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PUBLIC TRANSPORT FARES AND TICKETING POLICY

In recent years, public transport fares and ticketing policy research has tended to focus on the investigation or review of specific issues or proposals. Rather less attention has been directed at reviewing general international practice in the fares and ticketing policy area. This paper provides a review of international fare systems, with an emphasis on comparing and contrasting those approaches favoured in Australia and in various international cities in developed countries. Specific aspects addressed in the paper include fare structures, time-of-day pricing, multi-trip and periodical tickets, concession fare policies, on and off-vehicle ticketing and inter-modal and inter-operator ticketing.

1 INTRODUCTION

In recent years, public transport fares and ticketing policy research has tended to focus on the investigation or review of specific issues or proposals. Rather less attention has been directed at reviewing general international practice in the fares and ticketing policy area. This paper provides a review of international fare systems, with an emphasis on comparing and contrasting those approaches favoured in Australia and in various international cities in developed countries. Specific aspects addressed in the paper include fare structures, time-of-day pricing, multi-trip and periodical tickets, concession fare policies, on and off-vehicle ticketing and inter-modal and inter-operator ticketing.

2 FARE LEVELS

The overall objective for pricing in a commercial environment should be to generate sufficient revenue to cover working expenses and achieve a commercial rate of return on the assets employed.

In practice, the application of this objective in the urban public transport context needs to be modified to reflect among other things:

- government imposed Community Service Obligations (CSOs); and
- 'market failure' associated with transport pricing in urban areas.

From a pricing perspective, CSOs relate to policies which discriminate in favour of specific 'transport disadvantaged' groups (eg. pensioners, students, children) where there is no commercial rationale to do so or to do so to such an extent. The key issue for pricing policy is whether concession fares made available on a non-commercial basis are subject to appropriate reimbursement from Government, given their impact on costs and revenue respectively. Current policies on specific reimbursement to operators for offering concessions differ considerably between States, varying between no specific reimbursements (ie. WA) to a comprehensive system of reimbursements for almost all concessions (ie. NSW).

The significance of the external costs associated with passenger transport in urban areas and its implications for public transport pricing is attracting increasing attention. For example, Symonds Travers Morgan has estimated that the external costs 'saved' by CityRail reflected by way of reduced road congestion, road accidents, air pollution and noise pollution are worth around \$350M per annum (see CityRail 1995). In the absence of direct road pricing, striking the correct price relativity between the price of road use and competing public transport modes can only be achieved by internalising the external costs of road use into the price charged for public transport services. This 'second best' pricing solution ensures 'competitive efficiency' and has the effect of restricting the distortions in both urban transport investment decisions and resource allocation flowing from sub-optimal road pricing.

3 FARES STRUCTURE

3.1 Basic Principles

Economic pricing principles suggest that a public transport fare structure should reflect the efficient costs of service provision (ie. technical efficiency) and be free from cross subsidy. That is, with the exception of concession fares, long-run avoidable costs (including avoidable capital costs) should set the lower bound for fares charged to any major market segment. In addition, the fares charged to individual market segments should reflect their respective 'willingness to pay' (ie. allocative efficiency). That is, market segments which are less price elastic (eg. peak period commuters) can and should bear a higher proportion of joint and overhead costs.

Design features of a fares structure which need to be considered include:

- **administrative features:** ease of ticket issue and associated ticket issuing costs, implications for revenue protection, minimisation of on-vehicle sales and so on;
- **customer friendliness:** easy to understand, easy to use and easy to market; and
- **equity issues:** the fare structure must be perceived to be fair.

3.2 Fundamental Structures

The design of individual public transport fare structures can potentially draw on the features of one or more of the three fundamental fare structures:

- **Flat fares:** A single fare structure is applied to all services or perhaps a sub-set of services.
- **Sectional fares:** Fares can be defined with reference to the distance travelled, travel time or some combination of the two. Distance-based sectional fares are defined with reference to geographic 'section points' with an increasing fare applying for more sections of travel. Sections can be aggregated to produce fare bands and non-linear fare bands are possible. Time-based sections define individual sections in terms of passenger travel time (usually increments of 30 minutes).
- **Zonal fares:** Fares are defined with reference to a number of geographical zones. Zones can be designed as concentric rings around the predominant passenger attractor/generator (eg. the CBD) or as neighbourhood zones. The fare for any given trip is defined according to the boarding and alighting zone.

The basic structures described above are characterised by mix of strengths and weaknesses against the key commercial pricing principles and design features

summarised above (see Table 1). As such, it is not possible to develop a strong preference for any individual fare structure on an a priori basis.

| TABLE 1: BASIC FARE STRUCTURES: STRENGTHS AND WEAKNESSES | | |
|--|--|---|
| Structure | Strengths | Weaknesses |
| Flat fares | Simplicity | No relationship between fares and costs |
| | Low ticket issuing costs | Implicit cross-subsidisation |
| | Reduces fraud opportunities | Distorts travel patterns |
| Time-based sectional fares | Simplicity | Late running and service cancellations impact upon ticket value |
| | Transfers between services and modes are straightforward | No direct relationship between fares, distance travelled and hence costs of service provision |
| | | Revenue allocation to individual services is difficult |
| Distance-based sectional fares | Direct relationship between fares, distance travelled and hence costs of service provision | Transfers between services and modes difficult to handle |
| | Typically perceived to be fair by customers | Fare for irregular journeys difficult to calculate |
| Zonal fares | Fares can broadly reflect distance travelled and hence costs of service provision | 'boundary problems' create potential need for 'short hop' fares |
| | Relatively easy to understand | Revenue allocation to individual services is difficult |
| | Transfers between services and modes are straightforward | |

The strength of flat fares are their simplicity, minimal ticket issuing costs and the minimisation of fraud opportunities (ie. no scope for overriding). Conversely, a flat fare structure is at odds with the key commercial pricing principles summarised above. Most importantly, there is no relationship between fares and the costs of service provision and hence cross-subsidisation is implicit in the fares structure and trip patterns are distorted. If economic efficiency is considered important, a flat fare structure is only likely to be attractive for relatively simple, compact public transport systems such as the Sydney monorail.

Simplicity and the ease with which transfers between services and modes can be accommodated are the key strengths of a time-based sectional fare structure. On the other hand, there is no strong relationship between fares and the costs of service provision and from a management information perspective, the allocation of farebox revenue between services and modes will be complex if a significant number of transfers are made. In addition, variations in service performance (ie. late running, cancellations) can impact upon ticket value. Once again, if economic efficiency is

considered to be important, a pure time-based sectional fare structure is only likely to be attractive for relatively simple, compact public transport systems.

Unlike flat and time-based sectional fares, it is extremely difficult to draw any generalisations regarding those circumstances where a distance-based sectional fare structure and a zonal fare structure might be preferred or not preferred against an evaluation criteria based on economic efficiency, administrative features, customer friendliness and equity issues.

The absence of a clearly superior fare structure on a priori grounds, against the range of factors that might be incorporated in any fares policy review, is reflected in the range of fare structures adopted by Australian and international public transport providers. In the Australian context, while none of the systems has a 'pure' structure, their predominant structure can be summarised as follows:

- Flat - Canberra (for single vehicle boarding)
- Adelaide (except for short distance trips)
- Sectional - Sydney (sectional overlaid with zonal intermodal)
- Tasmania
- Zonal - Brisbane (transfers are generally permitted)
- Melbourne (multi-modal time-based)
- Perth (multi-modal time-based)
- Darwin (transfers allowed for onward travel).

The fare structures favoured internationally are similarly diverse. Based on a review of the fare structures favoured by 98 operators in 18 developed countries, Symonds Travers Morgan (1995) reported that:

- 61% had some flat fare component;
- 27% had some sectional (distance-related) fares; and
- 43% had some zonal fares.

It is interesting to note that the data exhibited some strong regional differences. Flat, sectional and zonal fares all featured strongly in the sample of Western European operators, while flat fares were strongly preferred by the sample of North American operators (see Symonds Travers Morgan 1995).

4 DIFFERENTIAL TIME-OF-DAY FARES

Three basic arguments are commonly put forward in favour of differential time-of-day fares:

- **Cost recovery and efficiency grounds:** costs of service provision are higher in peak periods than in off-peak periods. On an average cost per passenger basis, peak period costs are typically higher than interpeak costs, and may be higher than

at other off-peak periods. On a marginal cost (economic efficiency) basis, outside peak periods additional passengers can typically be carried at very low or zero marginal cost, whereas the marginal peak period costs are relatively high.

- **Demand elasticity grounds:** typically off-peak trips are significantly more price-elastic than peak trips. Thus, if the operator objective is to maximise revenue subject to ridership or service constraints, then increasing peak period fares rather than off-peak fares will generate relatively large revenue increases with relatively small decreases in ridership.
- **Equity grounds:** in general, people travelling in off-peak periods have lower average incomes are less likely to be in employment than those travelling in the peaks. Therefore, in terms of equity (ability to pay), there is a strong case for lower fares in off-peak periods. For systems involving flat fares (or approximations to flat fares), the argument for lower off-peak fares is reinforced, as off-peak passengers tend to travel shorter distances than peak passengers.

Together, these arguments present a strong case for differential time-of-day fares. The strongest argument against such differential fares is that of simplicity and comprehension - administrative and operational simplicity for the operator (perhaps together with lower costs) and easier comprehension for the user and potential user.

There are a number of ways in which differential time-of-day fares can be structured. Normally, there would be two fare levels ('peak' and 'off peak'). The higher peak fare might be charged at:

- Option A - peak periods only;
- Option B - all weekday (except the interpeak); and
- Option C - all weekday (except the interpeak) and the weekend.

On demand elasticity and equity grounds, Option A is probably most appropriate, as it is only the peak period (commuter) passengers that have low elasticities and relatively high ability to pay. On efficiency grounds, Option A is also suggested, as the marginal costs of providing additional services are typically much higher at peak periods than at all other periods. On cost recovery grounds, Option C is probably most appropriate, as cost recovery in interpeak periods is typically much higher than in the peak, evening and weekend periods.

In considering the types of off-peak fares offered by Australian public transport operators, there are a number of dimensions to be taken into account including area of validity, whether the ticket allows an unlimited number of trips or a restricted number of trips, times of validity, points of sale and the level of discount.

Australian public operators can be grouped into four categories in terms of their differential time-of-day (off-peak) adult fare policies:

- No off-peak fares
 - Sydney (bus/ferry)
 - Canberra (bus)
 - Darwin (bus)

- System-wide daily off-peak tickets
 - Brisbane (bus/ferry)
 - Tasmania (bus)
 - Perth (bus/ferry/rail)

- Off-peak return tickets
 - Sydney (rail)
 - Brisbane (rail)
 - Melbourne (rail - specific movements)

- Full range of off-peak tickets - Adelaide (bus/tram/rail).

Adelaide is the only city where a full range of off-peak tickets are available including off-peak multi-ride tickets.

The Adelaide differential fare system, which was introduced in August 1981 is one of the 'classic' applications of time-of-day pricing and has been widely researched. Two separate analyses were undertaken to examine whether the introduction of differential fares was accompanied by a redistribution of trips from peak to off-peak periods (Scrafton and Starrs 1983):

- a 'before and after' study was undertaken by Travers Morgan, with the after component some 3½ months after the scheme was introduced. The study found that no perceptible shift of passengers from the peak to the interpeak had occurred (as had been hoped)

- the State Transport Authority undertook a comprehensive analysis of its patronage for the period July-September 1982 and compared this with its patronage pattern in November 1981. This revealed an increase in the proportion of adult journeys made in the 0900-1500 period from 24.8% in November 1981 to 34.0% in July-September 1982 - this is an unexpectedly large and (if true) highly significant shift.

There is clearly a conflict between the findings of the two analyses, which has never been properly resolved. One possible explanation is that the change in time of travel took some months to develop and hardly became apparent by the time of the 'after' survey and that any trends up to that period may have been masked by seasonal factors.

Internationally, the application of time-of-day pricing remains relatively limited. In the USA, the 1993 American Public Transit Association (APTA) Fares Survey revealed that only 5% of respondents fare structures included time-of-day pricing (see Lago 1993). The survey of UITP members conducted by Beasley and Grimsey (1991), of which 80% of respondents were from Western Europe, found that only 16% of respondents were applying differential time-of-day pricing.

The practice and experience with time-of-day fares in the USA and Europe is summarised by Cervero (1986 and 1990). Key points to emerge from the USA experience include:

- the policies adopted were split roughly evenly between peak surcharges, inter-peak discounts and differential increases (ie. peak fares increased more than off-peak fares);
- typically, the fare differentials between periods has been around 25%-30% (which is much lower than the average peak/off-peak cost differentials);
- in many cases, differential fares have applied only to cash tickets; and
- any shift in ridership from peak to off-peak periods as a result of the policies was modest - off-peak discounts were found to induce additional public transport trips more than switches in trips between time periods.

The European experience with time-of-day fares is also summarised by Cervero (1986), and contrasted with the USA experience:

- time of day cash differentials for regular adult users are less common elsewhere in the world than in the USA;
- outside the USA, the most common form of time of day pricing involved surcharges for late night services - these applied in over 30 cities worldwide, many of which were in Europe;
- historically, most international time-of-day differentials involved either free or heavily discounted travel at peak periods (eg. Rome, Bologna and Prato, Italy in 1972/73) - these policies were aimed at reducing peak period road traffic levels;
- more recently, European adult fare discounts have been targeted to inter-peak periods, while most UK systems offer off-peak discounts for pensioners and other concessionary users.

5 MULTI-TRIP AND PERIODICAL TICKETS

5.1 Multi-Trip Tickets

All public transport operators in Australia, except the two rail-only operators (CityRail, Sydney and CityTrain, Brisbane) offer 10-trip tickets (the rail-only operators tend to concentrate on weekly and longer periodical tickets for regular travellers). The price ratio between adult 10-trip tickets and single tickets in Australia is typically around 80%, although ratios are as low as 59%.

Internationally, 10-trip tickets are generally priced at between 65% and 95% of single ticket prices, although there are some cases of ratios as low as 50%. In the USA and Canada, there is a considerable variation in price ratios, although the majority of cities have ratios between 75% and 95%. In the UK/Europe there is also considerable variation, with a tendency towards higher ratios in the UK (80%-90%) than in Europe (50%-85%).

To a substantial extent, there is a trade-off between the objective of maximising revenue and that of minimising the number of ticket transactions, particularly for on-vehicle sales. If the revenue maximisation objective is dominant, this indicates that only a small discount (if any) is appropriate - suggesting a price ratio of around 90% (as is typical in the UK), or possibly higher. If the objective of minimising ticket transactions, and providing more attractive arrangements for passengers, is dominant, this would tend to suggest rather larger discounts in order to maximise the use of the discounted tickets.

However, it is difficult to see the justification for a multi-trip discount of over 20% (ie. a price ratio of under 80%), if the single ticket is regarded as the basic fare¹. If, however, the policy is that the multi-trip ticket should be the basic ticket and a punitive surcharge be imposed on anyone purchasing a ticket on the vehicle (as was introduced with the abortive Melbourne Met-ticket scheme in 1989/90), then a price ratio below 80% might be appropriate.

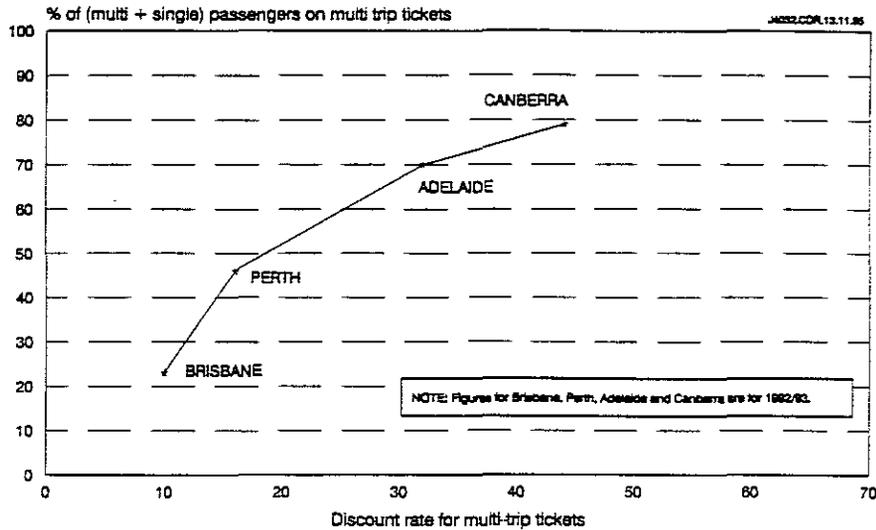
Figure 1 shows the proportion of multi-trip ticket usage for four major Australian public transport operators against the discount rate offered on multi-trip tickets. It compares:

- ratio of multi-trip passengers to (multi plus single) trip passengers; with
- discount rate on multi-trip tickets relative to single tickets.

The four systems lie on a smooth curve, which suggests that the curve might be used to help assess the impact of varying the discount rate within any system. The figure suggests that a discount of around 20% is necessary to achieve a multi-trip usage of about half.

¹ In drawing these conclusions, we are comparing multi-trip prices with single ticket prices on the basis that the latter have been set 'optimally' - this, of course, may not be so in practice.

FIGURE 1 : MULTI-TRIP TICKET USAGE v DISCOUNT LEVEL



5.2 Periodical Tickets

In Australia, weekly tickets are generally priced at between 7.5 and 9.0 times the price of single tickets. Monthly tickets are generally priced at between 3.5 and 4.0 times the price of weekly tickets, which translates typically into 30-35 times the price of single tickets.

The international evidence is broadly consistent with that observed in Australia. Weekly tickets are generally priced at between 7.5 and 11.0 times the price of single tickets. Monthly tickets are generally priced at around 3.1 to 4.0 times weekly ticket prices, which translates into 30-40 times single ticket prices. Price ratios tend to be higher than average in the USA and rather lower in continental Europe.

Typical usage rates for periodical tickets are as follows:

- for weekly tickets, typical usage rates in UK/Europe are around 20 trips per week. The available Australian evidence ranges from 11 trips per week (CityRail RailPass) to around 21 trips per week (Sydney's Green bus/rail/ferry TravelPass); and
- for monthly tickets, typical usage rates in UK/Europe are around 80 trips per month. The Australian evidence is consistent with somewhat lower figures, around 60-65 trips per month.

These results indicate that, with the typical pricing multipliers for periodical tickets noted above, users of such tickets both in Australia and internationally are generally making broadly twice as many trips on average as would be needed for them to 'break even' with these tickets relative to single cash tickets.

6 CONCESSION FARE POLICIES

As noted in Industry Commission (1994), the most visible way in which governments intervene in transport in pursuit of social goals is through directing public transport authorities to provide concessionary travel to certain categories of people.

The range of concession fares made available made available by Australian operators can be summarised as follows:

- free travel is generally made available to children under 5, blind persons, employees, ex-employees and police;
- all operators provide concessions to children 5 or over, secondary school students and pensioners;
- all operators with the exception of Brisbane Transport and Darwin Bus Service make concessions available to seniors; and
- all operators make concessions available to low income earners or those in receipt of social welfare payments, although eligibility is defined in a number of different ways (ie. holders of Transport Concession cards, Health Care/Health Benefits cards etc).

Excluding those groups receiving free travel, concession fares are generally set as a proportion of the corresponding 'standard' adult fares. This proportion is typically 50%, but ranges as low as 30% (ie. a 70% discount).

The extent to which operators are directly reimbursed by governments for offering concession fares to selected groups varies from state to state. Policies in NSW, Queensland, Tasmania and the ACT are under extensive development, while in SA and WA previous policies are being dispensed with coinciding with competitive tendering.

Traditionally, NSW and SA have had the most comprehensive reimbursement policies, covering children, seniors and welfare groups. The ACT, Victoria and Tasmania have had less comprehensive reimbursement policies, covering only selected concession groups. Queensland and WA have not provided any direct reimbursements.

The responsibility for reimbursement has also differed between states. In NSW all reimbursement has been via the Department of Transport. However, the implementation of the Social Program Policy is consistent with the implementation of a 'purchaser -provider' model. This will bring NSW into line with the approach favoured in other states where operator reimbursement for the carriage of school children is made through the Education Department (eg. SA) and reimbursement for seniors and social welfare groups through the relevant state welfare/community services department.

7 ON AND OFF-VEHICLE TICKETING

In the past, only one Australian operator, TransAdelaide has offered the same tickets on and off-bus with a price differential as a means of encouraging off-bus purchase. However, this differential was eliminated at the July 1995 fare change on the grounds that it would simplify the fare structure, while it was felt that the high off-bus market share (c.80%) that had been achieved was unlikely to be substantially eroded.

The proportion of off-bus ticket sales by Australian operators is subject to wide variation, ranging from a low of 30% (Perth) to a high of 86% (Canberra). Although the detailed reasons for the substantial variation between systems would require further investigation, two reasons are undoubtedly:

- ticket availability, in terms of on-bus or off-bus, but also in terms of the number and convenience of off-bus sales outlets; and
- the relative pricing of different tickets - the market share of multi-trip tickets (available only off-bus) depends on the prices relative to alternative tickets, particularly single cash fares which are always available on-bus.

Internationally, the proportion of off-bus ticket sales also varies significantly. The off-bus proportion is lowest of all in Singapore and Hong Kong (0%-20%), somewhat higher in the UK, Ireland and USA (20%-50%), substantially higher in Continental European countries including Sweden, France and Spain (70%-90%) and highest of all (generally above 90%) in Germany, Greece and the Netherlands.

8 INTER-MODAL AND INTER-OPERATOR TICKETING

Inter-operator ticketing and revenue-sharing arrangements appear not to be very common worldwide, and where such arrangements are in place they are not widely documented. In many cities inter-operator revenue sharing is not an issue, for one of several reasons:

- there is only one substantial operator;
- there are several operators, but each has an independent ticketing system and does not accept the tickets of the other operators;
- there are several operators, with funding on a gross cost basis and all revenue being paid into the government authority (this would typically be the case in European conurbations and is largely the case in Melbourne); or
- there are several (usually public sector) operators, with funding on a net basis, but no revenue sharing arrangements.

In essence, the development of revenue-sharing arrangements for multi-operator tickets can be approached in one of two ways.

Firstly, revenue allocation principles can be developed on the basis of the relative costs incurred by each participating operator associated with the provision of services to holders of multi-operator tickets (ie. a 'cost-based' allocation). There are a number of practical difficulties associated with the pure application of a cost-based allocation (eg. the specification and calibration of the 'appropriate' cost functions). Accordingly, the cost-based approach is typically applied by approximating the costs of service provision to multi-operator ticket holders with reference to a fundamental cost 'driver' such as passenger journeys or passenger kilometres.

Alternatively, allocation can be based on a measure of the respective revenue that would accrue to each operator for the package of trips made on the multi-operator ticket, in the absence of such a ticket (ie. a 'revenue-based' allocation). This is termed the 'Total Value of Travel' (TVT) concept. TVT is defined as the sum of the 'next best' single operator fares that would otherwise have been payable for the package of trips made on each multi-operator ticket in the absence of such a ticket.

In Australia, inter-operator ticketing/revenue sharing schemes are very limited. For the most part, revenue allocation systems have been put in place primarily for internal accounting purposes. The notable exception is Sydney where revenue sharing arrangements exist for the multi-modal TravelPass and Pensioner Excursion products. These revenue sharing arrangements are currently under review, with agreement reached (in principle) that the TVT concept should provide the basis of future revenue sharing arrangements.

9 CONCLUSIONS

The more significant findings emerging from our review of international fare and ticketing systems can be summarised as follows.

Each of the basic fare structures (ie. flat, sectional and zonal) are favoured by one or more Australian public transport operators. Internationally, each of the three fundamental structures are all well represented, although flat fare structures tend to be dominant in North America, while there is a greater emphasis on zonal fare structures in European cities.

Apart from the issue of increasing the complexity of a fares structure, a strong case for differential time-of-day pricing can be mounted on several grounds including cost recovery, efficiency, demand elasticity and equity. Despite this, the application of differential time-of-day pricing, both within Australia and internationally remains limited.

A review of the relative price of multi-trip tickets reveals that the 'norm' is for multi-trip tickets to be priced at around 80% of the equivalent single cash tickets. To a substantial extent, there is a trade-off between the objective of maximising revenue and that of minimising the number of ticket transactions, particularly for on-vehicle sales. If the revenue maximisation objective is dominant, this indicates that only a

small discount (if any) is appropriate - suggesting a price ratio of around 90% (as is typical in the UK), or possibly higher. If the objective of minimising ticket transactions, and providing more attractive arrangements for passengers, is dominant, this would tend to suggest rather larger discounts in order to maximise the use of the discounted tickets (ie. up to 20%)

A review of periodical ticket pricing practice, together with associated evidence regarding trip rates, reveals that users of such tickets in both Australia and internationally are making broadly twice as many trips on average as would be needed for them to 'break even' with these tickets relative to single cash tickets.

Within Australia, free public transport is usually made available to children under 5, blind persons, employees, ex-employees and police. Concession fares for other groups are generally set as a proportion of the corresponding 'standard' adult fares. This proportion is typically 50%, but ranges as low as 30% (ie. a 70% discount).

Both within Australia and internationally, the proportion of off-bus sales is subject to wide variation. Although the detailed reasons for the substantial variation between systems would require further investigation, two reasons can be identified on a priori grounds. First, ticket availability, in terms of on-bus or off-bus, but also in terms of the number and convenience of off-bus sales outlets. Secondly, the relative price of multi-trip tickets (sold off-bus) relative to alternative tickets, particularly single cash tickets which are always available on-bus.

In Australia, inter-operator ticketing/revenue sharing schemes are very limited. For the most part, revenue allocation systems have been put in place primarily for internal accounting purposes.

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