

A Submission to the Independent
Pricing and Regulatory Tribunal Inquiry
on Government and Private
Public Transport Services.

David Caldwell

14th July 2004

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Mr James Cox,
Acting Chairman,
Independent Pricing and Regulatory Tribunal,
PO Box Q290,
QVB Post Office,
NSW 1230.

Dear Mr Cox,

Please find enclosed my submission to the 2004 Inquiry on Government and private public transport fares for buses and ferries.

Yours sincerely,

David Caldwell.


CC:
Rt. Hon. R.J. Carr MLA, Premier of New South Wales
Ian Cohen MLC
Auditor General, New South Wales

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Glossary

A note on language

Generally I employ technical terms in the established (broadly printed) sense. Conceptually critical words in the text are *italicised*, and are used in the precise sense I define.

Definitions

Description of travel

Trip, travel undertaken on a single *vehicle*.

Journey, the complete course of travel from one place to another (origin to destination). Frequently a *journey* will necessitate multiple *trips*.
[note: this distinction is not recognised by the Government authorities, which use trip, ride and journey interchangeably to describe different things].

Linked trip, a *trip* that forms part of a *journey* made by multiple *vehicles* of transportation (including kiss'n'ride car trips), and of which one or more *trips* is by public transport.

Chained trip, a *trip* that forms part of a *journey* which is broken for purposes other than exclusively changing *vehicles*; e.g. one may visit a shop or drop children at school (secondary destination) en route to work (primary destination).

Ticketing and ticketing integration

Integrate, "To bring together (parts) into a whole" –Macquarie Dictionary

Flag fall, An initial fee for engaging a service. In this context however, the effect of a *flag fall* may also be achieved by a regressive non-linear relationship between distance and charge (i.e. a cheaper charge per unit distance for a longer *trip* than for a shorter *trip*)

Ticket, an authority to travel commensurate with *fare*

Fare, money charge for intended travel

Ticketing, the processes of issuing and validating of tickets for fare paid.

Automatic Fare Collection (AFC), An electronic system for the vending and validation of tickets. This term, widely used in the 1970s-1980s, is notable for its emphasis upon the fare (rather than the ticket), and is representative of the industry's interchangeable use of the words *fare* and *ticket*. AFC does not necessarily imply *intermodal* or *integrated ticketing*.

Intermodal ticketing, a ticketing arrangement that recognises a multi-modal *journey* as a single commodity. The aim of *intermodal ticketing* is typically the elimination of financial penalty for passengers making transfers between *modes*. *Intermodal ticketing* frequently takes the form of free feeder-buses to railway stations. *Intermodal ticketing* generally applies to radial routes of travel affected by gravity-driven scale changes, e.g. bus to train, tram to train, bus to ferry. It is generally a restrictive form of *Integrated ticketing* in that it typically makes no allowance for generalised *Chained Trips*. Both *intermodal* and *integrated* ticketing share a profound deviation in principle from *trip* based ticketing systems, which incur cumulative, discrete *flag-falls*.

Integrated ticketing, a ticketing arrangement which accommodates modern *journeys* constituted of *linked* and *chained trips*, by better reflecting the *journey* commodity as a function of time lost in transfer (waiting), indirect routes of travel, distance of travel, and land-use patterns. Recognising that indirect, and therefore undesirably longer, *journeys* defy the assumption of charge being a function of distance alone, *integrated ticketing* typically generalises *journey* value on the basis of pre-defined geographic zones. Furthermore, *integrated ticketing* recognises that a *journey* requiring transfer(s) is not intrinsically more valuable than one not requiring transfer(s). Frequently, though not necessarily, integrated ticketing has been implemented co-dependently with an Automatic Fare Collection system. This provides exact validation data for revenue division between multiple service operators, and aids fraud prevention.

Carriage

Vehicle, a single conveyance (e.g. a bus, tram, ferry or train)

Mode, (collective), a single form or type of *vehicle* (busses, trams, ferries, trains)

Acronyms

AFC, Automatic Fare Collection (see definition above)

DoT, (1989-2003) Department of Transport (now MoT)

GPT, (1992-1995) Government Pricing Tribunal (now IPART)

IPART, (1995-) The (NSW) Independent Pricing and Regulatory Tribunal

ITSRR, (2003-) The (NSW) Independent Transport Safety and Reliability Regulator

MoT, (1981-1989,2003-) Ministry of Transport (Previously Transport Coordination Authority, previously Department of Transport)

PTC, (1973-1980) Public Transport Commission (now State Rail Authority, State Transit Authority, Ministry of Transport, Rail Infrastructure Corporation, Sydney Ferries Corporation etc.)

STA, (1989-) State Transit Authority of NSW, previously Urban Transit Authority, previously Public Transport Commission

SRA, (1981-) State Rail Authority (NSW), previously Public Transport Commission.

TVT, Total Value of Travel study, an ambiguously defined process utilised by the STA and IPART, which seeks to quantify the 'value' of *journeys* undertaken on *integrated tickets* in terms of discrete single *trip* fares. This process yields high claimed 'discounts' which are frequently utilised in IPART, Ministerial and Authority reports.

UTA, (1981-1989) Urban Transit Authority of NSW, (now State Transit Authority)

1. What does integrated ticketing mean?

This may seem a rather trivial question— one of semantics— it is however not in the least bit trivial, for a \$330m New South Wales Government contract has been secured on its basis. My aim here is not to pine over the fraud exacted by the Ministry of Transport (though I hope to convince you that this is a certain fraud), but rather to trace, and to clarify what *integrated ticketing* means. I have sought previously to engage the Ministry on its own terms, and have used in previous papers terms (such as integrated ticketing) in the Ministry’s dynamically-redefined sense. This, I have found, is utterly futile, for it only muddies the water further and defeats any meaningful communication. Ambiguity and obfuscation are no aid to either knowledge or advancement.

In order to temporarily escape the loaded terms associated with this subject, allow me to tentatively define a notion I will describe here as *fried-omelette*. *Fried-omelette* is a public transport ticketing system within which passengers can make *multi-vehicle journeys* (i.e. can transfer) without being charged cumulative *flag-falls*. Essentially, *Fried-omelette* considers passenger *journeys* independently of the number of *vehicle* boardings made within a passenger *journey*.

“Fried-omelette defined

Fried-omelette means a single ticket is available which allows travellers to use the services of all forms of public transport.

Fried-omelette can imply one or more of the following:

- the same fares apply for similar *journeys* on public transport all over Sydney
- the same ticket applies for different modes for the one *journey*
- free transfers are available.”

In 1978 Mr Alan Reiher, Chief Commissioner of the Public Transport Commission (PTC) observed,

“The convenience of interchange between bus, rail and ferry services in respect of fares to be paid is yet another area in which there is room for considerable development. Intermodal ticketing in which users can move freely between the various forms of Government owned transport with the one ticket is being developed by the Commission, the Commuter Council and the Government...”¹

The realisation of the PTC’s desire for intermodal ticketing came in 1979 when the Eastern Suburbs Railway was opened;

“The first Automatic Fare Collection system to be installed in Australia will be in use on the Eastern Suburbs Railway.

As the Eastern Suburbs Railway will be an intermodal bus/rail transport system, the Public Transport Commission is conscious of the need for the introduction of smooth and speedy ticket selling and checking procedures.

These tickets cover bus/rail, rail/bus or rail only journeys...

¹ Alan S Reiher, Chief Commissioner, 16th August 1978, **The Public Transport Commission and the commuter** (seminar), p20.

The Automatic Fare Collection System provides ... the flexibility to accommodate multiple fare structures.”²

Neither of these quotes explicitly states that the aims of the PTC’s *intermodal-ticketing* are the same as those of my *fried-omelette*. It might be argued, on the basis of these quotes, that the PTC was merely aiming to develop a common ticket medium, that their aim was not the abolition of the intrinsic *vehicle-transfer* fare (money) penalty. This however, is clearly not the case. On the matter of implementing the new *intermodal ticketing* system the PTC observed;

“In the main, single journey fares for travel by train, or combined train and bus services will be the same as the existing fares. In a very few cases costs will be reduced, such as on the longer distance intermodal journeys between Dover Heights and Circular Quay.

The present cost of bus travel from Dover Heights to Market Street, Sydney, is 35 cents, and to points beyond Market Street to Circular Quay 45 cents. The combined bus/ rail fare in this case will be 35 cents, which is in line with the general cost of travel taken by rail over similar distances on other lines”³

The point of interest here is that the intermodal system overcame the additional cost of transfer— it eliminated the *flag-fall* for passengers transferring from the bus to the train. The new combine bus-rail fare was no more expensive than the bus fare (alone), which it replaced. In fact, for transferring from bus to train, passengers making the longer (Circular Quay) journey saved 10 cents (22% of their bus fare). This may have been recognition of the inconvenience of changing modes. Mr Reiher spoke of *intermodal* ticketing, that is, ticketing which accommodates modal transfer without a *flag-fall*. Mr Reiher’s *Intermodal ticketing* was a restrictive form of *fried-omelette*.

As a matter of academic propriety, I must concede I plagiarised my definition of *fried-omelette*. The previous definition is in fact IPART’s definition of *integrated ticketing* from §5.3 **Fare Structures for Public Transport**, No.4, March 1996. I did however interpose *fried-omelette* for *integrated ticketing*, and *journey* for *trip*, the latter for purposes of definition clarification (the meaning is unchanged). As it turns out, I agree with IPART’s definition, and will henceforth refer to *fried-omelette* as *integrated ticketing*. Furthermore, as shown here, *intermodal ticketing* and *integrated ticketing* are generally synonymous to one another in NSW Government publications. The distinction I make between *intermodal ticketing* and *integrated ticketing* in my **definitions** will be clarified by example.

The Eastern Suburbs Railway Automatic Fare Collection (ESR AFC) system was very specific; every City bound intermodal journey was defined for ticketing purposes. The ESR AFC only addressed intermodal *journeys* to the City. The ESR did not accommodate general *linked trips* (e.g. Bus: Darling Point to Edgecliff, Train: Edgecliff DOWN Bondi Junction). It drew together some common City *journey* structures, providing point-to-point *intermodal* fares, a very limited form of *integration*. This system was short lived; a more general form of intermodal (or *integrated*) ticketing was required. In 1984 the Urban Transit Authority (successor of the PTC bus and ferry administration wing) stated:

² Public Transport Commission, June 1979, **ESR; Now a reality – Automatic Fare Collection**, p1

³ Public Transport Commission, June 1979, **ESR; Now a reality – Automatic Fare Collection**, p3

“Perhaps the most significant change has been the introduction of the TravelPass system of inter-modal tickets. TravelPass replaced the earlier restricted periodical point to point system. A suitable TravelPass can now be purchased to match travel patterns within all areas served by the Urban Transit Authority”⁴

This TravelPass was a general form of intermodal ticketing, it was an *integrated* ticketing system. Again IPART explains:

“5 FARE INTEGRATION

5.4 Extent of integration in Sydney

At present, integrated ticketing does not apply to cash fares in Sydney. However, the second level of fare integration does exist. Inter-modal travel is possible using TravelPasses on CityRail, Sydney Buses and Sydney Ferry services.”⁵

The meaning of *integrated ticketing* will be made more lucid by contemplating what it is not.

“5.4.1 Non-integrated transport

...

Passengers who undertake multi-modal travel but do not have access to integrated ticketing include:

1. **STA bus passenger paying cash fares or using TravelTens** (about 79 million trips per annum) who have to pay an additional fare if their journey involves transfers between busses
2. **STA ferry cash fare or FerryTen passengers** (about 6 million trips per annum) who have to pay the fixed component of the fare on any feeder bus.
3. **CityRail cash fare passengers** (about 39 million trips per annum) using bus feeders.”⁶

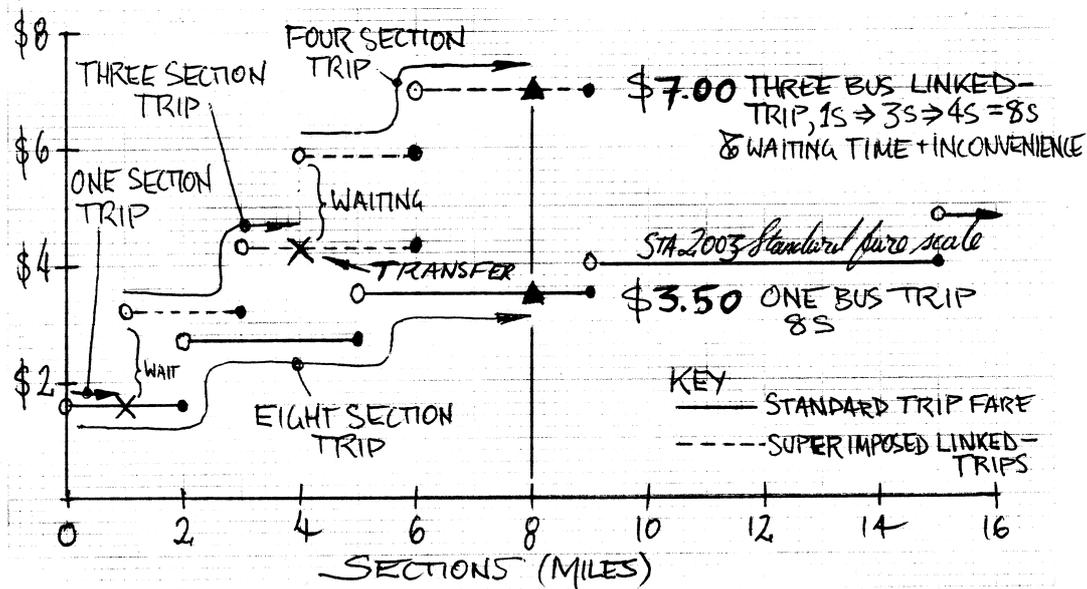
There are some very important, though not immediately apparent, observations above on why the listed fare types are not integrated. Point one implies that there is some penalty intrinsic in these fares that affects transfers. If fares were charged linearly with respect to distance, and if there were no *flag-fall*, there would be no financial disincentive, and the payment of the additional fare would not represent non-integration. Therefore it is implied as understood that a *flag-fall* exists on cash fares and TravelTens. **Figure 1** shows the combined effect of the Sydney Buses regressive fare structure and hidden *flag-fall* on *linked* and *chained trips*. Point two refers to the fixed component of a feeder-bus fare, again alluding to the *flag-fall* that is paid. Point three, notably unlike point one, does not list transfers between trains as non-integrated; this is because the Railways, unlike busses and ferries, are a closed-system. In a closed system a passenger purchases a ticket between an origin and a destination, price being a function of distance alone, taking no account of the number of vehicles boarded.

⁴ Urban Transit Authority, 1983-1984 Annual Report, p18

⁵ IPART, March 1996, **An Inquiry into Pricing of Public Passenger Transport Services, Fare Structures for Public Transport, Transport Interim Report No 4**, p27

⁶ IPART, March 1996, **An Inquiry into Pricing of Public Passenger Transport Services, Fare Structures for Public Transport, Transport Interim Report No 4**, p29

FIG 1: Distance versus price comparison for two non-integrated 8 section journeys on Sydney Buses. The lower is a single 8 section trip, the upper one 1 section trip, one three section trip, and one four section trip.



IPART made clear the reasons for *integrated ticketing*:

“5.2 Purpose of integration

The purpose of integrated ticketing is to make the public transport system more attractive to customers, and more effective at meeting customers’ demands. Patronage can be increased by offering customers increased flexibility, convenience and accessibility.... This means that integrated ticketing needs to be ... applicable across the whole network.”⁷

i.e. *integrated ticketing* needed to be made applicable across the whole network, not restricted to Government only TravelPass zones. Indeed the beneficiaries of Sydney-wide integrated ticketing would be those in the west, not served by the Government bus and ferry system and not able to use the TravelPass system. IPART stated;

“5.4.2 Beneficiaries of further integrated ticketing

The main beneficiaries of the extension of public transport ticketing in Sydney would be travellers originating on the private bus network who wish to transfer to CityRail services, and who presently pay a full private bus fare in addition to either:

- a discounted rail season ticket (commuters)
- a rail off peak...”⁸

⁷ IPART, March 1996, *An Inquiry into Pricing of Public Passenger Transport Services, Fare Structures for Public Transport, Transport Interim Report No 4*, p27

⁸ IPART, March 1996, *An Inquiry into Pricing of Public Passenger Transport Services, Fare Structures for Public Transport, Transport Interim Report No 4*, p29

One of the most important implications of integrated ticketing is revenue sharing between operators, enabling this inter-modal transfer without a *flag-fall*. IPART further observes:

“5.5.1 Issues of revenue division

One of the primary issues in the provision of integrated ticketing is the need for an appropriate agreement for the division of ticketing revenue amongst the various operators. This is an important prerequisite in establishing any integrated fare system.”⁹

In 1999 the Department of Transport took the first steps towards the Sydney wide introduction of integrated ticketing. The direction of the integrated ticketing project seemed faithful to the then understood notion of expanding *integrated ticketing*. The Department of Transport stated:

“ ‘*Action for Transport* outlined our plan to deliver integrated ticketing to the public transport system by 2003 and I’m delighted the project has taken another step forward,’ Mr Scully said. ‘A fully integrated ticketing system will be especially welcome for commuters in Western Sydney and the Illawarra region, who often have to buy more than one ticket for a combined private bus and CityRail journey to the Sydney or Parramatta CBD,’ Mr Scully said.”¹⁰

The imperative of *integrated ticketing* was still clear in July 1999. Passengers in the West and Illawarra served by private bus services, who currently had to buy multiple *trip* tickets each incurring cumulative *flag-falls* (without the option of the TravelPass), would be benefited by extension of integration—benefited by the elimination of discrete *trip* fares embodying discrete *flag-falls*. There was a new buzzword associated with integrated ticketing, ‘SmartCard’. In 1999 it was unclear that this seemingly innocuous techno-babble was about to become the mother of all technological panacea.

As if prophesising the fraud that was to unfold over the next eight years IPART had remarked previously;

“Smart cards are not a substitute for ticket integration, but are a convenient way of buying tickets. It would not be acceptable for fares to be deducted from the stored value as travel was taken. Unless the rider had a good knowledge of the fare structures, there would be no way of knowing the price of the journey before setting out.”¹¹

By August 2001, something seemed to be going awry. The Department press release, “integrated ticketing a step closer” suggests, contrary to all previous assertions, that the primary concern of integrated ticketing is convenience of buying tickets, the convenience of the fare medium:

⁹ IPART, March 1996, **An Inquiry into Pricing of Public Passenger Transport Services, Fare Structures for Public Transport, Transport Interim Report No 4**, p29

¹⁰ Department of Transport media release, **integrated ticketing – shortlist announced**, 17/7/1999

¹¹ IPART, March 1996, **An Inquiry into Pricing of Public Passenger Transport Services, Fare Structures for Public Transport, Transport Interim Report No 4**, p33

“A key benefit of having just one ticket for all forms of public transport, both public and private, will be that instead of queuing up for a ticket, your preferred fare can be automatically loaded onto your smart card when it is required”¹²

Nowhere in the press release is there even an illusion to the purpose of ticket *integration*. Gone are the references to benefiting private bus users; gone is the concept of zone-based revenue sharing. Gone is the fundamental principle of *integration*: that a *journey's* worth is a function of its origin and destination, rather than the number of *vehicle* boardings. Suddenly the Ministry flipped *integrated ticketing* on its head; it looked like integrated ticketing without the *integrated ticketing*. This supposition was however supported by implication only, there was at this time no explicit statement confirming that the ‘integrated ticketing’ project had nothing to do with *integrated ticketing*.

In April 2003, at about the time integrated ticketing was meant to be implemented on the original time-scale, the Transport Coordination Authority released two brochures.

“Setting fares is not part of this project. The statutory Independent Pricing and Regulatory Tribunal makes determinations and recommendations on fare levels.”¹³
“The SmartCard will accommodate the existing fare structures and ticketing products.”¹⁴

The notion I described as *fried-omelette*, which had been described as *integrated ticketing* by the Department of Transport and IPART, was conspicuously absent. The DoT/ MoT offloaded responsibility for fares to IPART, while devising a \$330m contract specification with no regard for key integration recommendations of IPART’s 1996 major Inquiry. As if hoping that nobody would notice, the Department was now presenting the integrated ticketing project as a technological rather than a planning solution. The very basis upon which the contract had been sold to the people of New South Wales was a fraud.

Worse was yet to come. Not only had the ‘integrated ticketing’ project divorced itself of *integrated ticketing* in the shadow of an electronic nostrum, the process of developing revenue sharing mechanisms, the process of expanding *integrated ticketing*, had been actively stalled. Mr Paul Dunn, the STA’s General Manager Finance and Business services, stated at the 2003 Hearing:

“...we took a conscious decision some several years ago now to put on hold any further product development because the integrated ticketing project was imminent.”¹⁵

The MoT further conceded that the project was not to bring *integrated ticketing*:

“The SmartCard can adjust to various fare structures, and may provide future opportunities to review [fare structures] across the transport system.”¹⁶

¹² Ministry of Transport media release, **integrated ticketing a step closer**, 12/8/2001

¹³ Transport Coordination Authority brochure, **v8 TRA001 Smart Card Q&A**, 10/4/2003

¹⁴ Transport Coordination Authority brochure, **TRA001 SmartCard F/ART**, 10/4/2003

¹⁵ IPART, 3/7/2003, **PUBLIC HEARINGS INTO PUBLIC TRANSPORT FARE DETERMINATION (transcript)**, L22-31, p36

Clarifying the new definition of ‘integrated ticketing’, and confirming my hypothesis, the State Transit Authority 2002 annual report had explained;

“The purpose of the Integrated Ticketing project is to introduce a smartcard ticketing system within the greater Sydney metropolitan area, across rail, bus, ferry, light-rail and monorail transport services. The system will provide a common fare medium...”¹⁷

On the 6th of May 2003, Mr Paul Armstrong, Director of the integrated ticketing project, explained to the Institution of Engineers the purpose of the project. He stated that the Ministry of Transport’s (MoT’s) ‘integrated ticketing’ project was concerned only with the ticketing medium, not with fare structures. He drew a strange distinction between ‘integrated ticketing’ and ‘integrated fares’, as if the means (fare collection system) was now independent of the end (fare structures). This bizarre new distinction was clarified in the 2003 Ministerial Inquiry Final Report Appendix C.

One may have expected, commensurate with its pricing policy review capacity described in the **IPART Act (1992)** §5.11(b), that IPART would express formal concern over this hijacking of the integrated ticketing concept. It is IPART’s responsibility to investigate pricing policies. IPART had consistently recommended *integrated ticketing*, and better directed spending, and yet it expressed no concern for a \$330m contract that fails to deliver the very thing it was commissioned to accomplish.

The redefinition was complete, integrated ticketing was now offloaded to technocrats on the other side of a firewall, no management effort required. Sydney is to get an ‘integrated ticketing system’ that has nothing to do with *integrated ticketing*. The redefinition is demonstrated by comparison of these statements:

BEFORE

1996, IPART:

“Passengers who undertake multi-modal travel but do not have access to integrated ticketing include STA bus passenger paying cash fares or using TravelTens”

“Smart cards are not a substitute for ticket integration, but are a convenient way of buying tickets.”

AFTER

2002, STA:

“The purpose of the Integrated Ticketing project is to introduce a smartcard ticketing system”

“In a smart card system on our busses I would be looking at the smart-card fare being essentially what is now the TravelTen fare”¹⁸

2003, Parry Inquiry:

“integrated ticketing [definition:] The use of a single stored value card to purchase travel (referred to as the ‘smart card’)”¹⁹

¹⁶ Transport Coordination Authority brochure, v8 **TRA001 Smart Card Q&A**, 10/4/2003

¹⁷ State Transit Authority, **Annual Report 2001-02**, p31

¹⁸ IPART, 10/5/2002, **Transcript, Public Hearing Into Public Transport**, L40-42, p7

“The Inquiry believes STA needs to develop a simpler bus ticket regime, and one that is better attuned to the prospect of ‘smart cards’ ...[a] rationalised TravelTen discount is desirable”²⁰

George Orwell’s MoT (Ministry of Truth) would have been proud.

But something worse had been happening to Sydney’s fare structures.

¹⁹ Prof T Parry, December 2003, **Ministerial Inquiry Into Sustainable Transport In New South Wales**, Appendix C, glossary. Strangely, he thought it important to (re)define this term even though it doesn’t appear in his text.

²⁰ Prof T Parry, December 2003, **Ministerial Inquiry Into Sustainable Transport In New South Wales**, 6.3.1, p59

2 The plight of TravelPass integrated ticketing

State Transit had substantial experience with integrated ticketing. From its inception in 1984, the TravelPass system experienced tremendous growth;

“The continuing trend towards weekly, quarterly and yearly intermodal Travelpass tickets evident again this year is most encouraging. Travelpass tickets now account for 24% of total passenger journeys, an increase of 9% over the previous year”²¹

Throughout the late 1980s the growth continued;

“The sale of TravelPass continued to grow and now represents 25.6 per cent of total passenger revenue”²²

In 1989, and again in 1990, State Transit stated that this highly successful system of integrated ticketing would replace section based fares upon the implementation of Sydney’s first widespread electronic bus ticketing system (Green Machine/ STATS):

“TravelPass, pensioners tickets and [school] student tickets already give travel by time rather than distance and MetroTen travel will be made even more convenient by also making these tickets time-based – available in easy to understand zones rather than for a number of sections on the one route at present.”²³

This system was applied to the Newcastle network as a trial but, for reasons that have never been stated, was not implemented throughout the Sydney network. There are several reasons why this may have been the case, but the most eligible seems State Transit’s inability to effectively model the worth of the commodity it provided— the passenger *journey*. Coincident with the formation of the Government Pricing Tribunal (GPT) came a desire to quantitatively assess how the pricing of fare types related to the commodity. It appears that defining the commodity was the problem. It is easy to define passenger *trips* in a non-integrated pricing framework, and difficult to define *journeys* in an integrated pricing framework. In 1995 the Government Pricing Tribunal (GPT) observed:

“The TravelPass ticket recovers a low proportion of the costs of providing the service. However the ticket is very popular with commuters and provides one of the few integrated tickets for Sydney commuters. The level of discount is difficult to estimate.”²⁴

In the absolute terms of a viable commercial business, all Sydney transport fares recover a low proportion of the costs of providing the services. The GPT’s statement therefore implies relativity, that the TravelPass tickets recover a low proportion of costs compared to cash *trip* fares. This is indeed self evident, and arose from planning policy of the State Transit Authority, stated in its Corporate Plan six years earlier:

²¹ UTA, **Annual Report 1985/86**, p22.

²² UTA, **1987-88 Annual Report**, p12

²³ STA, **1988-89 Annual Report**, p12 **AND** STA, **1989-90 Annual Report**, p39

²⁴ GPT, June 1995, **Public Transport Fares Determinations Nos 5 and 6**, p12

“Continued emphasis on pre-sold and multi-trip tickets is designed to speed up services, reduce costs and discourage fare evasion.”²⁵

That is, it was purposeful design that passengers be encourage away from the inefficient cash fare toward the weekly loyalty based integrated TravelPass. Accordingly, cash fares were priced higher, and accordingly one would expect cash fares to provide relatively better cost-recovery. Indeed, one would have expected price signals consistent with the STA’s corporate plan “emphasis”. Rather than observe that this reality was a manifestation of planning design, the GPT goes on to state that there is a discount on the TravelPass, relative to cash fares, and for this reason “The Tribunal considers a modest increase in TravelPass prices is appropriate”. For the second year in a row, STA bus cash fares had been frozen while TravelPass fares were increased. The GPT failed to acknowledge the role of planning policy. More disturbingly, the GPT seemed to imply that some direct comparison could be made between *zone journey* fares and *distance trip* fares; that some discount was measurable by comparing two different commodities. The following year the GPT was to have a major Inquiry into fare structures, and was to familiarise itself with the passenger transport pricing environment.

The 1996 major Inquiry of IPART (new name for GPT) into transport fares is the only comprehensive body of research on revenue collection for Sydney public transport. This Inquiry recognised the TravelPass as Sydney’s only commuter integrated ticketing (as discussed in section 1), and recognised the need for extension of TravelPass style zone fares throughout the metropolitan area and revenue sharing to this end²⁶;

“5.7 Practical integrated ticketing would require zone fares

Practical integrated ticketing for periodical tickets, multi-ride tickets and cash fares requires zone fares.”²⁷

There was however a disturbing development evident in this Inquiry. The STA had abandoned the aim of *integrated ticketing* and of reducing burdensome cash fare usage:

“In its submission, STA recommends the following changes to its fares:

...

- The high discounts available on TravelPass, and to a lesser extent, TravelTen and FerryTen should be reduced to the level of 15% over time (any increase should be implemented over a period of five years).
- The (real) price of single ride fares should be reduced by leaving them unchanged over a period of time”²⁸

The STA, in a dramatic departure from ten years of planning, now endorsed the notion expressed by the GPT in 1995, that the TravelPass embodied some measurable

²⁵ STA, **Annual Report 1988-89 Corporate Plan**, p12

²⁶ IPART, March 1996, **An Inquiry into Pricing of Public Passenger Transport Services, Fare Structures for Public Transport, Transport Interim Report No 4, §5 FARE INTEGRATION**

²⁷ IPART, March 1996, **An Inquiry into Pricing of Public Passenger Transport Services, Fare Structures for Public Transport, Transport Interim Report No 4**, p32

²⁸ IPART, March 1996, **An Inquiry into Pricing of Public Passenger Transport Services, Fare Structures for Public Transport, Transport Interim Report No 4**, p21

discount from discrete cash fares, and that this ‘discount’ should be some how linked to the price of discrete *trip* fares. The STA’s desire to reverse the policy of “emphasis on pre-sold and multi-trip tickets” is not explained, was contrary to the Department’s integration policy, and seemed entirely incoherent. The more important observation of the STA’s submission is that it now viewed TravelPass tickets as some form of discount ticket, which were to be priced with a 15% discount relative to the single cash fare. The STA, as the GPT had in 1995, was suggesting that two different commodities, the *trip* and the *journey* could be linked by a discount constant.

IPART received the STA’s submission with a level of disagreement:

“...the Tribunal is not convinced that discounts on TravelPass and TravelTen tickets need to be reduced and standardised to a 15% discount on the equivalent cost of travelling on cash fares.”²⁹

While IPART did not endorse the reduction of the extent of the ‘discount’, it accepted the STA’s terms, it confirmed the viewpoint of the GPT expressed in 1995 that the TravelPass ticket embodies a measurable discount from discrete trip fares. Over the coming years this ill-conceived policy was to undermine the Major Inquiry’s endorsement of expansion of zone-based integrated ticketing.

In accordance with the desire of the STA and IPART to quantify the relative ‘discount’ represented in TravelPass tickets, the STA developed the Total Value of Travel (TVT) study.

“STA has recently undertaken a total value of travel (TVT) study to measure the average value of travel consumed by TravelPass customers and the subsequent average discount on these tickets. Unlike TravelTens the accurate estimation of TravelPass discounts has previously been difficult as methods of assessing TravelPass usage were more arbitrary. The conversion of TravelPasses to magnetic stripe tickets enabled the TVT study to utilise ‘green machine’ and ferry ticket validation data to enhance accuracy. These and future TVT results will be used by the Tribunal to assist in fare determinations.”³⁰

The TVT process fails to take account of some fairly basic, and vitally important principles. A *journey*, in the case of TravelPass users, is invariably composed of multiple *trips*. The TravelPass recognises that the value of a *journey* is not a function of the number of *trips* made, whether arising from a *chained trips* or a *linked trips*. Furthermore, of all the people *journeys* that may be made in any metropolitan area, particularly in the case of dispersed land-use, very few can be executed origin-to-destination by a single public transport *trip*. The vast majority of people *journeys*, if made by public transport, require multiple *trips*.

Intrinsically, a *trip* fare recognises the *trip* as the commodity, by virtue of the *flag-fall*. There are other costs associated with undertaking a multi-modal *journey* such as time lost in waiting between *trips*, inconvenience of changing *vehicles* and exposure to inclement weather. The TravelPass is characterised by flexibility and

²⁹ IPART, March 1996, **An Inquiry into Pricing of Public Passenger Transport Services, Fare Structures for Public Transport, Transport Interim Report No 4**, p22

³⁰ IPART, May 1997, **Public Transport Fares Report No 2**, p20

invites loyalty, encouraging evening and weekend use when marginal costs are the main burden on the operators. These ancillary *journeys* should not be seen as a burden upon the system, rather as an intrinsic by-product of a fare system that encourages use in the evenings and on weekends. Measuring the comparative discrete cash fare value of whimsical *journey* breakages (*chained trips*), that were only made by virtue of the TravelPass structure, is completely meaningless and bares no relation to operating cost or cost recovery. The cost of providing a *journey* and the worth of a *journey* are therefore affected by several variables. **Appendix 2** suggests ways in which these might be modelled.

Yet Sydney's transport administration, and its policy supremos remain steadfastly oblivious to these most basic considerations. This strange TVT rationale is apt to degenerative circularity, so obviously self-destructive (Figure 2.1), one might surmise that the authorities seek to destroy Sydney's *integrated ticketing*.

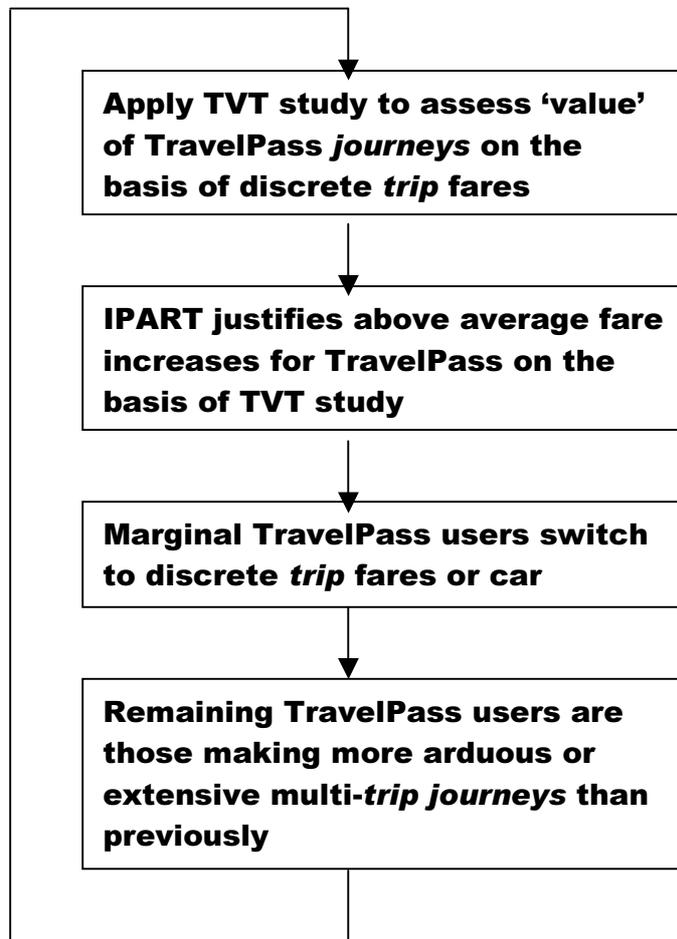


Fig 2.1, Degenerative cycle of TVT studies

In order that the ‘discounts’, determined by the TVT process, be reduced, TravelPass fare increases above average are justified by IPART in 1997:

“Clearly, the Red and Green TravelPasses have high discounts and could reasonably increase”³¹

in 1998:

“The TVT analysis illustrates that high average discounts prevail on all TravelPasses which provides justification for modest fare rises. The Tribunal considers that a \$1 increase in all TravelPasses is both affordable and will assist in discount reductions. The TVT analysis illustrates that all TravelPasses will continue to represent excellent value”³²

in 1999:

“The TVT analysis illustrates that high average discounts prevail on all TravelPasses which provides justification for modest fare rises. The Tribunal considers that a \$3.00 to \$4.00 [greater than 10%] increase in all TravelPasses is affordable and will assist in reducing the high discount. The TVT analysis illustrates that all TravelPasses will continue to represent excellent value”³³

The resulting TravelPass fare increases are shown in **Figure 2.2**. Raw data and additional explanation may be found in **Appendix 1**. While Figure 2.2 shows clearly the massive discrepancy of fare increases (e.g. in 1999 Blue TravelPass increased at a rate about 15 times greater than inflation), it fails to convey the cumulative effect of increases. Importantly, over any time period one contemplates the change in price of a commodity, annual increases early in that period have a flow on effect. That is, the hugely disproportionate TravelPass fare increases of 1997, 1998 and 1999 have an immense effect on the overall pricing path of 1995-6 to 2003-4. **Figure 2.3** shows the Per Cent change in price of fares from 1995. The two most common integrated tickets, the Red TravelPass and Blue TravelPass, have inflated around three times CPI. It is these increases, arising from the application of circularly degenerative pricing rationale, that have thwarted IPART’s 1996 proposition of Sydney-wide *integrated* ticketing.

There is an important assumption I have made in my critical modelling of the TVT analysis and the ensuing hyperinflation of TravelPasses. That assumption is that TravelPass demand is price elastic; that demand is sensitive to price increases. Furthermore, it is assumed that a cross-elasticity exists between *integrated* and *non-integrated* fares. This is the basis of box three in the flowchart (fig 2.1).

³¹ IPART, May 1997, **Public Transport Fares Report No 1**, p21

³² IPART, June 1998, **Public Transport Fares Report No 2**, p29

³³ IPART, July 1999, **Public Transport Fares Report No 4**, p27

Fig 2.2:PerCent increase, year-to-year

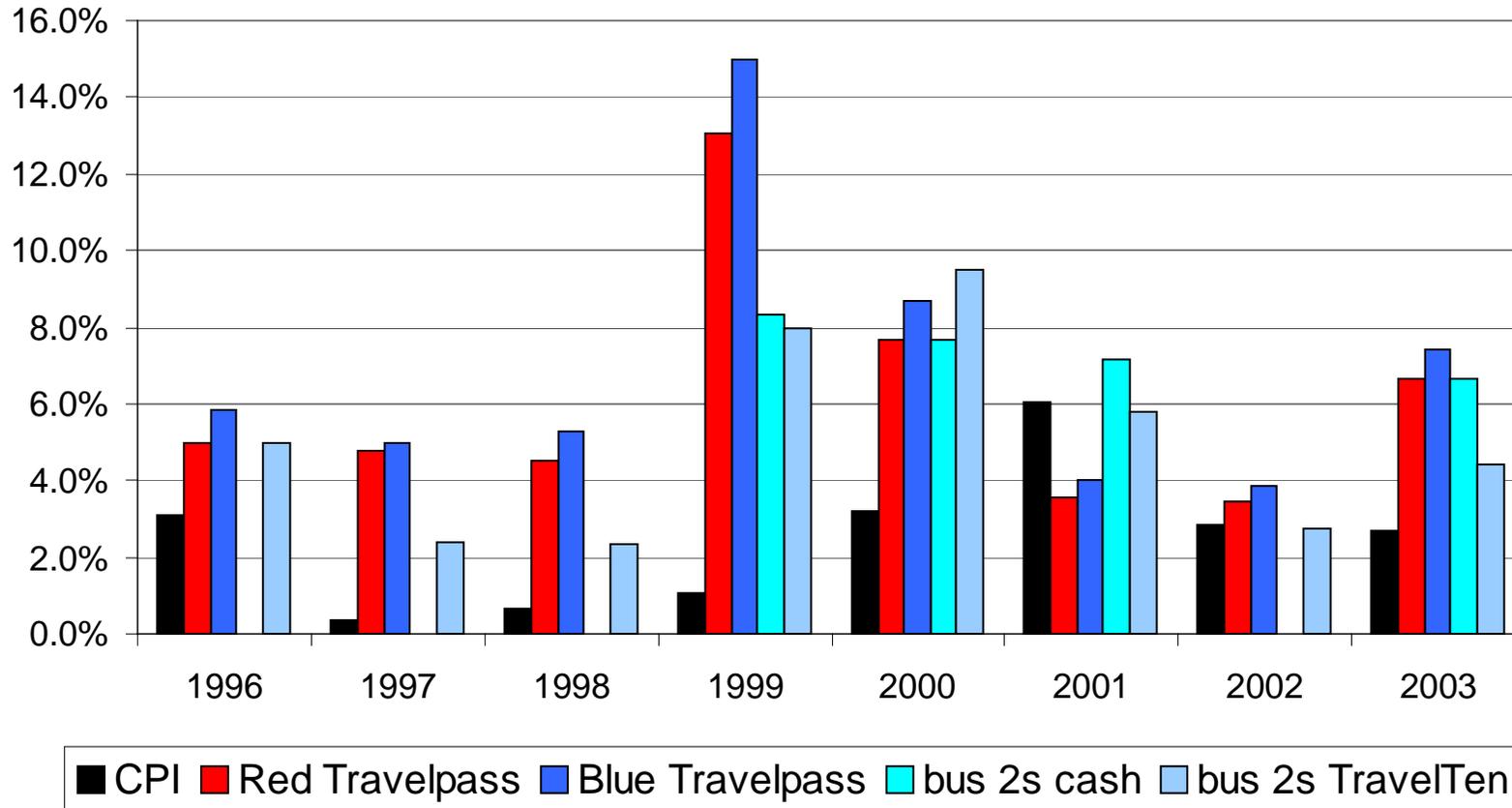
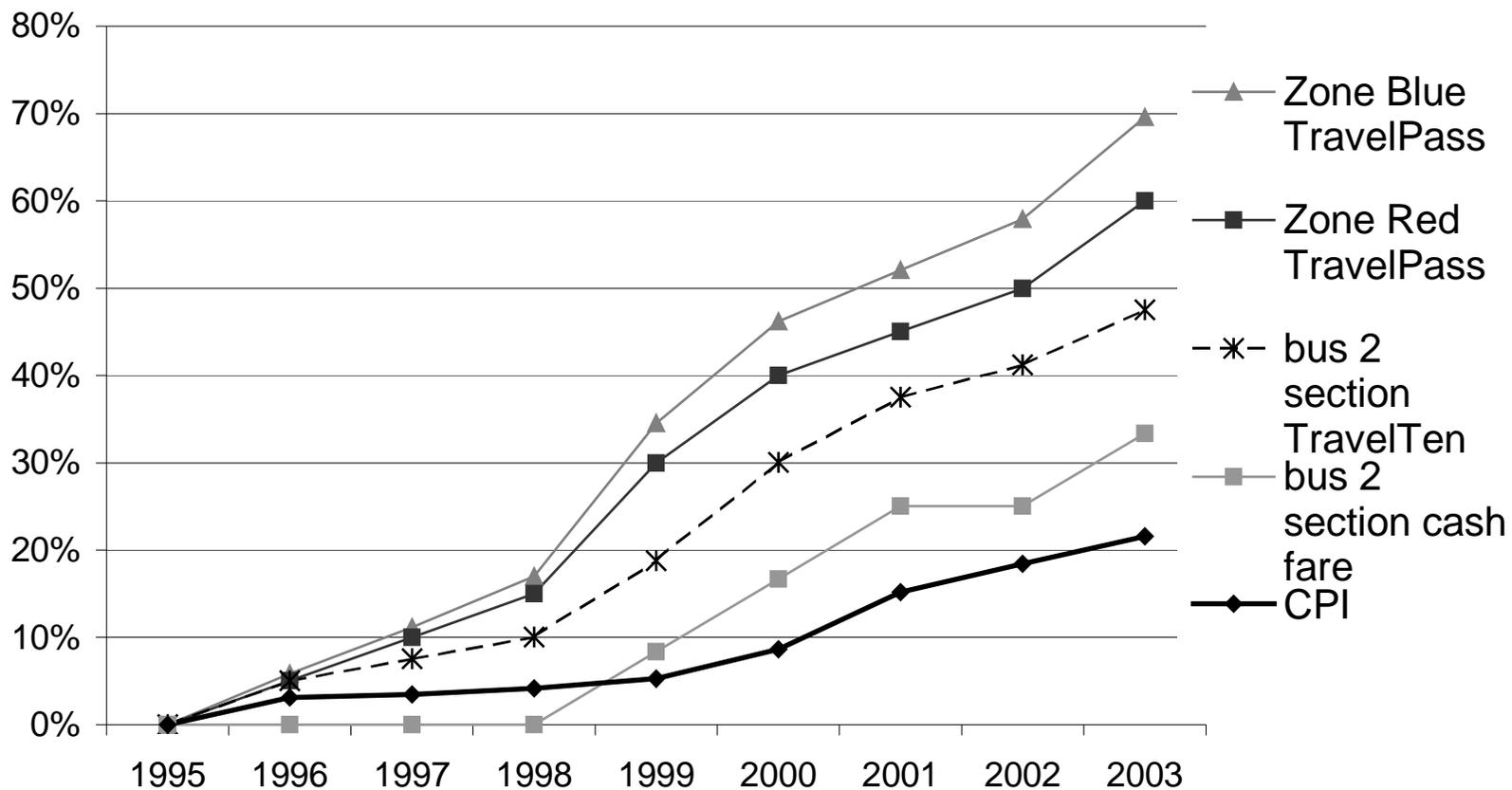


Fig 2.3: TravelPass and Sydney Buses 2 section trip fares, PerCent Increase since 1995



It may well be, some might argue, that there is a willingness to pay for this lavish *integrated ticketing* access to the public transport system, that some people derive such pleasure from changing and waiting between services, they might do it all day. If anyone were likely to put such an argument, it surely would have been in the late 1990s at the time of huge TravelPass fare increases. The highly discounted indulgence uncovered by the 1999 TVT study had to be countered with ‘modest’³⁴ fare increases. Given that TravelPasses would “continue to represent excellent value”, despite having outstripped inflation by six times over the four years prior, IPART must have know that TravelPass demand was highly inelastic. A price inelastic demand would surely corroborate the STA’s repeated claims that TravelPasses were “heavily discounted” and “excellent value”.

This however is not the case. The claim arising from the flawed TVT study, that TravelPasses represented “excessive discounts”, was contrary to IPART’s 1996 Major Inquiry findings on price elasticity of demand. In the report **Estimation of Public Transport Fare Elasticities in the Sydney Region** (IPART October 1996), the direct price elasticity of demand by fare type was presented (p23):

Direct elasticities for bus fares

Ticket type	Elasticity
Single	-0.078
TravelTen	-0.383
Bus travel on Bus/Ferry TravelPass	-0.813
Bus travel on Bus/Train/Ferry TravelPass	-0.822

(Source: Hensher and Raimond, *Evaluation of Fare Elasticities for the Sydney Region*, March 1996.)

It was known to IPART that for Sydney Buses services demand for TravelPass fares was above ten times more sensitive to price increase than cash fares. IPART stated:

“This has interesting implications for fares policy. For example, increasing the price of a single ticket offers higher revenue growth prospects with smaller losses of patronage than is the case for similar percentage increases in weekly tickets, TravelPasses, TravelTens and multi-modal tickets.”³⁵

“The price of the multi-ride fare should be set in relation to the core nature of this ticket type- that is the ticket used by the large group of users of the Sydney Bus system – regular commuters. This is consistent with Government transport policy which, among other things, is concerned with providing public transport services for commuters rather than excessive reliance on private motor vehicles.”³⁶

i.e., for any given percentage increase in fare, IPART understood that ten times as many travellers would be lost from zone TravelPass fares than from cash fares. My

³⁴ I use ‘modest’ here in IPART’s sense from their description of Blue TravelPass increases in 1999, meaning exceeding annual inflation by 15 times.

³⁵ IPART, October 1996, **Estimation of Public Transport Fare Elasticities in the Sydney Region, Research Paper No 7**, p22

³⁶ IPART, March 1996, **An Inquiry into Pricing of Public Passenger Transport Services, Buses and Ferries, Transport Interim Report No 2**, p29

previous assumption for fig 2.1 box three, that TravelPass fares are elastic, is therefore wholly justified.

It should have been evident that there was a contradiction between customers' actions (represented in direct elasticity) and the STA's claims (arising from the TVT). That is, passengers' sensitivity to TravelPass price increases, being ten times greater than cash fare sensitivity, indicates that passengers considered TravelPass value as being far more marginal than cash fare value.

With a comparable elasticity by fare type for rail services³⁷, it should have been obvious that TravelPass patronage was prone to loss either to cars, or to the *trip* based non-integrated fares. Consistent with IPART's recommendation of expansion of zone-based *integrated ticketing*, and with the Transport Minister's 1999 endorsement of expansion of *integrated ticketing*, one may have expected IPART would pursue a pricing path maintaining relativities (at the very least) between *integrated* and *non-integrated* fares.

Instead it is found that over the course of the three years following the 1996 findings and recommendations, IPART endorsed the STA's request for TravelPass price increases up to and above four times greater than cash single fares. IPART defended these massively disproportionate increases claiming in 1999 that TravelPasses would "continue to represent excellent value". This assertion was clearly contradicted by the elasticity figures. A chasm was formed between *integrated* and *non-integrated* pricing paths, apparently solely on the basis of the STA's TVT analysis.

Strangely, by 2002 the STA was claiming that;

"Economic efficiency considerations suggest that fare increases should be skewed towards (price inelastic) commuter-oriented products, specifically the TravelTen and TravelPass."³⁸

As the STA characteristically presents no meaningful data (in this case no data at all) to support its claim, one is lead to imagine that they misread their table of elasticities. If the STA believes that the ratio of direct elasticity of TravelPasses/cash singles .822/.078 determined in 1996 had reversed over the six years to 2002, then that would be an extraordinary development they may like to draw to IPART's attention. In the absence of evidence to sustain its claim, and in light of its massive divergence from the extensive 1996 Institute of Transport Studies research, it seems the STA got it wrong.

As the STA has not presented relevant³⁹ operations statistics to the public record for some years, it is not known whether the 1996 elasticity figures proved to be accurate. Irrespective of whether the elasticity figures continue to hold eight years later, the fact remains these figures, at the time of reporting, contradicted the STA's

³⁷ elasticity for rail single -0.08 cf. TravelPass -0.529 IPART, October 1996, **Estimation of Public Transport Fare Elasticities in the Sydney Region, Research Paper No 7**, table 12, p22

³⁸ STA, March 2002, **IPART SUBMISSION 2002/03**, 2.1, p6

³⁹ Statistics that I consider useful are of the quantitative un-massaged form such as revenue by fare type and total boardings break-down by fare type by financial year

claims. The fact remains that the TVT study, provided by the monopolising service operator, is a self-destructive circularly degenerative process. The fact remains that disproportionate TravelPass increases, justified on the STA's TVT claims, have destroyed the incentive relativities for *integrated ticketing* and have alienated the vast majority of Sydney travellers who do not have direct single *vehicle* services between their origin and destination. The magnitude of the divergence is clearly evident in figure 2.3.

The outlandish fare increases of Sydney's TravelPass *integrated ticketing* is not confined to the late 1990s. After a brief respite in 2001 and 2002, IPART again endorsed massively disproportionate TravelPass increases in 2003. Despite expressed demands from several submissions that TravelPass fares not increase, IPART granted increases of the two core TravelPass fares more than doubling inflation in that year. IPART's justification for the 2003 increase is particularly unclear, given not only that they failed to answer criticisms of the TVT, but also given that the STA⁴⁰ did not even attempt to demonstrate a maintenance in service quality (let alone an improvement);

“STA's submission for Sydney Buses provided an historical table of KPIs (key performance indicators) which generally show good performance, but no data for 2002/03 was presented.”⁴¹

While there is no explanation in the 2003 IPART report as to why above average TravelPass fare increases were endorsed, it seemed in all likelihood that the TVT study was lurking in the shadows. Perhaps in response to criticism of the process in submissions, the 2003 IPART report for the first time since 1997 makes no mention of the TVT study, or its influence on the determination. Furthermore, reference to, and the TVT study itself, were absent from the STA's submission to IPART. Was it possible that IPART had responded to my 2002 criticism of the TVT process, by having a quiet word to the STA and dropping TVT studies? This may have been a possibility, until the Parry Interim Ministerial-inquiry Paper (PIMP) was released.

Amongst the multitude of references to discounts, the PIMP reproduced a chart showing “Effective average discount from standard single fare”⁴². Expectedly, in the name of Sustainable Transport, the PIMP relied on the TVT study, in all but name, to support the argument for increased fares cf. ‘sustainable funding’. What was unexpected was the source; “Source: STA data provided to IPART, July 2003”. The STA **had** presented the TVT study to IPART in 2003, but neither the STA nor IPART had mentioned it. Perhaps it was submitted after the Public Hearing, together with the accolades of the ‘independent customer satisfaction survey’. Why the STA declined to present the TVT study in its submission to IPART, and why IPART neglected to mention the TVT study in the 2003 Determination, while granting disproportionate TravelPass increases commensurate with the 2003 TVT claims, is best known to

⁴⁰ Though Red TravelPass pricing is also affected by CityRail considerations, price increases have been driven by STA interests. The Blue TravelPass is exclusively for STA services (soon to be STA Sydney Buses and Sydney Ferries Corp.)

⁴¹ IPART, August 2003, **Report on the Determination of NSW Public Transport Fares, Cityrail and State Transit Authority, Determinations 5 and 6**, p3, 4.2.3

⁴² Prof Parry/ Ministry of Transport, August 2003, **Ministerial Inquiry into Sustainable Transport in New South Wales Interim Report**, table 6.4 p89

them. IPART may well have responded in 2003 to my 2002 criticism of the TVT process by dropping it – from public scrutiny.

In summary, IPART's readiness to ignore its own research in support of the Government agencies, and IPART's failure to criticise the Ministry's incompetent derailing of the 'integrated ticketing' project, have completely subverted the course towards *integrated ticketing*. This in turn has undoubtedly stifled public transport (particularly private bus use), and has undermined it for many years to come. There exists extreme disagreement between research presented by IPART, and the STA's unsubstantiated claims. Furthermore, the notion of directly comparing 'value' of *integrated* tickets with non-*integrated* tickets, whether one calls it TVT or otherwise, fails to take account of fundamental variables affecting the worth of the *journey* commodity, and is prone to destructive retrogression.

My hypothesis that the TVT study is circularly degenerative is sustained ironically by the STA's own figures. Referring to **Figure 2.1**, irrespective of how much a TravelPass price is increased above inflation, up to the limit where only one passenger remains, and assuming that passengers choose the cheapest fare product, there always remains a marginal user, who always received a limiting 'discount'. i.e. if a passenger uses a TravelPass because it is cheaper than discrete fares, it self evidently recovers less cost than the discrete fares would. There will always exist a limiting 'discount' arising from the additional general costs of a multi-vehicle *journey*; loss of time to waiting and transferring that exists in this limiting case.⁴³ At any 'discount' less than the limiting 'discount', passengers will always be lost. This limiting 'discount' is not known, but it is probably higher than 40% for the core Red and Blue TravelPasses, as use has historically declined in periods of TVT 40% discount. In anything up to the limiting case of the last marginal passenger, chasing a TVT average 'discount' aim less than the limiting 'discount' is futile. The market reacts to the according disproportionate TravelPass fare increase (marginal users leave), a new equilibrium is found, and the 'discount' resolutely refuses to fall below the limiting 'discount'.

Blue TravelPasses were stated as having a TVT 'discount' of 36% in 1996. Over the next 7 years, Blue TravelPass fares increased 60.2%, the comparable single fares (2 and 5 sections) increased 33% and 8%, and CPI increased 18%⁴⁴. The usage of TravelPasses on buses declined from 22.4% in 1996 to 19.5% in 2002⁴⁵. Consistent with the methodology of IPART and the PIMP, Blue TravelPass increases between two and seven times greater than cash singles may have been expected to fix up those 'excessive discounts'. Instead the 2003 TVT study shows a Blue TravelPass 'discount' of 42.8%⁴⁶ — surprise! The 'discount' had gone up.

⁴³ This limiting 'discount' will vary depending on the form of inter-modal *journeys* in a given geographic zone, and among other things, it is a complex function of geographical distribution of land-use, and *journey* coincidence with established trunk routes. Also see **Appendix Two**

⁴⁴ These figures are readily calculated from **Appendix One** as percentage differences between years.

⁴⁵ While these figures represent the percentage validations of all TravelPasses, Red and Blue TravelPasses dominate these validations. Furthermore, the TVT rationale is applied to all TravelPasses. Figures from STA, 2002, **Submission to IPART, APPENDIX C**, Sydney Buses boarding profiles.

⁴⁶ Prof Parry/ Ministry of Transport, August 2003, **Ministerial Inquiry into Sustainable Transport in New South Wales Interim Report**, table 6.4 p89

Any analysis which aims to set integrated fares on the basis of non-integrated fares is clearly degenerative, is fundamentally flawed, and forms no basis for either analysing cost of service provision or the worth of the service to the consumer. The TVT should be discarded.

Those TravelPass price increases (more than tripling inflation) that have been justified on the basis of TVT are unjust. In the absence of any defined, quantitative evidence of STA service improvement, there is no basis for the obscene escalation of core TravelPass prices (fig 2.3).

IPART should move to restore the relativities between non-integrated and integrated fares that existed prior to the commencement of TVT studies in 1997. IPART should move to establish revenue sharing arrangements between operators to facilitate expansion of integrated ticketing. IPART should question the Ministry of Transport's mishandling of the 'Integrated Ticketing' project, and should question the Ministry's failure to observe IPART's 1996 recommendations on pricing policy.

3. Amnesia, Professor Parry and Mr Unsworth

The abandonment of methodical researched based fares policy has marked IPART Inquiries of recent years, the 2003 Ministerial Inquiry and the 2004 Unsworth Review. Increasingly IPART has endorsed State Transit and Ministry policy on no sound basis, frequently contradicting its own recommendations. The culmination of this abandonment was the Parry Report in 2003, in which “the Carr Government’s favourite econocrat”⁴⁷ rejected the research and policy proposals of the Tribunal he had governed.

The Ministerial Inquiry Final Report is most remarkable for what it does not say. This report, while claiming to be “a framework for the future” of public transport, and while claiming to investigate future funding, completely ignores the issue of *integrated ticketing*. Amazingly, the TravelPass zone system, recommended by the 1996 Major Inquiry (also under direction of Prof. Parry) as the basis for integrated ticketing, is not mentioned once in the entire report. One may have expected that the issue of revenue division from *integrated ticketing* would have been the dominant concern of any paper on funding, yet the Ministerial Inquiry does not even address this core issue.

Both the Unsworth Report and the Ministerial Inquiry reports assume that discrete *trip* fares should form the basis of Sydney’s future fare structures. Both reports fail to acknowledge the fundamental inequity of cumulative *flag-falls*, both completely ignore the role of *integrated ticketing*. Both reports fail to consider the importance of integrated transport generally, and the provision of service to this end.

The Ministerial Interim report was seated in ignorance, making such statements as:

“6.4 Options for improved fare integration

Fare structures that can accommodate varying degrees of fare integration across transport modes include:

- a strictly distance-based system with a single ticket purchase or access component (the taxi fare system) regardless of operator
- a flat fare for a trip regardless of distance
- a zonal system with a set fare applicable within a zone for a prespecified time of use
- a mixture of zone and distance-based fares.”⁴⁸

The first two points are the very antithesis of *integration*. Every *trip* incurs a *flag-fall*. A flat fare (without free transfers) is the perfect opposite of *integrated ticketing*, it is entirely constituted of *flag-fall* taking no account for the *journey* at all. Had Prof. Parry forgotten what *integrated* meant? A lack of basic understanding permeates both the Ministerial Inquiry reports, which ultimately recommend the adoption of uniform *trip* based fares:

“Pending decisions on the arrangements for bus franchises and smart card

⁴⁷ Quentin Dempster, 13/06/2003, ABC (NSW) State Line **Users to Pay (more)**, television interview

⁴⁸ Prof Parry/ Ministry of Transport, August 2003, **Ministerial Inquiry into Sustainable Transport in New South Wales Interim Report**, p93

ticketing, continue to provide the following STA ticket products:

- a standard single journey cash ticket whose price increases with distance
- a magnetic stripe TravelTen ticket with a constant percentage discount to the single journey cash fare.

If STA and private bus fares are standardised, use a simple fare structure with a constant per kilometre fare.”⁴⁹

This reflects a very retrograde logic. Irrespective of the alignment of *trip* fares between operators, there is no consideration as to how system entry charge (or *flag-fall*) is divided between operators. Otherwise, there is an assumption that every *trip* will incur a *flag-fall*, i.e. that the “framework for the future” is non-integration. There is no consideration of equity between *journeys*, which is a far more significant issue than equity between *trips* fares charged by different operators. With the intention of coinciding with the introduction of the T-Card system⁵⁰, there is an apparent drive toward ‘standardised fares’:

“32. Once the smartcard system is implemented, only single fares and a more limited number of products (such as TravelTens and the Pensioner Excursion Ticket) should be allowed to be loaded onto the smartcard, to promote ease of use.”⁵¹

The great irony of Sydney’s contemporary transport planning, is that the very project that was claimed to bring metro wide *integrated ticketing* seems to be on-track to destroy *integrated ticketing* all together. A combination of dysfunctional regulation, inbred consultancies and blissful ignorance continue to burn hundreds of millions of dollars of State revenue in the process of rendering the public transport system less and less useable.

These major policy papers, framed in the context of a non-integrated fare structure (the effect of which is demonstrated in figure 1), ignore significant underlying problems, and deny the form of modern people movements. Both reports fail to address the core concern of integrated ticketing revenue sharing. The recommendations of the Parry Inquiry and the recommendations of the Unsworth Report in regard to revenue collection are flawed and should be discarded.

Ignorance of the Ministry, vested interests, and contradictory rhetoric must not be permitted to conquer the researched policy propositions of the IPART 1996 Major Inquiry. Moves to weaken or supplant TravelPass integrated ticketing, and further entrench inequitable trip based fares must be strenuously opposed.

⁴⁹ Prof Parry/ Ministry of Transport, August 2003, **Ministerial Inquiry into Sustainable Transport in New South Wales Final Report**, summary of recommendations, p.xix

⁵⁰ Previously known as the ‘integrated ticketing project’ and the Smart Card

⁵¹ Barry Unsworth/ Ministry of Transport, February 2004, **Review of Bus Services in New South Wales Final Report**, p.xxiii

4. Lies, damned lies and KPIs

4.1 KPIs and fare setting

“Not everything that can be counted counts, and not everything that counts can be counted”

Albert Einstein’s famous remark is eminently applicable to the problem of devising Key Performance Indicators (KPIs). Indeed, for the purpose of performance assessment, definition of meaningful quantitative measures is frequently a mammoth task. This, however, is not a task that faces Sydney’s public transport providers. Not only are the key characteristics of their service provision known, but also the data to analyse performance in terms of these characteristics is precisely quantitative and is already recorded. Notwithstanding this, for the reasons discussed in my 2003 submission, the existing KPIs are predominantly fraudulent.

The first recommendation of **The Ministerial inquiry into sustainable transport in New South Wales final report**, was;

“As part of an improved incentive structure to achieve service improvements in public transport, public transport operators should be required to demonstrate their performance against a set of carefully chosen Key Performance Indicators. This requirement should be reflected in a transparent five year contract between the operators' CEO and Board and the Ministry of Transport. Failure to perform satisfactorily against the KPIs should trigger a government review at the conclusion of the contract...”⁵²

The problem with the KPIs that IPART has employed to date is that they bare little, if any, relevance to the assessment of performance from the patron’s viewpoint. IPART’s role is the review of pricing of monopolised services, apparently on a performance basis;

“the Tribunal considers service quality to be a key consideration in setting maximum fares.”⁵³

Yet it takes no specific regard for performance other than the fraudulent indices provided by the monopolising operators. As I observed in my submission last year, the existing KPIs appear to be devised with the object of yielding high percentage results. Perhaps drawing from the indoctrination in primary school of high percentages being good, the agencies seem to value arbitrary, non-dimensional, and unspecified measures in preference to justified, dimensionally quantitative, and specified measures.

I expressed last year detailed concerns on the matter of the fraud of existing KPIs. The criterion by which many of these indicators are devised is unknown. Many bare no obvious connection with that they purport to represent. Some are defined

⁵² Prof T Parry, **Ministerial inquiry into sustainable transport in New South Wales, final report**, 2003, pXVII

⁵³ IPART, August 2003, Report on the Determination of NSW Public Transport Fares, Determinations 5 & 6, p19

differently by IPART and the authority that furnished them, indicating uncertainty, even within the regulator, as to what these figures are, let alone what they mean. I drew my concerns to the attention of IPART, the NSW Ombudsman and the Auditor General. The Ministry also forwarded my allegations of fraud to the Independent Commission Against Corruption.

IPART failed to respond, only acknowledging that I had raised a concern (IPART, 2003, det.s 5&6 p14). IPART again endorsed the meaningless figures provided by the transport agencies. In the absence of any useful contribution on these matters from those paid to administer this State, I will now propose a methodology for devising meaningful performance indicators.

4.2 A recipe for Key Performance Indicators

- I) Define the purpose of the indicators (e.g. to reflect quality of service provision from the patrons' viewpoint)*
- II) Determine the most important characteristics of the service (From survey, e.g. timeliness, reliability, convenience, safety, cleanliness)*
- III) Develop quantitative measures of those characteristics this may be by a direct or indirect method. Requires consideration of availability of data. (e.g. cleanliness may be reflected by the competitively tendered per vehicle expenditure on cleaning services)*
- IV) Define an unambiguous criterion in mathematical terms, including defining the data source, sample space or system boundary*
- V) State assumptions made, and define indicator limitations*

4.3 Example of how to apply the KPI recipe: Sydney Buses

Define purpose

To provide a measure of public transport service quality from a customer's standpoint

Determine important characteristics

- a) Timeliness
- b) Reliability
- c) Convenience
- d) Safety
- e) Cleanliness

Develop quantitative measure

Consider characteristic (a) Timeliness, for Sydney Buses.

What does timely mean? The Macquarie Dictionary says it means "occurring at a suitable time". For our purpose here it is more specific, it means that the service timing is in accurate agreement with timing stated in the timetable. But what does accurate mean? To one person it may mean 10seconds, to the STA 10minutes. It is best therefore to avoid unnecessary time-interval defined binary conditions like "on-time" and "not-on-time". Any interval requires the setting of arbitrary boundaries; of great value to political agendas and bureaucrats' self-preservation, but of little value for the purpose of actually assessing performance.

The ultimate concern of the passenger, behind the desire that services be on-time, is firstly, whether the service arrives at his origin in accordance with the timetable, and secondly (as a function of this) whether the service conveys him to his destination in accordance with the timetable. Any deviation from the timetable is bad, the more, the worse. The aim is thus to devise a measure that is quantifiable in these terms.

In devising a measure, the first thing to contemplate is the data we have at our disposal: What do we know that may be of use in defining such a useful measure?

Known data from Sydney Buses STATS system for any given bus run:

- i) The times at which the bus enters a section
- ii) Times of validations
- iii) Sections in which those validations are made

Additionally known:

- iv) Timetable time for all stops

We know quite a lot about validations, and therefore boarding, but nothing about alighting. With this information alone it is not possible to directly obtain the service timeliness at the point of alighting for a given passenger. An assumption can be made however, that timeliness of boardings will have a high correlation with timeliness of alightings. The weakness of this assumption is that on a service of polarised loading patterns (i.e. in the suburb it picks up and in the City it sets down) the correlation may not hold. On the basis of this assumption, the concern here shall be the timeliness of a passenger's trip commencement for which we have ample data. In the advent of a "tag on/ tag off" system, data would be available for all boarding and alighting.

Assuming that a passenger arrives at his given stop in accordance with the timetable, the late-running of his intended service is equal to his waiting time. It is this waiting time of the intending passenger which is of particular concern. The waiting (and irate) passenger is the most visible and memorable manifestation of late running. An apt measure of this waiting is hence waiting-time, or expected waiting-time.

The existing STATS system records only discontinuous (section-based) location data. Therefore the only time we know where the bus is for certain is at the moment of section change triggered by the driver. It is known therefore, how timely the bus is at each section (each 1.6km of distance) with respect to the timetable. From this we can interpolate the intervening time, to form a continuous curve of timeliness with respect to time for a given run. There are many techniques that can be employed, linear interpolation being the easiest.

Knowing all of the boarding times, we then know how late the bus was at the time of boarding for any given passenger. A system boundary must be established, it can be anything from a single run to the whole bus system. A summation of all the waiting times within that system can then be taken.

Define mathematical criterion

The Caldwell Waiting Time criterion

$$WT \text{ [mins/trip]} = \frac{1}{m} \sum_{j=1}^m (t_R - t_T)_j \quad \text{--- [1]}$$

Where

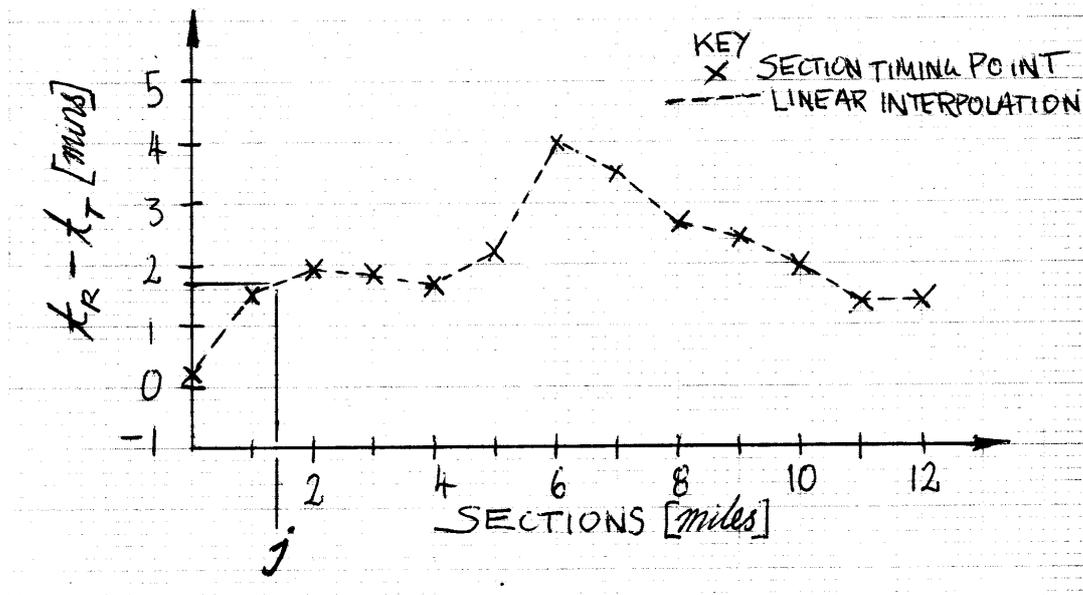
WT = waiting time in minutes per trip
 m = total number of boardings within defined system
 j is a boarding event
 t_R = the real time of a boarding event
 t_T = the timetable time for that boarding event

And where

Waiting time prior to a single boarding event, $(t_R - t_T) \geq 0$
 i.e. strict no-early-running enforcement

This equation can be applied to any mode of open-system time-tabled transport. For the current consideration of Sydney Buses there are some specific concerns. The value of t_T is known for a given spatial location (from the timetable), it is a function of the physical location of a bus, x. The location of the bus is however only known (with respect to time) at a Section timing point. The interpolated curve for an example run is constructed from $(t_R - t_T)$ at the section points (**fig 4.1**).

Figure 4.1 example interpolated curve of timeliness over a bus run



For any given boarding event, j, waiting time $(t_R - t_T)$ is therefore determinable. This process can be applied on any PC with Microsoft Excel or similar, and yields an

immediately understandable measure, that is useable in further models. In essence, it is the average waiting time for every *trip* within a system. It may be applied by route, region or time of day. This may be particularly useful for modelling waiting time between *linked trips*, and therefore determining the cost of transfer to the passenger. This may also be used for economic analysis on general costs of waiting time. Further it could be used for more accurate modelling market response to changes in the operating environment (also see **Appendix Two**).

Assumptions and limitations

This indicator takes no account of early running; strict enforcement preventing early running is assumed. It may be desirable to devise an indicator for early running, such as “incidence of buses departing more than 30 seconds early”. Combating early running is a driver training issue, an early bus can always be held; lost time is frequently irrecoverable. This indicator takes no explicit account for timeliness at *trip* destination. With the employment of tag-on/ tag-off validations, a “set-down timeliness” indicator may be warranted. As operators could be expected to slacken timetables in order to improve average waiting time, an important co-indicator would be an average timetable trip speed. That is, a reduction in waiting time is of little benefit to passengers if operators trade it off against trip time by slackening the timetable.⁵⁴

4.4 General remarks

A direct measure of timeliness such as this could be similarly derived from Eq. [1] for the information available for trains and ferries (i.e. through the employment of train describer output, electronic validation records, and platform/ wharf information data). The significant difference between a measure of this type and the existing confidence-interval type is that there is no setting of arbitrary intervals (or tolerances).

Measures of this form do not yield a percentage score. This distances the service quality KPI process from the ideology that performance is some kind of competition or test that requires a high mark. The concern that performance benchmarking may compromise safe operation has been raised many times. I would suggest therefore, that the first response in the hierarchy of control should be to eliminate non-dimensionalised percentage scores, which are predisposed to associations of competition and ranking.

KPIs must be formulated in a methodical manner and must be transparent. As per my 2003 submission, the KPIs that have been tendered by the STA to date are fraudulent, and I again call upon the Auditor General to review them.

The results of IPART’s 2003 recommendation that the agencies provide “better performance criteria and reporting” are anticipated. In the event that the agencies again fail to provide meaningful, unambiguously defined, and verifiable figures, IPART should call for a full independent audit of service quality KPIs.

⁵⁴ This problem afflicts any indicator of timeliness with respect to a timetable. It is important to always remain mindful of the purpose of the indicator: in this case service quality from a customer’s standpoint. Trading one determinant of quality off against another e.g. timeliness and trip speed, for the benefit of improving KPI results, is entirely defeating and unproductive.

5. ITSRR joke

In response to the Ministerial Inquiry recommendation for performance-linked fare reviews, the Ministry of Transport (MoT) responded;

“The Government does support the establishment of KPIs and annual review through the performance benchmarks established under the Statement of Corporate Intent (SCI) process and from advice provided by the Independent Transport Safety and Reliability Regulator.”⁵⁵

ITSRR confirms its purpose:

“The Reliability Standards branch will have responsibility for providing advice, from a consumer perspective, on reliability standards across the range of publicly funded transport services.”⁵⁶

This additional division of functions in transport administration is unhelpful. Given that IPART is the body contemplating fares in the context of service quality, it would seem more logical to associate service quality KPI review with IPART rather than with a safety regulator⁵⁷. An intimate appreciation of passenger requirements is required both for setting fares and for the review of service quality KPIs. The ITSRR is clearly driven by concerns other than solely assessing reliability⁵⁸ from ‘a consumer perspective’.

Transport Minister Costa, in his 19th November 2003 letter to Mr Ron Christie⁵⁹, suggests that rail on-time performance expectations may have to be reduced in order to aid the safe running of the rail network. The Minister requested an examination of “the appropriateness of the on time running benchmark”.

Rather than recognising that service quality KPIs should be devised in response to customer requirements, the Minister presumes that KPI criterion should be manipulated to suit management purposes. In this case the management purpose is trading safety against timeliness. This view of service quality performance reporting is completely defeating.

The most important aspect of the Minister’s letter is that it betrays the real purpose of interval based percentage reporting. The Minister assumes that an expectation of performance score exists, referring to an “on time running culture”. The implication is that employees may compromise safety as a result of being compelled to achieve the SRA’s targets. The SRA’s target had been previously described:

⁵⁵ NSW Government’s Response to the Final Report of the Parry Inquiry, Press release

⁵⁶ ITSRR, <http://www.transportregulator.nsw.gov.au/reliability/index.html> retrieved 12/7/2004

⁵⁷ “The principal objective of the ITSRR is to facilitate the safe operation of transport services in the State.” TRANSPORT LEGISLATION AMENDMENT (SAFETY AND RELIABILITY) ACT 2003 - SCHEDULE 1, division 3, 42C Objectives of ITSRR

⁵⁸ The definition of ‘reliability’ under the Act is unusually broad, and includes performance considerations such as timeliness (see extract on p34)

⁵⁹ ITSRR, June 2004, **Review of on-time running of CityRail services**, Attachment A, p42

“The key targets outlined in the CityRail Customer Service Commitment and the Community Service Obligation Agreement with the Government are for 99% of peak timetabled services to operate and for 92 % of peak services to arrive within three minutes of their scheduled arrival time”⁶⁰

The Minister suggests that a broadening of the “on time” interval will help combat the “on time running culture” and therefore contribute to safer operation. The implication is that KPIs are expected to produce high percentage scores. If the percentage is too low, and employees feel compelled to ‘perform better’ at the expense of safety, the solution is to redefine the interval to yield higher percentages. Therefore employees will not be as compelled to compromise safety. This rationale may be reasonable from an operations point of view; i.e., if operations managers believe that less stringent expectations of running will provide a more appropriate acceptable risk, then pursuing that course is their managerial prerogative. The problem is however, that the Minister’s request was directed to the ITSRR.

The Minister was not requesting merely that operations staff should reduce expectations of performance, but rather that KPIs used for “consumer perspective” performance reporting should be modified in order that higher (better) results be obtained. Worse still, the Minister recalled the series of horrific rail accidents, as if the burden of associated thoughts might add greater justification to massaging KPIs. The Minister wants to maintain high percentage scores for performance, despite deterioration in that aspect of performance. Perhaps CityRail should take a lesson from the STA on generating meaningless high percentages, and then no doubt the whole public transport system would run perfectly.



Figure 5: STA proudly shows result of defining KPIs that produce high percentages. [From Sydney Buses performance report 17/10/2003]

Like a cat that has killed a mouse, and then parades the surprising outcome hoping for his master’s pleasure, the STA has devised a high score generator that it parades perhaps hoping for the pleasure of its customers (Fig 5). One finds that STA defines reliability as “the percentage of services that actually ran”. This is in stark

⁶⁰ SRA/ CityRail, May 2003, **Submission to the IPART of NSW CityRail fare review**, 3.1.1,p17

contrast to the definition of reliability under the Transport Legislation Amendment (Safety and Reliability) Act 2003 (the Act):

“ ‘reliability’ , in relation to a transport service, means the quality, effectiveness and efficiency of the service, having regard to the following matters:

- (a) management and administration of infrastructure, assets, resources and liabilities,
- (b) fulfilment of obligations under contracts and arrangements relating to the provision of services, including timeliness and quality of services,
- (c) any other matters prescribed by the regulations”

Clearly there is a substantial difference between the STA’s and ITSRR’s definition of reliable. When these STA figures are read in reports and press releases, I would expect that the readership would be familiar with neither of these extreme definitions. The common definition of reliable, from the Macquarie Dictionary, is “that may be relied on; trustworthy”. The STA pretends that the extent to which it can be relied on is solely a function of cancelled trips. This is an extremely tenuous definition.

The definition is not the only concern here; the method of presentation is equally dubious. Percentage scores are completely useless for representing incidents of low frequency but of significant importance. For instance, if one wished to convey the incidents of workplace deaths, a “safety” score defined as “the percent of workers who didn’t die” would completely miss the point. A result of 99%, while outwardly appearing to be a near-perfect score, would represent 1 death per 100 workers per year. The method of statistical presentation should be consistent with both the likelihood and consequences of the occurrence. Accordingly, rather than reporting the “percentage of services that actually ran” the STA should report “cancelled trips per 10,000” or similar.

If, in the spirit of the Transport Minister’s requests, the STA aims to produce high percentages which provide no basis for performance assessment, and that thus do not “conflict with safety management”, then they have succeeded with style. If the INDEPENDENT Pricing and Regulatory Tribunal is to consider service quality, for price setting purposes, these figures are of no value whatsoever.

From the Minister’s correspondence, and from the Act, a general impression forms that ITSRR has been conceived on the basis that safety can be traded against performance definitions. Furthermore, it is a recurring theme that performance benchmarks cannot be endorsed for fear of adverse safety implications. Does this mean that performance cannot be assessed at all for pricing purposes for fear of causing a fatal accident?

If safety truly is the Minister’s concern, the first step (as in 4.4 previously) may be the abolition of the percentage score mentality for timeliness and reliability. Notwithstanding this, it is clearly a managerial role to ensure that a safe service is provided, and any measure of service quality assumes that management has struck the appropriate balance between safety and performance. How this is achieved is not a concern from the customer’s perspective. There remains a need to quantify that performance for efficiency considerations and fare setting purposes. The aim therefore

should be to devise indicators that are useful and meaningful, and which do not lend themselves to abstraction, sensationalism and test-style score rankings.

The ITSRR's first review is an appropriately rigorous analysis within the terms of reference of the Minister's letter. The problem is that those terms of reference are inappropriate and unhelpful for fare setting purposes.

Indicators of service quality used for price setting must be devised with regard for the passenger's perspective. The ITSRR's first report clearly exhibits the effects of other influences.

While IPART is, for the first time, to consider Government and Private fares in a single hearing, ITSRR is developing standards only for "publicly funded transport services". In the case of buses and ferries, a uniform reporting convention is required for all operators.

6. Conclusion

Sydney's public transport system remains extensively *un-integrated*, particularly in terms of ticketing. The 'integrated ticketing' project, the Unsworth Review and the Ministerial (Parry) Inquiry all fail to address the key issue of integrated revenue collection and sharing. Both the Unsworth Review and the Parry Inquiry are built upon, and project, non-integration.

The 'integrated ticketing' T-Card project, far from the project's original intent of facilitating *integrated ticketing*, is on course to supplant Sydney's *integrated ticketing* all together. If the T-Card system takes the form suggested by the Unsworth and Parry reports, it will represent a substantial impediment to integration, by further entrenching *trip* based fare charging. The Ministry has consistently demonstrated a lack of basic understanding on these matters, reflected by contradictory and incorrect statements.

Timed zone TravelPass tickets, previously recommended as the basis for Sydney's ticketing system, have been forced into decline as a result of circularly degenerative price setting methods. On this basis the Blue TravelPass (Sydney Buses and Ferries) has increased at a rate exceeding triple inflation over the last eight years. The price relativities between integrated and non-integrated fares should be re-established at the 1996 (pre-TVT) levels. Accordingly, TravelPass ticket prices should be frozen for several years, while increasing trip fares to maintain revenue neutrality. Ultimately all trip fares should be abolished. One-day and two hour TravelPasses should be made available. Revenue sharing mechanisms should be developed jointly with new additional fare zones.

The performance indicators tendered by the STA to date are fraudulent. Service quality KPIs require complete reform, taking specific regard for the passenger's viewpoint. ITSRR's first Inquiry has been driven by inappropriate Ministerial requests. Service quality indicators should be consistent across all operators. KPIs that are undefined, unverifiable or spurious lend no support to fare increases.

APPENDIX ONE Sydney Government zone, fare ferry and bus fare increases since 1995

David Caldwell			Zone Fares (weekly TravelPass) [2]									
Year	CPI, 30th June [1]		Annual increase	Red		Annual Increase	Blue (STA only)		Annual Increase	Green		Annual Increase
	Index Nos	Change		Change	Change		Change	Change				
1995	116.2	0.0%		\$20.00	0.0%		\$17.10	0.0%		\$26.00	0.0%	
1996	119.8	3.1%	3.1%	\$21.00	5.0%	5.0%	\$18.10	5.8%	5.8%	\$27.00	3.8%	3.8%
1997	120.2	3.4%	0.3%	\$22.00	10.0%	4.8%	\$19.00	11.1%	5.0%	\$28.00	7.7%	3.7%
1998	121.0	4.1%	0.7%	\$23.00	15.0%	4.5%	\$20.00	17.0%	5.3%	\$29.00	11.5%	3.6%
1999	122.3	5.2%	1.1%	\$26.00	30.0%	13.0%	\$23.00	34.5%	15.0%	\$33.00	26.9%	13.8%
2000	126.2	8.6%	3.2%	\$28.00	40.0%	7.7%	\$25.00	46.2%	8.7%	\$36.00	38.5%	9.1%
2001	133.8	15.1%	6.0%	\$29.00	45.0%	3.6%	\$26.00	52.0%	4.0%	\$37.00	42.3%	2.8%
2002	137.6	18.4%	2.8%	\$30.00	50.0%	3.4%	\$27.00	57.9%	3.8%	\$38.00	46.2%	2.7%
2003	141.3	21.6%	2.7%	\$32.00	60.0%	6.7%	\$29.00	69.6%	7.4%	\$40.00	53.8%	5.3%

[1] Consumer Price Index, All Groups, Weighted Average of Eight Capital Cities, Index Numbers(a), 6401.0 Australian Bureau of Statistics.

[2] All full fares. All fares from IPART schedules, determinations closest 1st July.

Year	CPI, 30th June [1]		Annual increase	Cash Fare (STA)		Bus Cash Fare (STA)		IH Ferry cash (STA)	
	Index Nos	Change		Blue (2section)	Annual Increase	3-5 sections [3]	Annual Increase	IHS (zone 1) trip	Annual Increase
				Change		Change		Change	
1995	116.2	0.0%		\$1.20	0.0%	\$2.50	0.0%	\$2.80	0.0%
1996	119.8	3.1%	3.1%	\$1.20	0.0%	\$2.50	0.0%	\$2.80	0.0%
1997	120.2	3.4%	0.3%	\$1.20	0.0%	\$2.50	0.0%	\$3.00	7.1%
1998	121.0	4.1%	0.7%	\$1.20	0.0%	\$2.50	0.0%	\$3.20	14.3%
1999	122.3	5.2%	1.1%	\$1.30	8.3%	\$2.50	0.0%	\$3.70	32.1%
2000	126.2	8.6%	3.2%	\$1.40	16.7%	\$2.50	0.0%	\$4.00	42.9%
2001	133.8	15.1%	6.0%	\$1.50	25.0%	\$2.60	4.0%	\$4.20	50.0%
2002	137.6	18.4%	2.8%	\$1.50	25.0%	\$2.60	4.0%	\$4.30	53.6%
2003	141.3	21.6%	2.7%	\$1.60	33.3%	\$2.70	8.0%	\$4.50	60.7%

[3] The bus fare covered 3-9 section until July 2000, when it was split into 3-5 and 6-9 section fares. The 3-9 fares are shaded

			TravelTen (STA)						IH FerryTen (STA)			
	CPI, 30th June [1]		Annual increase	Blue (2section)		Annual Increase	3-5 sections [3]		Annual Increase	IHS (zone 1) trip		Annual Increase
Year	Index	Nos Change		Change	Change		Change	Change		Change	Change	
1995	116.2	0.0%		\$8.00	0.0%		\$16.00	0.0%		\$16.40	0.0%	
1996	119.8	3.1%	3.1%	\$8.40	5.0%	5.0%	\$16.80	5.0%	5.0%	\$16.60	1.2%	1.2%
1997	120.2	3.4%	0.3%	\$8.60	7.5%	2.4%	\$17.20	7.5%	2.4%	\$17.00	3.7%	2.4%
1998	121.0	4.1%	0.7%	\$8.80	10.0%	2.3%	\$17.60	10.0%	2.3%	\$19.00	15.9%	11.8%
1999	122.3	5.2%	1.1%	\$9.50	18.8%	8.0%	\$17.60	10.0%	0.0%	\$23.00	40.2%	21.1%
2000	126.2	8.6%	3.2%	\$10.40	30.0%	9.5%	\$17.60	10.0%	0.0%	\$25.30	54.3%	10.0%
2001	133.8	15.1%	6.0%	\$11.00	37.5%	5.8%	\$18.40	15.0%	4.5%	\$26.30	60.4%	4.0%
2002	137.6	18.4%	2.8%	\$11.30	41.3%	2.7%	\$18.90	18.1%	2.7%	\$26.50	61.6%	0.8%
2003	141.3	21.6%	2.7%	\$11.80	47.5%	4.4%	\$19.70	23.1%	4.2%	\$28.50	73.8%	7.5%

APPENDIX TWO

Considering the general costs to the passenger of *linked trips*.

Reproduced from: R. Balcombe Et al, *The Demand for public transport: a practical guide* (TRL593), TRL Limited, 2004, London.

pp39-40

between the dependent and independent variables. A particular specification of the demand function which is often used to analyse travel demand is expressed in terms of 'generalised costs'. This concept is an attempt to summarise the 'cost' of a journey by adding together the various components of time or money spent; it may be written:

$$GC = a_o + p + \sum_i a_i q_i \quad (2)$$

where:

GC is the generalised cost of the journey (see above).

p is the monetary cost of the journey.

q_i is the time required to complete the journey divided into the various components i of travelling time.

a_i is the value of time associated with time component i .

a_o is the residual component of the 'cost' of making a journey which is not a function of the monetary cost or the time involved but is a 'cost' associated with making use of a particular mode: it is often referred to as a 'mode-specific cost' or 'residual effort' component.

The values of time in the generalised cost function represent the traveller's willingness to pay to reduce the waiting, walking or in-vehicle time by one unit of time. The residual effort component is also measured in monetary units. This cost may represent many different aspects of travel, e.g. the effort involved in taking heavy or bulky baggage on a trip or that part of the discomfort or general inconvenience which is not a function of the time duration of the journey, such as is experienced when having to transfer from one vehicle to another. In some models this component also represents the different

propensities to travel of different segments of the population, grouped by income, sex, age etc and will take different average values in all these categories.

Although equation (2) is the most commonly used expression for the 'cost' of a journey, the concept of generalised time is also widely used. In this formulation, all the various costs are expressed in terms of an equivalent amount of time, i.e. the generalised time is given by:

$$GT = \frac{a_o + p}{a_i} + \sum_i \frac{a_i q_i}{a_i} \quad (3)$$

where a_i is the appropriate value of time (usually the value of in-vehicle leisure time) and the other symbols are as defined earlier.

The idea of amalgamating time, money and effort into a single quantity is obviously a very attractive one for considering the decisions which travellers might make when confronted with a number of alternatives, and since the two equations (2) and (3) differ only by the constant and it makes no difference which of the two formulations (generalised time or cost) is used in such cases - they both give the same result. Difficulties are likely to arise, however, in situations where the value of time (a_i) is assumed to change. Since it is generally believed that people with higher incomes are more willing to pay money in order to save time than lower-income travellers, this causes problems in forecasting future travel behaviour, since incomes will change over time. If the value of time is assumed to vary with shifts in income (as seems plausible), inconsistencies are likely to occur in the theoretical underpinning of the generalised cost concept. Changes in overall travel behaviour which result from changes in income are much more likely to be connected with changes in activity patterns, rather than with changes in the perceived 'cost' of travel and must therefore be predicted by a separate process. Within this overall demand for travel, however, the generalised cost concept still offers a useful approximation of people's behaviour in choosing where to go and which mode to use.

The assumption that the 'cost' of a journey may be formulated as equation (2) (or equation (3)) means that the demand function (1) can be rewritten in the following way:

$$y_j = g(GC_i, \dots, GC_j, \dots, GC_r) \quad (4)$$

i.e. that the demand for a trip of type j may be expressed not only in terms of the generalised cost for this trip, but also in terms of the generalised costs of alternative trips. In this context alternative trips may refer to trips by a different mode, to a different location or with a different purpose⁷.

The values of the parameters of demand functions such as (1) and (4) can be estimated from statistical analysis of data concerning travel demand and the explanatory variables. These parameters determine the functional form of (1) and (4), as well as the values of time and the residual effort component a_θ . When the parameters have been estimated it is then possible to use the functions to forecast the effects on demand from changes in the explanatory variables, such as prices, travel times and income (but note the words of caution given earlier).