the absence of any changes in public transport policy and service design, the average recurrent cost (per passenger-km) for bus services could continue to increase, albeit gradually, relative to the other modes. In contrast with recurrent costs, there are few opportunities to achieve substantial reductions in total capital costs. This will temper the extent to which the average unit cost of carrying passengers by train and tram will decline relative to bus. In practice, current tendering of bus services in Adelaide has the potential to achieve early gains in technical efficiency and should open the way for continuing improvement in service efficiency in the bus system.

Finally, it is somewhat misleading to make comparisons between the whole bus system and specific tram and train lines serving the major corridors. If the data were available, better comparisons would be between tram, train and selected trunk/major corridor bus services. The costs for these bus services would be unaffected by the gradual spreading of the bus system overall, and they would serve similar regions to those served by the rail modes. Such an analysis is likely to show the trunk bus services in more favourable light relative to the other modes (ie more comparable with the O-Bahn results, and hence with a significant cost advantage compared with train and tram).

Implications for Investment

The preceding data indicates that the use of rail is a more costly means for carrying passengers than bus in Adelaide at present, and is likely to remain so. Given the long life of rail mode assets, there needs to be confidence that sufficient funds will be available in future decades to sustain the use of these more expensive modes, and that the structure of transport demand will remain consistent with the corridors served by rail lines.

Of course, cost minimisation is not the sole, nor even the major criterion for taking decisions on urban public transport investment. Rail-based services are more attractive to existing and potential users than on-street bus services. However, evidence in Adelaide indicates that users of the O-Bahn view it as being similarly attractive as rail users perceive their mode. This is facilitated by the attributes of the O-Bahn which include high speed, smooth ride, the potential to eliminate the need to interchange (with buses serving both feeder and line haul functions), more frequent service because of the use of smaller vehicles than are used on rail lines, and better penetration of the City core than can be cost-effectively achieved with rail modes. Opportunities also exist to make on-street buses more attractive to users. Moreover, the low cost of fixed infrastructure for bus systems, including the O-Bahn, provide greater flexibility to adapt services to match changes in consumer demand.

These attributes, complemented by increasing use of more environmentally-friendly buses and the cost advantage offered by buses, suggests that more serious consideration should be given to the potential role for buses in urban public transport.

Conclusion

This paper has reported an appraisal of the costs of providing the current public transport services in Adelaide, with an emphasis on examining the costs of services by the different fixed track modes in the major transport corridors. Capital costs have been derived on a long-run annualised basis and added to recurrent costs to give total costs. These have been related to the passenger task, measured by passenger-kilometres.

The main conclusions are:

- With respect to recurrent costs alone, the average cost (per passenger-km) for the best-patronised train lines (Noarlunga and Gawler) are very similar to those for the O-Bahn, after allowing for trip length differences. The recurrent costs for the other two train lines (Outer Harbor and Belair) and for bus services in general are significantly higher, even after allowing for trip length differences.
- High capital costs are a major reason for the high average cost of carrying passengers by train. For train mode, annualised capital costs average $0.31/passenger-km, compared with $0.14/passenger-km for the O-Bahn and $0.10/passenger-km for on-street bus services. Capital costs comprise 59 percent of total costs for the train system, 39 percent for the O-Bahn, and 22 percent for on-street bus services.
- Taking capital and recurrent costs together, current average costs per passenger-km for bus mode are in the range of 45-65 percent of those for train mode for the Noarlunga/Gawler lines (and a lower percentage for the other two train lines), after adjusting for trip length differences. In this comparison, the bus figures are based on average rates for the whole bus system: it is likely that separate data for major bus corridors serving similar functions to the rail lines would show the bus mode in an even more favourable light.

- The recurrent costs for the current Glenelg tram services are high relative to the train services, but the capital costs relatively low because of the age of the rolling stock. Overall the costs per passenger-km are about a third higher than for comparable bus services. Replacement of the current 70 year old trams by modern light rail vehicles would not change this comparison substantially as higher capital charges would largely offset the reduced recurrent costs of new vehicles.
- It seems unlikely that future changes in efficiency and utilisation of the different modes will change the above results substantially. There is scope for further efficiency gains in all three modes.

These results indicate, on purely cost minimisation grounds, that the level of capital assets involved for the rail-based modes relative to the levels of passenger demand is such as to make rail unattractive. This conclusion is consistent with the weight of international studies, which suggest that suburban heavy rail (and light rail) systems are not economically justified at the levels of corridor demand prevailing in Adelaide – and in a context where underlying demand appears to be falling.

The substantial cost advantage for bus services, including the high quality O-Bahn, suggests that more serious consideration should be given to the relative merits of using bus in the place of rail services in instances where patronage is low, and where funding is constrained.

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