

INDEPENDENT AUDIT

MELBOURNE METROPOLITAN PUBLIC TRANSPORT AUTOMATIC TICKETING SYSTEM

CUSTOMER DEFINED AVAILABILITY

This report was commissioned by the DOI as an independent audit and the views expressed in the report are those of the consultant and are not necessarily those of the DOI or the Government of Victoria

Downie Consulting

February 2003

Customer Defined Availability Review and Report

Executive Summary

In March 2001, the Miller Network Group was contracted by the Department of Infrastructure to undertake an independent audit of the Automatic Ticketing System (ATS). Their report was delivered in June 2001 and their findings included a summary of the performance of the ATS equipment in terms of availability as would be experienced by the customer. It found that the performance of the ATS fell far short of the requirements of the travelling public. One of the major causes of loss of availability was the effects of vandalism, and the contract excluded this from the definition of loss of availability, and so there was little commercial incentive for the contractor (OLT) to act to minimise this. There were a number of disputes on foot and the relationships between the parties were poor.

Following receipt of the Miller report, steps were taken to change the nature of the relationships between the parties. These included agreement for the Operators to pay the cost of “hardening” of customer interface ticketing equipment to enhance its ability to resist vandalism, renegotiation of the contract to provide appropriate drivers for enhanced performance, implementation of the “hardening” program and development of improved computer on-line monitoring processes structured around a new set of Customer Defined Availability (CDA) measures, and establishment of much improved communications between the parties. In addition, many work practices were improved. These changes had been progressively implemented during late 2001 and 2002.

In mid 2002, Downie Consulting was engaged to update the ATS audit findings and to report on whether the performance of the ATS had improved, with particular emphasis on the performance of the railway station equipment which had been by far the worst performing equipment at the time of the Miller Report. Physical audits of the availability of the ATS customer interface equipment were conducted by the Revenue Clearing House (RCH) between August and October 2002. The results of these audits were compared to the Miller Report to identify any changes in performance. They were also compared to the reports being produced on railway station equipment by the new OLT computer system (called the Availability Engine or AVE) as a check on its effectiveness in providing an accurate CDA measure.

The equipment hardening program had concentrated on the rail network and included changes to detect and frustrate cash interception attempts, strengthening doors, hinges, locks and vaults to frustrate break-in attempts, and improved software to give earlier indications of tampering.

These changes gave a step-change improvement in the availability of the fixed ATS ticket issuing equipment on the rail network and a significant improvement in the “fully operational” availability of the mobile ticket issuing equipment compared to the situation that had existed at the time of the Miller Report. There was a 62% reduction in the number of reported vandalism incidents in 2002 over 2001, and the trend is continuing downwards.

Availability of validators also improved across the system.

Item	March 2001 Survey (Miller report)	Aug & Sept/Oct 2002 survey
Fixed Equipment		
Train ticket machines “fully operational” (able to buy ticket with no major faults/defects #)	72.8%	92.1%
Percentage unable to buy a ticket at all	18.7%	1.3%
Train Validators assessed as non operational	5.7%	3.3%
Mobile Equipment		
Tram & Bus ticket machines “fully operational” (able to buy ticket with no major faults/defects)	88.1%	98.3%
Percentage unable to buy a ticket at all	3.2%	1.6%
Tram & Bus Validators assessed as non operational	4.0%	2.7%

There was a change in definition of “non-operational” between the 2001 and 2002 audits. The Miller report had included a third classification of “partly operational”. All Miller partly operational classifications have been counted as “non operational” for the 2002 audits, with the sole exception that “Exact Fare Operation” mode in TVM2’s, (the machines that accept coins, notes and EFTPOS), which has been classified as fully operational.

The AVE has been tested by an independent consultant to the Government, Dialog Information Technology, and received endorsement of the overall integrity and functionality of the system in reporting the performance of the fixed equipment. In the expectation of the ultimate extension of the system to cover trams (and possibly buses), it suggests some enhancements to the processes for the mobile equipment, where communication systems and access for maintenance are more constraining.

The CDA measures produced by the OLT AVE can now be regarded as robust enough for indicating trends in the performance of the fixed equipment on the railway network subject to future periodic calibration checks. The CDA measure has been shown by the physical audit to represent the actual situation experienced by the travelling public on the train network in terms of “operational availability” within acceptable limits of accuracy in the range of results obtained in the 2002 physical audits.

The system availability reports produced by OLT had not previously been sufficiently representative of customer experience to use for regular public reporting. The September/October physical audit established that the information system reports could now be used for regular public reporting for the train network. There are some relatively minor outstanding issues of business rules and communication processes that could enhance the value of the CDA measures. The adoption of the current structure of the CDA definitions has contributed to a significant improvement in hardware performance, particularly in regard to the resistance to vandalism of the railway station ticket machines.

Significant additional work would need to be completed before the information system reports could be used for regular public reporting for the tram and bus networks. The existing system can provide some useful information for tram and bus reporting although care would need to be taken to explain the definitions used by the business rules, as these are not directly related to the performance of the system as perceived by the customer.

There is clear evidence of a new, cooperative and professional approach to improving the availability of the ATS to the public, and processes are in place to ensure its continuance. It may be expected that new challenges will arise with different types

and techniques of attack on the ATS. However, the new contract structures and the cooperative approach can be expected to trigger a rapid and effective reaction.

Any further step-changes will be more difficult to achieve, but there is certainly room for a program of continuous improvement to give further substantial incremental improvement. These may include:

- Continued improvement in the CDA measurement and reporting processes.
- Expanded involvement of the operators and their staff in ensuring the successful operation of the public transport ticketing system, including particular attention to timely reporting of any ticketing equipment faults.
- Expansion of the initiatives that have been so successful for the fixed equipment to cover the mobile equipment.
- Improved communication processes between the stakeholders and with the public.

In 2001, the Miller report said “public frustration with the performance of the ticketing system is understandable.” After such a long period of time struggling with an unsatisfactory ticketing system, it can be expected that it will take some time before the public believe that these improvements are here to stay. A continuation of the successful processes put in place since 2001 will ensure that the improved performance on trains is retained, and further improved upon. The extension of this type of approach, at least to the tram system, would seem worth detailed evaluation in planning the next phase of the continuous improvement process.

Finally, it is recommended that further physical audits be conducted on the entire ATS system at appropriate times, to ensure that the improvement in performance has been sustained and to validate the appropriateness of the CDA across different performance ranges.

Executive Summary	i
1. Scope of Work.....	1
2. Background	1
3. The Miller Report.....	3
4. Major Developments since the Miller Report	4
4.1. Contract Renegotiation	4
4.2. “Hardening” the ATS Equipment.....	6
4.3. Computer System Enhancements (AVE)	11
4.4. Comments on the Physical Audit and its correlation with the AVE.....	16
5. Continuous Improvement Program	21
6. Other issues to consider.....	22
6.1. Customer satisfaction and the CDA	22
6.2. Validators.....	23
7. Conclusions and Recommendations.....	24
8. Appendices	25
8.1 Executive Summary Miller Report (2001)	
8.2 RCH Report – Availability of On-Line Ticketing Equipment Field Survey, September-October 2002 Summary Report	
8.3 Continuous Improvement Program.....	
8.4 Progress on the Miller Recommendations	
8.5 Customer Satisfaction Monitoring Survey Data.....	

1. Scope of Work

Downie Consulting has been engaged by the Department of Infrastructure to provide an independent assessment and report on the performance and availability of the Automatic Ticketing System (ATS) to the travelling public. This required an evaluation of the proposed Customer Defined Availability (CDA) measures currently being finalised, including:

- Assessment of the ATS performance compared with an earlier benchmark assessment (the Miller Report).
- Whether the proposed CDA measures are robust and accurately reflect what the travelling public experiences, and
- Whether the CDA information being provided in system availability reports is sufficiently reliable for use in regular public reporting.

2. Background

The Victorian Public Transport system is a network of train, tram and bus services, with a multi-modal ticketing system. In May 1994, OneLink Transit Systems Pty Ltd (OLT) was contracted by PTC to Build Own and Operate an automated ticketing system.

In 1997 the Metropolitan rail divisions were restructured and in 1999 franchised to private operators of two metro train business units (Bayside Trains and Hillside Trains) and two tram businesses (Yarra Trams and Swanston Trams).

Coincident with franchising, the Revenue Clearing House (RCH) was established to manage the OLT contract and distribute system revenue. RCH is owned by the four Metropolitan Public Transport Franchisees and the Department of Infrastructure (DOI), representing the Private Bus Operators. PTC and RCH both have an interest in the OLT contract.

The relationship between the principal stakeholders is shown in Figure 1.

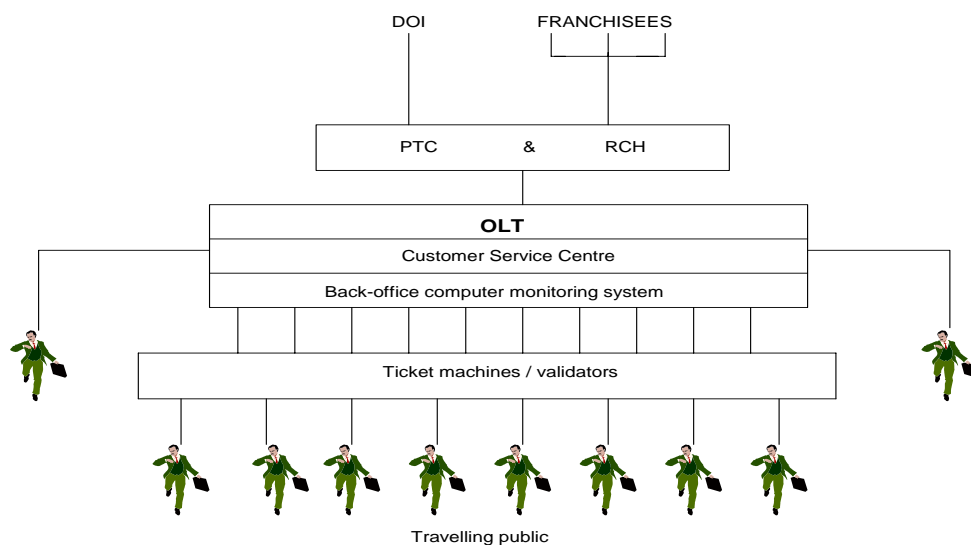


Figure 1 Stakeholder Relationships

In March 2001, the Miller Network Group was contracted by the Department of Infrastructure to undertake an independent audit of the Automatic Ticketing System (ATS). The audit involved a review of the ATS contracts and the performance of the ticketing system comprising ticket vending and validating machines at metropolitan railway stations and on-board metropolitan trams and buses. Their report was delivered in June 2001 and their findings included a summary of the performance of the ATS equipment in terms of availability as would be experienced by the customer. The performance of the equipment on the railway stations was much inferior to that on trams and buses.

In an attempt to radically improve the performance of the ATS, a number of major attitudinal, contractual and performance changes have occurred in the management and operation of the Automatic Ticketing System since the release of the “Miller Report”, including the negotiation of an improved incentive-based contract with OneLink Transit Systems in May 2002. One of the changes has been the development of the new CDA measure to be used as an ongoing indicator of the performance of the system as seen by the Customer. This has been implemented so that it is robust enough for indicating trends in the performance of the fixed equipment on the railway network.

In 2002, Downie Consulting was engaged to update the ATS audit findings and to report on whether the performance of the ATS had improved. Physical audits of the availability of the ATS customer interface equipment (excluding the few new fixed ticket machines installed on city tram stops) were conducted between August and October 2002. The results of these audits were compared to the Miller Report to determine any changes in performance and to the reports concurrently produced by the OLT AVE computer system as a check on the AVE’s effectiveness in providing an accurate CDA measure. This report describes the changes that have taken place and the effectiveness of the CDA measures provided by the AVE.

In the work of this review, the following material has been examined:

- The Miller report (May 2001).
- Heads of Agreement (HOA) between PTC, RCH, OLT and ERG relating to proposed changes to the Consolidated Service Contract and other related documents, and the performance requirements that need to be satisfied before such changes are implemented. (The amended Consolidated Service Contract was executed on 23 October 2002 consistent with the HOA signed earlier. The HOA is a more convenient document for reference purposes).
- The Dialog review of the OneLink Ticketing System Availability Engine (AVE) (December 2002).
- The RCH summary report on the methodology used for, and the results of the physical audits carried out in August and September/October 2002 into Availability of On-Line Ticketing Equipment, Field Survey, September-October 2002, which includes a summary of the reports by the AVE for the same period as the September-October audits.

Interviews were conducted with personnel from RCH, PTC, ERG and Dialog Information Technology. The OneLink Control Centre was inspected and the operation of the AVE reporting system demonstrated.

3. The Miller Report

An independent audit of the Automatic Ticketing System by the Miller Consulting Group was commissioned by the Department of Infrastructure and the report was presented in May 2001. It has become known as the “Miller Report”.

The Miller Report adopted certain definitions. (These have since been further refined in the CDA). They included:

Definition

- As “availability” has a specific meaning in the contract, we use the term “operational” in the following sections to describe a ticket machine’s functionality.
- “Fully operational” means the machine performed all required tasks,
- “Partially operational” identifies a machine able to undertake its primary task – provide tickets or validate - but has faults in (one or more) functions
- “Non operational” is a machine unable to undertake its primary task – deliver a ticket or validate. (Credit card ticket purchase was not tested.)

(Miller Report, 2001 pp.29-30)

Its findings (pp. 3-4) included:

- Only 72.8% of the ticketing machines on stations were fully operational. 18.7% were “fully non-operational” and 8.5% were “partially operational” but were able to provide a ticket.
- The situation on trams and buses was better, with 88.5% of ticket machines on trams and 87.6% of ticket machines on buses fully operational.
- On average, 95.6% of validators were fully operational.
- There were significant deficiencies in reporting of defects.

It concluded that

Public frustration with the performance of the ticketing system is understandable.

(Miller Report, 2001 pp. 29-30)

Miller recognised that the contract had fundamental problems and that relationships were adversely affected by long-running disputes that prevented effective communication and the development of a common purpose. Its recommendations (p.6) included:

- A forum be convened of OneLink, the Franchisees and the RCH to address customer needs and ATS improvements.
- To agree meaningful performance reporting for the travelling public.
- Resolution of the then current disputes between the parties.
- Improved contract relationships.

The report also made the point that “how to combat vandalism remains in contract limbo.” (p.18).

Another aspect that received attention in the report was the status of the agency network and what it termed “off-system sales” generally. It said

The link between off-system sales targets and the minimal equipment provision was a critical aspect of the system balance. The slow performance of the off-system sales network has had the effect of increasing the sensitivity to the on-system equipment problems.

(Miller Report pp.15-16)

It also stated that

The performance specification envisages an expansion of retail outlets from 580 to more than 1000. (As at May 2001 there were) 800 agencies selling only around 16% of the tickets compared to a target of 26%.”

(Miller Report, 2001 p.15)

The off-system sales aspects are not included in the scope of this 2002 report.

The Executive Summary of the Miller Report is included as Appendix 1 to this report. Certain material extracted from the Miller Report has also been included in text and tables in this report for the purpose of comparison or explanation.

4. Major Developments since the Miller Report

Following receipt of the Miller report and consideration of its findings, a series of programs were introduced on a “prioritised” basis, including:

- Improved communications between parties.
- Hardening of customer interface ticketing equipment on railway stations to enhance its ability to resist vandalism.
- Improved computer on-line monitoring processes for equipment on railway stations; and
- Rectification of the contract.

Some of these, with particular relevance to the performance of the ATS as experienced by the travelling public, are discussed in more detail in the following sections.

4.1. Contract Renegotiation

One of the most important conclusions of the Miller report was that the “contract framework was dense and restrictive” and that the contract was “inflexible and not necessarily consistent with customer and system priorities in 2001, or for 2005.” (p.14).

Considerable effort has been expended on renegotiating the contract and it would appear that this has achieved most of the objectives of the parties. Certainly, the relationships between the parties have significantly improved; there is evidence of a new common purpose in improving availability of the ATS, availability has actually improved and new measures of Customer Defined Availability have been developed.

The original contract structure was developed during the initial privatisation of one key aspect of the public transport system.

It was complex (and partly unsuitable for the purpose) for a number of reasons including:

- The complexity of the relationships between the parties/stakeholders.
- The progressive changes in management and ownership from PTC to a number of corporatised entities and then to the franchise structure of the current operating entities.
- A risk allocation that gave insufficient weight to the drivers for satisfactory performance by the parties.

In addition, the performance of the contract had been complicated by a history of implementation difficulties and resultant stresses in personal relationships. The Miller Report had drawn attention to the failure of the contract to meet its basic customer service objectives, with only about 73% of Ticket Vending Machines on the train network fully operational in March 2001.

Once a decision had been made for the Operators to pay the cost of an agreed program of equipment modification on railway stations, leading the way to a renegotiation of the contract with OLT, a number of strategies were developed by PTC and RCH, with improved availability as the main objective. It was also recognised that OLT had to be provided with appropriate commercial drivers to achieve the desired performance objectives. One of the major changes was to move the responsibility for dealing with the effects of vandalism to OLT, including paying an additional fixed sum per annum for the risk transfer. This process facilitated the tapping of the body of knowledge within OLT and elsewhere of the most common modes of vandalism-induced failures and the identification of cost-effective corrective action. Coincidentally, there were some changes in management and a new common determination amongst the key players to start again and make the successful operation of the system for the customers one of the central objectives. One of the results of this change was a general improvement of work practices in many areas, including more frequent or better timed cash collection and repair effort. At the same time, attention was being given to the structure of the next generation ticketing system and it was made clear to OLT that satisfactory performance of the ATS would be a pre-condition for being included as a tenderer for the next system.

As a result of these changes in the environment, there was a high level of cooperation during the contract re-negotiation phase leading to Heads of Agreement for a restructured contract that sought to reward good performance from the customer perspective.

Another major change was agreement to develop an enhanced software system reporting on functionality and availability of equipment on railway stations, both to the Customer and generally under the contract. This software is called the Availability Engine (AVE). It is described more particularly in Section 4.3 below.

The tenor of the proposed changes to the Contract is expressed in the Heads of Agreement, which say:

The CDA measure will change the current approach of the Melbourne (Automatic Ticketing System) contract from an equipment-focussed contract to a customer orientated contract. The CDA measure will require all stakeholders to be focussed on the customer needs when interacting with the (ATS) system.

Introduction to Schedule 1 CDA Measures, in the Heads of Agreement

Actual changes to the contract included:

- Commencement of a trial of a modified basis for assessment of OLT's delivery using new performance standards (CDA Measures) and agreement to publish the CDA measure results.

- Transfer of Vandalism and Non-Relevant Failure risk to an agreed maximum level to OLT.
- An increase in the Part B component of Ordinary Payments in recognition of the transferred responsibilities.
- Settlement of all outstanding claims on agreed terms.
- Adoption of weekly meetings during implementation, and at least monthly thereafter, to agree whether OLT were meeting the CDA measures and the level of compliance achieved. Matters to be covered include the number of vandalism incidents for the previous period and all other relevant matters, leading to determining the financial consequences to OLT of any non-availability for the previous period.
- The “implementation of a new management approach and co-operative partnership”.
- A new dispute resolution clause embodying Short-form Expert Determination.

The contract is not amended with respect to retail agents.

As described in Section 4.2, there has been substantial progress achieved to date, with a step-change in availability of ATS equipment on railway stations and a significant improvement in the availability of the rest of the system. In addition, as described in Section 4.3, there have also been significant improvements in the quality and timeliness of the data reported to RCH, although there is still some way to go on reporting for mobile ticketing equipment on trams and buses.

There may need to be some further work over time to fine-tune elements of the revised agreement. For example, certain business rules are established that serve the dual objectives of establishing contract penalty charges and of reporting “customer availability”. As discussed in Section 4.3, some limited instances of equipment being actually “unavailable” for customers are treated as “available” for contract penalty purposes and arguably other instances occur where equipment actually “available” for customers is treated as “unavailable” for contract penalty purposes. It may be that the solution may ultimately be to make some parts of the reporting of Customer Defined Availability more sophisticated, separately allocating responsibility for lost availability between OLT and others (such as the franchisees). Just as the amendment of the contract provided more appropriate drivers for the behaviours expected to produce the desired outcomes, so the status of the business rules needs to be regularly reviewed to ensure that they continue to act to facilitate the appropriate outcomes.

4.2. “Hardening” the ATS Equipment

The Miller Report found that the structure of the contract as it existed in 2001 was such that not only did it fail to provide drivers for OLT to make the ATS equipment more resistant to vandalism and certain other “faults”, but also it obscured the incidence of many of the causes of loss of availability through the classification of these simply as matters outside OLT’s area of responsibility.

Behaviour by third parties leading to loss of availability to customers included incidents caused by:

- Attempts to steal money from machines.
- Attempts to facilitate fare evasion by the “excuse” of ticket machines or validators being disabled.
- Antisocial acts causing actual damage to equipment.

Chart 1 shows that between 1998 and 2001, the incidence of vandalism directed at the ATS had increased by almost 3 times. It can also be seen there was a recurrent peak each year in the period before Christmas. By the end of 2001, the weekly average incidence of vandalism had reached some 600 events per week, with about 95% of these train related. The situation then was arguably worse than as described in the Miller report in March 2001.

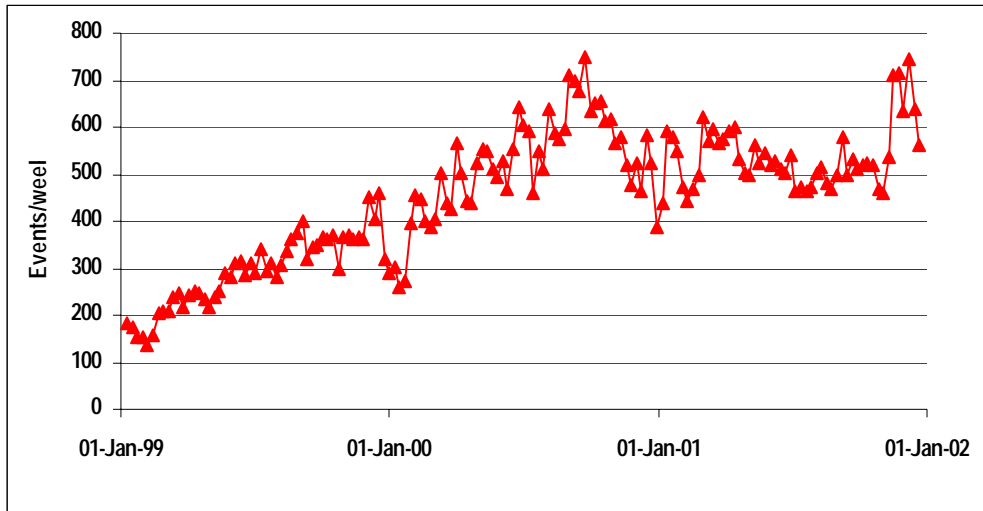


Chart 1 Vandalism on Public Transport Network 1998- 2001

Data supplied by RCH

Of the tram related incidents, over 70% were validator related.

For the purposes of monitoring and analysis, vandalism has been classified into nine broad classes.

CODE	DESCRIPTION
VA	Foreign Matter in Ticket Slot
VB	Foreign Matter in Coin Slot
VC	Foreign Matter in Note Slot
VD	Foreign Matter in EFTPOS Slot
VE	Graffiti
VF	Damage
VK	Attempted & Successful Break-ins
VQ	Liquid Damage
VX	Attempts To Steal Money Other Than Break-Ins

Table 1 - Vandalism Code Descriptions

While break-ins had accounted for only 6% of the total incidents, the impact had been very high since these generally caused equipment to be out-of-service for up to a week and repair costs were often tens of thousands of dollars.

Equipment	Vandalism	Break-ins
TVM1	125	10
TVM2	286	15

Table 2 – 2001 Average weekly TVM vandalism

Data supplied by RCH

A program, called “hardening” of the equipment, has been introduced to improve identification of the causes of faults and to modify the equipment on railway stations to reduce the incidence of faults caused by third parties. The development of the program included extensive consultation with the parties with an interest in the matter including transit police, ERG, Fujitsu and Mayne Nickless (the cash service subcontractor) and the introduction of enhanced analysis of the available data as an input to regular weekly availability meetings.

This program comprised a number of sub-programs including:

For Ticket machines on railway stations (TVM1 for Coin only machines and TVM2 for Coins, Notes and EFTPOS transactions)

- Addition of sensors & software to detect and frustrate cash interception.
- Strengthening doors and hinges.
- Better locks on doors and cash vaults within TVM’s.
- Stronger coin and note vault brackets and structures.
- Improved software to give earlier indications of tampering.

Validators for trams and buses

- Changing the throat angle.

The planned modifications to TVM’s were trialled through the latter part of 2001 and the roll-out was carried out across the train system in the first half of 2002. The “hardening” of the equipment, while requiring a concerted and innovative engineering effort and significant investment, has been relatively straightforward.

These enhancements have resulted in a dramatic reduction in the number of successful attempts at theft or actual disabling of ticket machines or validators and in antisocial acts causing actual damage to equipment, with total weekly vandalism declining to close to 20% of 2001 levels. Chart 2 shows a graphical representation of this improvement.

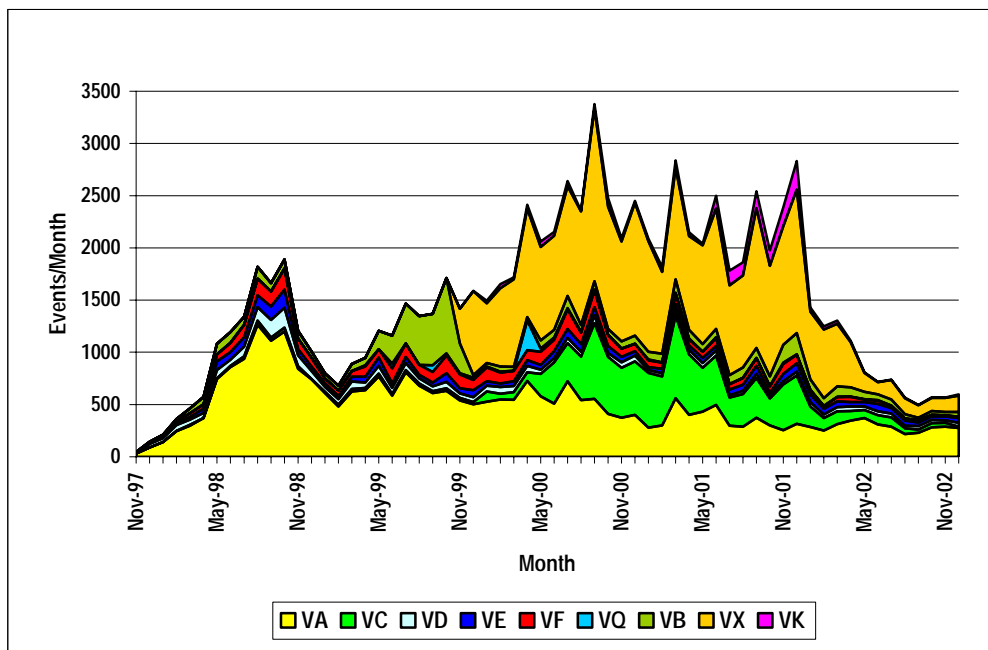


Chart 2 Monthly incidence of Vandalism by Class for 1998 to 2002

Data supplied by RCH

Chart 2 shows the vandalism incidents classified into the categories described in Table 1 over a time period extended to include calendar year 2002.

The overall number of vandalism events in each calendar year is summarised in Table 3. The table uses the same data as presented in Chart 2. It shows an increase of 18% in vandalism events in 1999 and an almost doubling in 2000. Vandalism reached a plateau in 2001 and then in 2002 the incidence was reduced to about one third of the 2000 and 2001 levels.

Code	Description	1998	1999	2000	2001	2002
VA	Foreign Matter in Ticket Slot	8751	7474	6435	4298	3406
VC	Foreign Matter in Note Slot	191	247	3962	5371	969
VD	Foreign Matter in EFTPOS Slot	1088	668	634	441	407
VE	Graffiti	864	617	685	630	586
VF	Damage	1076	1201	1386	846	313
VQ	Liquid Damage	0	177	399	53	36
VB	Foreign Matter in Coin Slot	836	3059	763	1265	723
VX	Theft attempts not Break-Ins	0	1141	12184	12560	3485
VK	Attempt/Successful Break-ins	0	2	439	1346	148
Annual Total		12806	14586	26887	26810	10074
Annual Increase			+14%	+84%	±0%	-62%

Table 3 Number of Vandalism Events per year

Data supplied by RCH

The variation in the incidence of the various types of vandalism over time shown graphically in Chart 2 and aggregated in Table 3 illustrates clearly the effects of the progressive implementation of the hardening measures in the early part of 2002. This augers well for a further reduction in 2003, with a full year's effect operating, although it may be expected that the vandals may learn new techniques to damage equipment and so cause a temporary interruption in reduction of successful disabling vandalism attempts and thus to the improvement in Customer Availability.

It can be seen that the most significant reductions in the number of vandalism events have been in the categories;

1. VC Foreign Matter in Note Slot (reduced from 5371 to 969), and
2. VX Attempts to steal money other than Break-ins (reduced from 12560 to 3485).

In addition, while the number of events in category VK (attempted and successful break-ins) has always been small, the expensive and highly disruptive break-ins have almost been totally eliminated. The recent trends show that the focussed attention of the hardening program has borne fruit.

To facilitate a direct comparison with the material presented in the Miller Report, Table 4 shows the improvement in performance since that time for equipment, segregated into fixed equipment on train stations and mobile equipment located on trams and buses. It can be seen that the very poor ATS availability as at 2001, described in the Miller report as causing "public frustration with the performance of

the ticketing system” has been turned around, at least as far as ticket machines are concerned.

Item	March 2001 Survey* (one sample)	Aug & Sept/Oct 2002 survey# (four samples)
Fixed Equipment		
Train ticket machines tested	459	1831
Train ticket machines “fully operational” (able to buy ticket with no major faults/defects)	72.8%	92.1%
Giving incorrect change	3.2%	1.4%
Percentage unable to buy a ticket at all	18.7%	1.3%
Train Validators tested	466	1969
Percentage assessed as non operational	5.7%	3.3%
Mobile Equipment		
Tram & Bus ticket machines tested	589	1059
Tram & Bus ticket machines “fully operational” (able to buy ticket with no major faults/defects)	88.1%	98.3%
Giving incorrect change (applicable to trams only)	7.0%	0%
Percentage unable to buy a ticket at all	3.2%	1.6%
Tram & Bus Validators tested	1730	3103
Percentage assessed as non operational	4.0%	2.7%

* = information extracted from the Miller Report, 2001 pp. 31 & 34

= information extracted from the RCH Report, Appendix 2 and other RCH sources

Table 4 Comparison of ATS Equipment Performance 2001 and 2002

The state of achievement of the range of primary objectives proposed by the Miller Report is discussed in some detail in Section 4.5, but it could be concluded that the fundamental requirement for a step change in the performance of the system as experienced by the customer has been substantially achieved.

The statistics collected during 2002 on the incidence of vandalism is graphed in Chart 3 and shows a disaggregation of vandalism between rail and trams during 2002. It further reinforces the very significant improvement in the incidence of vandalism for ATS equipment on rail but shows a slight increase of incidents for trams. This is not surprising for the hardening program was substantially directed at the highly vulnerable facilities on the train network. It may be that vandals are turning their attention away from the train network now that their success rate has diminished. It is expected that the tram and bus networks would be included in the continuous improvement program during 2003 as discussed later.

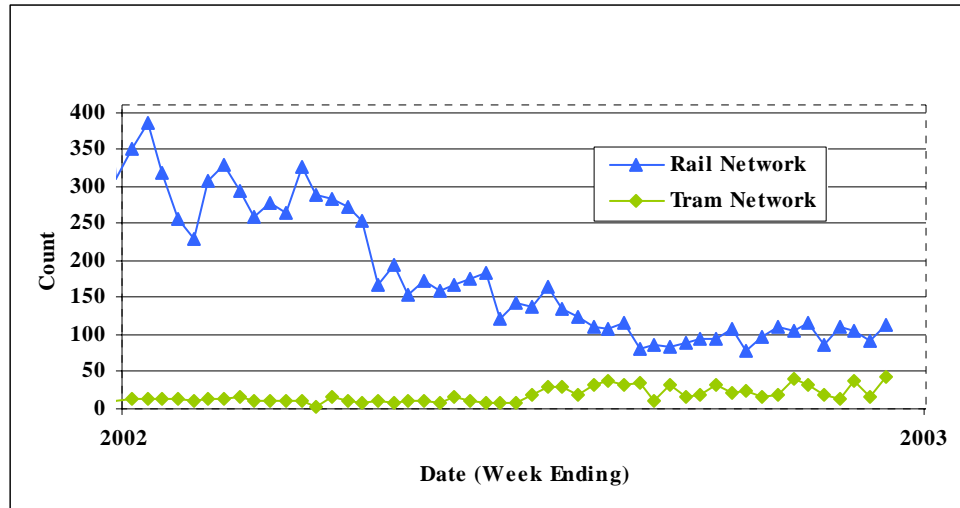


Chart 3 Weekly Incidence of Vandalism on Trams and Trains during 2002

Data supplied by RCH

More detailed data on the 2002 physical audit results is shown in Section 4.4 below.

The Miller Report provided data for the ATS performance on the Railway System on a line by line basis, derived from the audit. RCH has collected more complete data about the incidence of various types of vandalism since January 2002 and carried out extensive analysis as a means of focussing attention on areas needing improvement, for measuring the effectiveness of the “hardening” program and to detect trends in incidents. This data shows a high level of variability in vandalism week by week and by transport route (line by line) and suggests that it may be affected to some degree by events such as festivals or school or university holidays. Accordingly, no data is presented in this report on a line by line basis.

Now that the systemic weaknesses in the equipment have been substantially modified, one aspect of the continuous improvement program is working towards a better understanding of the nature of this variability. For example, it has now become possible to forecast some of the high risk periods and locations and to take active measures to reduce the incidents.

The experience of the hardening program has been that as the resistance of the equipment to vandalism improves, the number of vandalism attempts tends to reduce. If the same forces operate generally, the overall incidence of vandalism may decrease as a broader range of improvement programs takes effect.

4.3. Computer System Enhancements (AVE)

The Miller Report in “Part 2: ATS Performance” dealt with the performance of the system from the perspectives of the contract and the public, identified significant differences and sought to assess whether sufficient data existed within the ATS to allow the differences to be monitored and managed. It identified a number of occurrences that affected the public but which were not reported as “machine unavailability” (p.26). These occurrences included downtime due to agreed preventative maintenance, upgrades, vandalism, cash collection, failure caused by the operators, or deferred maintenance due to a requirement to avoid affecting adjacent in-service equipment.

The Miller Report said:

Qualifications of the Data

While the survey data shows a ‘snap shot’ of the state of the equipment, it is only a partial understanding of the effect on the public and the commercial standing of public transport.

For instance:

- (a) The data does not show how long machines were unable to deliver a ticket, or have had a fault.
- (b) The data does not show the number of travellers inconvenienced – ie whether the ‘fault’ occurred during peak travelling times and how many travellers use the mode of travel and access to the system.
- (c) The data does not show the regularity of ‘faults’ and whether travellers have changed their ticket purchase patterns in response to any pattern of faults.
- (d) The data does not show whether the fault affected all or just one of the available ticket sources for passengers.

These and many other factors need to be better understood if we are to quantify the effect that equipment failure will have on the attitude and actions of travellers.

(Miller Report, 2001 p.33)

In addition, in the section on Management Information and Data, Miller concluded that “OLT must provide PTC/RCH access to and the right to take copies of the files and records. However, there appears to be little or no management information which would routinely assist in the development of rectification strategies for the problems identified by this audit”. (p.21). In addition, at p.23 it said, “there is no attention to the actual level of equipment available to the public”. This improved access to records has been achieved.

In addition, as a consequence of the changes to the Contract, OLT is well advanced in a development program to bring together the software used to monitor and report on availability of equipment and functionality, both to the travelling public and generally under the contract, to a specification that has been agreed between the stakeholders. This software is now called the Availability Engine (AVE). It provides a comprehensive set of meaningful reports for the train network, and arrangements are in place for the data and report generator to be freely available to RCH and to PTC.

A systems review of the AVE has been conducted by Dialog Information Technology to assess the integrity of data and systems used by OLT to report ticketing machine availability and other performance aspects of the ticketing system. The Dialog review provides a strong endorsement for the overall integrity and functionality of the new information system.

Dialog examined how data is received from the point of collection, data checking, data integrity, control features and manipulation of raw data to produce CDA information. It reported that the AVE receives all of the real time alert and usage data provided from the computer system provided by OLT for the fixed ticketing machines used by the train system, and in addition, data manually entered by operators at the OneLink Call Centre (Manual Alerts). Alarms for fixed ticketing machines are transmitted immediately, but usage data is collected by a twice daily “polling” process carried out at about 10:30 am and 9:30pm. This information enables the AVE to identify in-service/out-of-service times for fixed ticketing machines and to calculate their availability. Manual Alerts cover all parts of the system, including mobile equipment, but there still seems to be room for improvements in the way some of this data is handled.

The AVE function includes comparing the timing and number of ticket sales within the period with historical statistics, and reporting as a potential fault for investigation any instances that are significantly lower than expected. It can be concluded that the design of the AVE addresses almost all of the fundamental defects identified by the Miller Report in management information particularly for the fixed equipment, with the exception of data about “the number of travellers inconvenienced”.

Dialog states that the AVE *accurately* reports the availability of the *fixed* ticketing machines *as specified by the contract with some minor exceptions*. It provides a strong endorsement for the integrity and functionality of the new information system. The important qualifications include:

- The reporting of mobile equipment is not so far advanced.
- The definitions of availability in the contract do not necessarily represent availability to the customer (particularly for mobile equipment), and
- The nature of the “minor exceptions”.

The phrase “as specified by the contract” in this case includes a set of agreed interpretations called “business rules” which define how data is to be handled.

The AVE serves two functions. It provides data for administration of the contract penalty provisions and it also provides data for use as a measure of Customer Defined Availability (CDA). These two different purposes are met by the same set of measures, and the requirement for the contract penalty provisions is the more important from OLT’s point of view, since this data determines OLT’s net remuneration under the contract. However, this design concept means that some of the data used for CDA is really only an indicator rather than a strict measure. There are some comparatively minor problems that arise due to certain business rules in the agreement attempting to serve the dual objectives.

For example, the difference between the business rules written for contract penalty purposes and a true algorithm for availability for CDA purposes arises in respect of “availability” for equipment on trams and buses.

“Real time” data on the availability of mobile ticket machines used on trams and buses is not provided because of:

- Limitations on the communications capacity provided on the vehicles.
- The structure of the business rules applied to trams and buses. For example, the business rules for trams recognise that the mobile ticketing equipment is not presently made available for repair by OLT except at terminuses or depots. The rules require 30 minutes notice to OLT as to the time the machine will be “first available” for repair and then a five minute period for the repair. The rules also provide that the vehicle must have been available within 5 minutes of the nominated time, or the repair window starts again after a further “first available” time is notified. If the defect is repaired within the repair window, for contract penalty purposes the ATS device is regarded as having been 100% available. Since availability for repair is a key requirement, this is reasonable for contract penalty purposes. However, it is scarcely a true algorithm for availability for CDA purposes.
- The machines on buses do not currently transmit data on machine alerts as they occur. Instead, the alerts are downloaded when the bus returns to the depot. As discussed for trams, while these mobile machines are reported as specified in the contract, this does not satisfactorily describe the availability of the machines as perceived by the customer.

Arguably, other instances occur but with the opposite effect. For example:

- Some train stations have redundancy in equipment, with 2 or more TVM's on the station. While for contract penalty purposes it may be desirable to count one machine not being available as a fault, it may not appear as such to a customer who is able to buy a ticket at the other machine. While there may sometimes be sufficient demand at peak times for this to discommode a customer, it is unlikely to do so at off-peak times. Perhaps a more complex algorithm based on time of fault or current level of demand would be more representative of CDA where multiple machines exist.
- It may be argued that many customers will have the cash or credit facilities on them to choose one of several payment options, such as coin, notes or EFTPOS. If only one function is not available, is the facility to purchase a ticket "unavailable" to the customer? Should the unavailability of only one of a number of alternative functions be reported and weighted in some way as less of a problem than the total unavailability of the only machine at a facility?

There is another instance where the business rule may be regarded as harsh, even for contract penalty purposes. For example, "being serviced or attended" (as may occur when change is being added to the coin vaults) is counted as "unavailable". Provided the period of unavailability for this cause is short, or interruptible at the request of any customer needing to buy a ticket, it may seem onerous to count this as a penalty event (or a CDA "unavailable") event.

It should be noted that there may be different views held by reasonable people as to the appropriateness of the business rules used for the purpose of contract penalty or for assessing CDA availability. Just as the amendment of the contract provided more appropriate drivers for the behaviours expected to produce the desired outcomes, so the status of the business rules needs to be regularly reviewed to ensure that they are acting to facilitate the appropriate outcomes.

The usage data collected by the "polling process" is already a valuable tool for management analysis, and provides scope for further enhancement. The polling periods have been set so that the data for each of the morning and evening peaks can be separately analysed soon after the peak is passed, with the maximum time made available for investigation and rectification before the next peak period commences. It is understood that the limiting factor on frequency of polling is in the communications system and the software, and it may be argued that more frequent polling could give earlier detection of faults that do not generate an alarm. However, the variability of the time phasing of ticket sales from any particular machine is such that it is not clear whether more frequent polling would improve CDA or simply divert resources to a series of false alarms.

Dialog recommends certain optional enhancements to address the problem of deficiencies in CDA reporting in the AVE for mobile equipment. These include:

- Move to real-time alerts for trams and buses. This would be relatively harder for buses than for trams, where data is already collected and a subset of major faults transmitted in real time to the staff at the tram control centre via the tram operator's vehicle monitoring system. A screen showing this information is now located in the OLT Control Room. (While Dialog did not comment, it seems that the screen information could be used to enhance timely entry into the AVE system.)
- Download daily the full data set on usage and machines out-of-service for CDA purposes; or

- Change the current recording of manual reports to the call centre from simple instance reports to a report including the duration from time of call to confirmed rectification, with a more adequate description of the reason for the fault and whether there was a genuine loss of availability to the customer.

Of these, the first would be the best option as far as contributing to improved availability to the public. It may be that the solution may ultimately include reporting the unavailability attributable to OLT under the contract as just one component of the unavailability perceived by the customer, and to also record other details including allocation of responsibility.

The data from the AVE is sorted and analysed, and the results presented using an accessible data structure. This is reasonably easy to use and the data provided is clear and meaningful. The major phase of development is now complete and the data base will shortly be available to RCH and PTC for access and interrogation. At that point, almost all of the defects in data for fixed machines identified in the Miller Report will have been rectified, and these had been the machines most prone to failure.

The physical audit conducted in August 2002 identified a number of cases, including:

- Those where the AVE reported items of equipment as having faults but the auditors reported that these faults were not evident, and
- Those the audit detected a fault that the AVE did not report.

Investigations revealed some defects in the AVE design, and these were substantially rectified and re-tested by a second audit in September/October 2002. The results for the September October 2002 audit reconciliation with the AVE for the train system are shown in summary in Table 4, discussed in Section 4.4 and shown in more detail in Appendix 2. In this report, “AVE incorrect” covers both false alarms and omitted alarms.

Since the commencement of development of the CDA measures, there has been a trend for progressively improving CDA performance and the systems are in place for this to continue to occur. The physical audits have established that the CDA is able to be used as a reasonable representation of the situation of “operational availability” of the ATS experienced by the public travelling on the train system in the range of performance at that time. It would be prudent to check the calibration of the electronic monitoring systems at another point or points in the range at some time in the future. In the meantime, it seems reasonable to consider the CDA as robust enough to use for indicating trends in the performance of the fixed equipment on the railway network, with further calibration work to be carried out in the future in extended ranges of performance. In this context, “robust” is used to describe a measure that provides consistent results sufficient to indicate trends and with a reasonable absolute accuracy. This is similar to the status of measures in common use such as the monthly CPI figures and unemployment statistics, which are usually regarded as robust measures, although there may be some debate about definitions and the absolute meaning of the numbers. .

The AVE can provide an indication of CDA measures for trams and buses, but the usefulness of the data is restricted by two major constraints. These relate to:

- The business rule definitions which currently take full account of the restrictions on OLT’s access to investigate possible faults and to repair machines, and
- The constraints on “real time” reporting of alerts that arises from the restricted availability of communication channels from the mobile equipment. These constraints are more restrictive for buses than for trams.

Both of these matters have been discussed earlier in this report.

Over the next year it is expected that some aspects of these constraints will be investigated and that the AVE, the business rules and communications processes will undergo some degree of refinement. These should increase the accuracy of the CDA still further.

The system availability reports have not previously been sufficiently representative of customer experience to use for regular public reporting. Analysis of the areas of discrepancy with the AVE identified during the August audit led to enhancements to the software being carried out in August and September 2002. The September/October physical audit established that the information system reports can now be used for regular public reporting for the train system. The AVE data could also be used to report on aspects of ATS performance for trams and buses, but care must be exercised with definition of terms and clarity of communication until the business rules and communication channel issues are resolved.

This review process proved the usefulness of physical audits in validating data systems, and should there be significant changes in the future to the definitions or operational processes, it is recommended that a further physical audit be conducted to ensure that the data remains fully valid.

4.4. Comments on the Physical Audit and its correlation with the AVE

The physical audits were conducted during normal working hours on weekdays according to an agreed set of protocols. The protocols included that the audit was conducted by an independent audit-survey contractor together with an observer selected by ERG-OLT. Results were logged on paper and signed by both parties.

The audits were conducted in a similar way to the audits carried out for the Miller report but with certain refinements arising from the greater body of experience obtained. These differences include:

- Whereas the Miller had 3 classes of availability as set out in page 2 of this report, (Fully Operational, Partially Operational and Non-operational), the 2002 audit used only Operational and Non-operational.
- Whilst the 2001 audit did not test EFTPOS at all, the 2002 audit tested the EFTPOS facility on TVM2 and classed a machine with an EFTPOS fault as Non-operational.
- The Miller Report generally tested machines only once, and where by chance a machine was tested more than once, only the first test was counted. The 2002 audit generally tested machines four times, and counted all faults as a Non-operational incident.

The 2002 audit therefore uses a more stringent set of definitions than Miller, and the results show a greater degree of improvement than simply appears from the numbers. Considerable statistical analysis has been carried out to test for any bias arising from factors such as sample size and the time of testing, and the results are considered free of any defect on this score.

The results of the physical audits conducted in 2002 are shown in detail in Appendix 2 and summarised below. Table 5 shows the data for the train network and includes a comparison with the AVE reports for the same time. Table 6 and Table 8 show the results for trams and buses but without any equivalent AVE comparison.

Table 4 (in Section 4.2), Table 7 and Table 9 compare the results of the 2002 audits to those of the 2001 audit. These comparisons show a step-change in performance for the previously poorly-performing ticket equipment located on railway stations, and a substantial improvement for the others.

Note that blank fields represent zeros suppressed for ease of reference				
Description	Number	percent of total	AVE Reports**	
			Correct	Incorrect
TICKET MACHINES				
TOTAL	915	100.0%	842	73
NUMBER AVAILABLE	851	93.0%	832	19
coin jam, correct message				
coin jam, message not OK				
can't insert coin due to slot trouble				
"exact fare", correct message	2	0.2%		2
"exact fare", message not OK				
out of service, correct message	2	0.2%	2	
out of service, message not OK	3	0.3%		3
out of service, dead				
money taken but no ticket	1	0.1%		1
coins drop straight through	13	1.4%	1	12
being serviced or attended				
added sign showing "out of order"	1	0.1%	1	
machine not there at all!				
notes only TVM2, coins not accepted	1	0.1%		1
coins only TVM2, notes not accepted	5	0.5%	2	3
no concession for sale, full fare only				
no tickets for the zone TVM is in				
message reads "Enter PIN"				
debit card only, no cash accepted	4	0.4%	3	1
change was short	16	1.7%		16
change was long	4	0.4%		4
no EFTPOS, msg "Exceed Pin Tries"				
EFTPOS not working, message OK	1	0.0%		1
no EFTPOS, message not OK	11	0.4%	1	10
VALIDATORS				
TOTAL	986	100.0%	939	47
NUMBER AVAILABLE	951	96.5%	927	24
out of service, correct message	4	0.4%	4	
out of service, message not OK				
out of service, dead	1	0.1%		1
being serviced or attended				
added sign showing "out of order"	2	0.2%	2	
machine not there at all!				
can't insert ticket	13	1.3%	3	10
VAL keeps ticket				
won't validate	1	0.1%		1
keeps saying re-try	13	1.3%	2	11
other	1	0.1%	1	
BARRIERS				
TOTAL	591	100.0%	587	4
NUMBER AVAILABLE	588	99.5%	587	1
Can't insert ticket	1	0.2%		1
keeps saying re-try	1	0.2%		1
Bar won't open for good ticket	1	0.2%		1
Bar opens for expired ticket				
FAULTS COMMON TO VARIOUS EQUIPMENT				
Frustrated access				
Impossible to read essential signs				
Impossible to read screen				
Machine functionally fouled				
TOTAL UNAVAILABLE	102	4.1%	22	124
TOTAL AVAILABLE	2390	95.9%	2346	44
TOTAL ITEMS OF EQUIPMENT	2492	100.0%	2368	

**Comparison of the results of the physical audit and the AVE Report, if they match = correct

Table 5 Comparison for Train equipment of AVE results with Sept/Oct 2002 Physical Audit

Derived from data supplied by RCH

Note that blank fields represent zeros suppressed for ease of reference		
Description	Number	Percent of total
TICKET MACHINES		
TOTAL	558	100%
NUMBER AVAILABLE	543	97.3%
coin jam, correct message		
coin jam, message not OK		
can't insert coin due to malfunction within slot	1	0.2%
"exact fare", correct message	1	0.2%
"exact fare", warning message not given		
out of service, correct message	7	1.3%
out of service, message not OK	2	0.4%
out of service, dead.....	1	0.2%
money taken but no ticket issued		
coins drop straight through, no deal	2	0.4%
being serviced OR attended		
added signage showing "out of order"		
machine not there at all	1	0.2%
coins not accepted		
no concession tickets for sale, full fare only		
no full fare for sale, conc fare only		
change was short		
change was long		
VALIDATORS		
TOTAL	2687	100%
NUMBER AVAILABLE	2605	96.9%
out of service, correct message		
out of service, message not OK		
out of service, dead.....	34	1.3%
being serviced OR attended		
added signage showing "out of order"		
machine not there at all	6	0.2%
can't insert ticket	25	0.9%
VAL keeps ticket	1	0.0%
VAL is dead	2	0.1%
keeps saying re-try	13	0.5%
other	1	0.0%
FAULTS COMMON TO VARIOUS EQUIPMENT		
Frustrated access		
Impossible to read essential signs		
Impossible to read screen		
Machine functionally fouled		
TOTAL UNAVAILABLE	97	3.0%
TOTAL AVAILABLE	3148	97.0%
TOTAL ITEMS OF EQUIPMENT	3245	100.0%

Table 6 Results of August 2002 Physical Audit for Tram Equipment

Derived from data supplied by RCH

These results when compared with those of the Miller report show significant improvement for the ATS ticket machines on trams, and modifications to vault emptying cycles have subsequently provided further improvement by reducing out of service incidents caused by "vault full" protection.

Item	Miller (2001)	August 2002
Ticket machines fully operational	88.5%	97.3%
Validators fully operational	95.9%	96.9%

Table 7 Comparison of Performance Changes for Tram Equipment

Description	Number	Percent of total
Ticket Issuing Machines		
Total	501	100%
Number Available	497	99.2%
Validators		
Total	501	100%
Number Available	499	99.6%
TOTAL UNAVAILABLE	6	0.6%
TOTAL AVAILABLE	996	99.4%
TOTAL ITEMS OF EQUIPMENT	1002	100%

Table 8 Results of August 2002 Physical Audit for Bus Equipment

Derived from data supplied by RCH

Note that bus operators make a significant effort to take defective equipment out of service and this is a contributing factor in the exceptional performance of the ATS on buses.

These results when compared with those of the Miller report also show significant improvement for the ATS ticket machines on buses.

Item	Miller (2001)	August 2002
Ticket machines fully operational	87.6%	99.2%
Validators fully operational	96.4%	99.6%

Table 9 Comparison of Performance Changes for Bus Equipment

The correlation between the Physical audit and the AVE reported availability was tested on an exhaustive comparison on a per machine per instance basis. Table 5 is based on the AVE being regarded as giving a false result if it reported a machine as having a fault when the auditor did not detect the fault, or if it failed to report a machine as defective and the auditor detected a fault. This may bias the result to make the AVE seem less accurate than actually true, if for example, a damaged coin was stuck in the slot and was later cleared by the following customer inserting a normal coin. The operation of these types of reporting and classification rules needs to be reviewed in the future to ensure that the AVE performance is not being incorrectly reported as lower than actually occurs.

The Miller report and its associated field survey used classifications of “Fully Operational”, “Partially Operational” and “Non- Operational”. The 2002 physical audits used only two classifications, “Available” and “Unavailable”, although a number of categories of unavailability were recorded for analysis and contract administration purposes. “Available” in this report is the equivalent of “Fully Operational” in the Miller Report, except that “Exact Fare Operation” (EFO) in TVM2’s has been treated as “available”, although in the contract, there is a separate penalty for EFO. In the 2002 physical audit results, there were 15 cases of EFO

included in the 805 “fully operational” TVM2’s. If these had been classified as “not operational”, the figure for “fully operational” would have been reported as 91.9% rather than 92.1% for the 2002 physical audit.

As discussed above, the CDA measures produced by the OLT AVE can now be considered robust enough to function as an indicator of trends for the train system within acceptable limits of accuracy with some qualifications on calibration as the range of application is extended. There are some minor issues that are undergoing progressive refinement and the outworking of these should increase the accuracy of the CDA still further.

In the time since the 2002 physical audits were conducted, the AVE has shown a further improvement in the performance of railway ticket machines. The overall improvement since the Miller Report has resulted from the program that has included hardening of the machines to resist the effects of vandalism, improved preventative maintenance processes and training, analysis of usage patterns and fault trending, improved electronic monitoring, improvements in work practices including rostering more technicians at peak demand time and improved ticket media. The program is ongoing and the effects are continuing even now.

The trend has been from a figure of around 92-93% “fully operational” in August/October 2002 to better than 95% for the period November 2002 through January 2003 for railway ticketing machines. The data is plotted in Chart 4, together with a representation of the two physical audit results for comparison purposes.

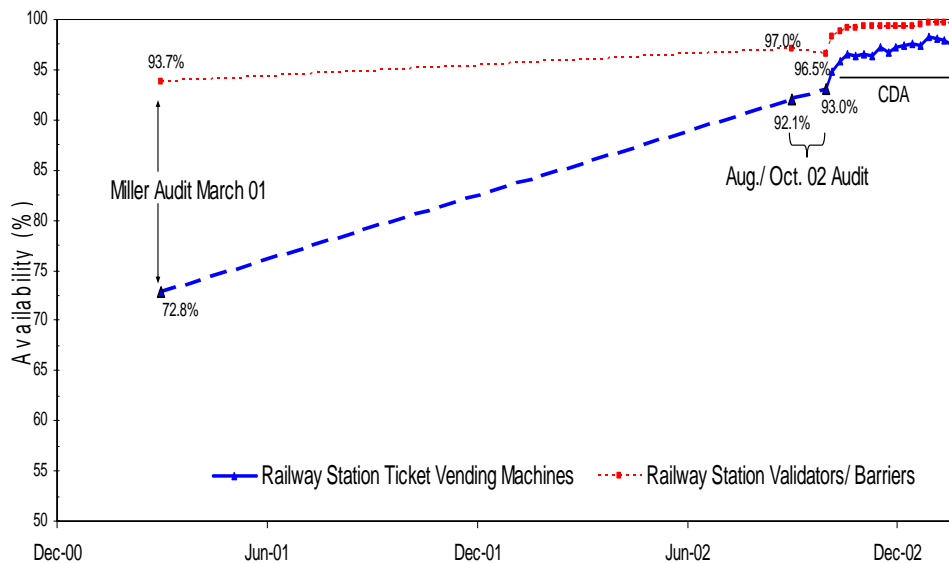


Chart 4. Trend in Improvement in Fully Operational Availability of Railway Station ATS Equipment
2001-2003 - Combined Audit and CDA Results

It would be desirable to conduct further physical audits for the train system from time to time to ensure that the CDA represents the real situation as experienced by the customer, particularly while there is significant change still taking place. It is not anticipated that a formal report (such as this report) would be necessary, unless there was a significant deterioration in the usefulness of the AVE as an indicator.

For the tram and bus systems, there are still significant issues to be resolved relating to business rules and communication channels that affect the usefulness of the CDA

reporting from the information systems, although the data is acceptable for contract administration purposes. Until the final resolution of these issues, it seems that there is still a place for physical audits for trams and buses to establish the real situation as experienced by the customer for annual reporting purposes.

5. Continuous Improvement Program

The implementation of changes to the contract, processes and systems since receipt of the Miller report has brought about a major step-change in performance of the ATS. These improvements have included:

- Changing the contract structure so as to provide effective drivers for improved customer defined availability.
- Changing the culture into a common endeavour to improve service as perceived by the customer.
- Hardening of the equipment, particularly for the fixed equipment, so as to reduce the impact of vandalism on the availability of the ATS equipment/system.
- Much improved data collection and reporting, particularly for the fixed equipment, so that the real state of the system is readily assessed and to facilitate analysis and rectification of any areas of weakness.

Any further step changes in the railway station equipment will be more difficult to achieve, but there is certainly room for a program of continuous improvement in both the ATS and the information systems that support and monitor it, and this can be expected to give further substantial incremental performance improvement. There have been some other changes not specifically discussed in this report, such as increasing the range of tickets available for purchase on trams. These are not included in the CDA definitions but affect aspects of the service available to the customer and may have a significant effect on customer perceptions of ATS performance.

Some of the broad areas to which continuous improvement activities may be directed include:

- Continued improvement in the CDA measurement and reporting processes.
- Expanded involvement of the operators, and their staff who interface with the public, in ensuring the successful operation of the public transport ticketing system. This may encompass a number of aspects including timely reporting of any faults in ATS equipment, or a focus on ensuring prior attention to the initial condition plus enhanced support of equipment performance, at the time of any special events that place the system under particular stress, such as might occur at Richmond station on AFL Grand Final day.
- Expansion of the initiatives that have been so successful for the fixed equipment to cover the mobile equipment. While there may be particular technical difficulties and possibly significant costs in full implementation, many of the benefits may be achieved by partial implementation.
- Improved communication processes between the stakeholders and with the public.

A more detailed listing is included in Appendix 3.

A number of these have already been identified by the stakeholders, in this report or in the Dialog review. These need to be evaluated, prioritised and an implementation program agreed.

6. Other issues to consider

6.1. Customer satisfaction and the CDA

The CDA has been developed to measure the performance of the ticketing system as seen by the customer. It is a well-structured and detailed measure and provides a high degree of information that enables well-focussed improvement programs and the ability to detect any emerging trends for new or increased incidence of defects. It is comprised substantially of machine and system measures. This is appropriate for a measure that is intended to perform two separate functions; customer service and contractual compliance.

Appendix 5 contains extracts from Customer Satisfaction surveys conducted by DOI.

One might expect there to be an inherent time delay in any changes to the public's perceptions at a time of step changes in ATS performance. This could arise because of the need for a period of continued improvement in the quality of a delivered service before the customer's acceptance that this is the new level of performance rather than simply an aberration. This is sometimes referred to as hysteresis. It is also possible that there are factors that affect customer satisfaction other than the performance of the ATS as a technical system.

Miller reported that in 2001

Of the ticket machines tested in the field, 72.8% of those at train stations were fully operational, 88.5% of those on board trams and 87.6% of those on board buses.

(Miller Report, 2001, Automatic Ticket System Field Surveys, Executive Summary)

It is interesting that customer satisfaction with the system as reported by customer satisfaction surveys (CSI) is significantly different than might be expected from the results as measured by either a physical audit or the CDA.

The CSI results extracted in Appendix 5, showed customer satisfaction (regardless of operator) ranked for the same period as the Miller report audit as:

Metro Buses	60 -75 (approaching very satisfied)
Trains	50 -55 (just on the satisfied side)
Trams	45 -50 (just on the dissatisfied side)

Where CSI is an index based on a scale of:

- 0 is fully dissatisfied,
- 20 is very dissatisfied,
- 40 somewhat dissatisfied,
- 60 somewhat satisfied,
- 80 very satisfied,
- 100 fully satisfied

Trams at that time ranked worst in the customer satisfaction survey even though Miller found them the best performed. The CSI is a subjective indicator and is likely to be affected by the total public perception of the ticketing environment which may include issues such as notions of unchecked fare evasion, the previous limitations as to the types of ticket available in trams, etc. Another major factor is likely to be the time-lag between people having changed experiences and coming to believe that this represents a genuine and sustained change in performance. A public relations campaign that communicates the improvement that has been achieved may well initiate public recognition of the new reality.

There may also be some other factors such as difficulties of access to equipment in a crowded peak-hour tram that represent a different type of limitation on customer defined availability to that covered by the current CDA measures.

The current approach to CDA has used a highly focussed set of criteria and this has generated the urgently required step-change improvement in ATS performance for the railway station based equipment. It is understood that the components of the CDA are under review as to whether it needs to cover a larger range of matters that are important to the travelling public, and particularly that it includes those areas most requiring improvement.

6.2. Validators

The availability of validators does not seem to have improved significantly since 2001, and although there is generally some equipment redundancy at a location, at about 97% for trams and trains is not satisfactory for this type of equipment. Recorded performance of this equipment on buses at 99.6% is much higher and this suggests that other factors such as operator attitudes or ease of swapping out defective equipment may be important.

While the availability of validators is therefore still an issue, anecdotal evidence suggests that the incidence of passengers validating tickets, particularly on trams and at peak times, is low. Validation on buses should not be such a problem, since the passenger passes by the driver on boarding and validation is able to be monitored, and encouraged. In addition, the linking of validation to ticket sales on buses is different to other transport modes, and this provides an additional driver for operator intervention in the event of a validator fault. Tickets sold by agencies or at train stations are not date stamped until validated, and exit (or entry) at city loop stations requires passing through a barrier that demands a validated ticket for the current time period. In addition, validators at train stations are conveniently located close to the quite limited number of entry points to platforms. A ticket that has never been date stamped is easily detected by a ticket checker. There is therefore probably a high degree of validation for train tickets, at least for the initial journey and for journeys that start or terminate at City Loop stations. However, it is unclear how often tickets are validated in practice for a second journey in the time period if it is between suburban stations.

Tickets purchased on trams are validated for that journey on issue by the ticket machine. Validators on trams are generally located away from entry points, to facilitate quick entry and exit of passengers, and are often difficult to access on a crowded tram. It would seem likely that tram journeys are characterised more by short journeys than trains, particularly around the city, and at peak times. A short journey on a crowded tram, with the need to exit again soon after boarding, may make validation so difficult as to seem to some passengers not worthwhile. This may reinforce any mistaken mindset that validation is an “option” rather than a mandatory requirement.

Alternatively, it may be worthwhile to run a focused publicity campaign so that the customers understand why tickets should be validated. It is generally insufficient to merely state that “You are legally required to validate your tickets on each boarding”. It may be better to show that:

- Validation provides patronage information, which is used to develop service and staffing schedules (ie every time you validate your ticket you are helping to ensure the services you need are provided at the time you need them).
- Validation data can facilitate revenue apportionment between operators, ensuring money is paid to the operator offering the service you want to use.

- Validating your ticket encourages others to do so, reducing fare evasion and ensuring the continued provision of services at the lowest prices.
- A validated ticket provides proof of a right to travel.

Increased compliance on validation may place additional stress on the robustness of the ticket media, especially for tickets subject to high degrees of use for extended periods of time, such as annuals or monthlies.

7. Conclusions and Recommendations

It is clear that the actual performance of the Automatic Ticketing System in terms of Customer Defined Availability is very much improved since the writing of the Miller Report in early 2001. By the September/October 2002 audit, “Fully operational” availability of ticketing machines on train stations had improved from 72.8% to 92% and the percentage at which it was not possible to buy a ticket at all had reduced from 18.7% to 1.3%. This step-change in performance of the ATS on the train system is the direct result of the changes that have taken place since consideration of the Miller Report in the areas of:

- Modification of the contract.
- Hardening of customer interface ticketing equipment to enhance its ability to resist vandalism.
- Improved computer on-line monitoring processes, and
- Improved communications and relationships between parties.

While buses and trams have not so far featured strongly in the equipment hardening program, the other changes to the ATS such as to the contract and to management processes have affected performance for these modes of public transport. The result has shown an improvement in “fully operational” performance between the 2001 and 2002 audits as follows:

Transport Mode	“Fully Available”	
	2001 Audit	2002 Audit
Train Ticket machines	72.8%	92.1%
Tram Ticket Machines	88.5%	97.3%
Bus Ticket Issuing Machines	87.6%	99.2%

The differences in the business rule definitions of availability need to be kept in mind when comparing the results between trains and other modes. However, there has clearly been a strong trend for progressively improving ATS performance over the period and the systems are in place for this to continue to occur.

The CDA measures produced by the OLT AVE are now robust enough for indicating trends in the performance of the fixed equipment on the railway network. They have been shown to represent the trends in the actual situation experienced by the travelling public on the railway system in terms of “operational availability” as detected by a physical audit, within acceptable limits of accuracy. There are minor issues of business rule definition that are undergoing progressive refinement and this should increase the accuracy of the CDA still further. The adoption of the current structure of the CDA definitions has proven to lead to significant improvement in

hardware performance, particularly in regard to the resistance to vandalism of ticket machines.

The system availability reports have not previously been sufficiently representative of customer experience to use for regular public reporting. Analysis of the areas of discrepancy with the AVE identified during the August audit led to enhancements being carried out in August and September 2002. The September/October physical audit established that the information system reports can now be used for regular public reporting of the performance of the ATS for trains. For the tram and bus systems, there are still significant issues to be resolved before representative CDA can be provided by the information systems, although the data is acceptable in the interim for contract administration purposes and as an indicator of some trends. Improvement of this area of the AVE system should be a priority for the next continuous improvement stage. Until these issues are resolved, there will be a place for physical audits for trams and buses to establish the real situation. In addition, this process proved the usefulness of physical audits in validating data systems. It would be desirable for a further physical audit to be conducted on the entire ATS system within the next year or so, to ensure that the improvement in performance has been maintained and that the robustness of the CDA has been maintained over the period. In addition, should there be significant changes in the future to the definitions or operational processes, it is recommended that a further physical audit be conducted to ensure that the data is valid.

8. Appendices

- 8.1 Executive Summary Miller Report (2001)**
- 8.2 RCH Report – Availability of On-Line Ticketing Equipment Field Survey, September-October 2002 Summary Report**
- 8.3 Continuous Improvement Program**
- 8.4 Progress on the Miller Recommendations**
- 8.5 Customer Satisfaction Monitoring Survey Data**

Appendix 8.1 Executive Summary Miller Report (2001)

EXECUTIVE SUMMARY

The Miller Network Group was contracted by the Department of Infrastructure to undertake an independent audit of the Automatic Ticketing System (ATS) in March 2001.

The audit involved two major elements: (1) the collection and analysis of data on the operational state of ticketing equipment, and (2) a review of the ATS contracts, including discussions with stakeholders.

Contractual material was analysed to identify the obligations of the parties and the performance measures included to measure performance against those obligations. The analysis was carried out as a functional and operational review. The review was not in any way intended as a legal or accounting review.

For the purposes of simplification, in this report, OneLink Transit Systems P/L is presented by the acronym OLT.

1. Customer perceptions of ticketing system performance

An intensive field survey was undertaken of ticket machines and validators. This identified the status of equipment across the transport system at the time of inspection. The results of the survey represent what a typical customer would perceive as the performance of the ticketing system.

In addition, data was also collected at two stations over 3 days to compare the actual operational state of the equipment and how this was being registered on the OLT data system. This allowed us to compare the alert system of OLT with the actual problems the public were experiencing with the equipment.

The system wide audit found the following - at the time of inspection:

- Only 72.8% of ticket selling machines on stations (334 of the 459 inspected) were “fully operational” – this means the public could buy a ticket with no major problems.
- 18.7% or 86 machines on stations were “non operational” - unable to provide a ticket, while 8.5% or 39 machines on stations, could provide a ticket, but had other major problems – were partially operational”.
- Unstaffed stations had a significantly lower proportion of fully operational ticket selling machines (69.9%) than staffed stations (78.1%).
- Cash holding equipment is more likely to have faults/defects than the validators.
- 88.5% of ticket machines on trams (285 of 322 inspected) and 87.6% of ticket machines on buses (234 of 267 inspected) were “fully operational”. On trams and buses, only a small proportion of machines were “non operational”; 4% on trams (13 machines) and 2.2% on buses (6 machines).
- On average, across all modes, 95.6% of validators tested were fully operational.

- “incorrect change” was the most common defect when a machine was able to deliver a ticket, but was not fully operational (15 machines at stations and 20 on trams).
- “coin slot blocked” was the major defect recorded when machines were unable to provide a ticket. 7.8% (36 machines) of all machines on the rail system were recorded as having a blocked coin slot. 27 of those machines were on unstaffed stations. This is about double the rate of coin blocks on staffed stations.

Where two stations were systematically monitored over 3 days and on site machines problems compared to OLT fault reporting, the following was identified:

- At the unmanned station, only 4 of the 13 actual machine problems were automatically reported. Total time for which the 2 machines were not ‘fully operational’ over the three days was 16 hours and 15 minutes – 33% of available time.
- On the manned station, 3 incidents occurred of which one was automatically notified. This involved a loss of 3 hours 15 minutes when machines were not fully operational (4.5% of available time).

The results of the field surveys show that public frustration with the performance of the Automatic Ticketing System is understandable. The major problems arise from vandalism of ticket dispensing machines on unstaffed and staffed railway stations.

2. Contracted performance requirements

The 1994 ATS contract is the base document identifying the range of responsibilities of the parties. The ATS contract was initially established between the OneLink Consortium (OLT) and the PTC. Following privatisation of the transport operations, a private company, the Revenue Clearing House (RCH) was set up. The RCH is owned by the franchisees and DOI (on behalf of the private bus contracts).

The ATS contract is between OLT and the PTC. We are advised that the PTC have allocated management of the contract to the RCH. At the time of writing, full assignment of the contract to the RCH had not occurred.

The ATS contract is complex, dense and prescriptive:

(The reviewers are aware that several aspects of the contract are the subject of long standing dispute between the PTC and OLT – and we are sensitive not to prejudice any party’s position in the disputes. However, as we commented in our recommendations, the sooner these matters are resolved, the sooner the parties can single mindedly concentrate on delivering quality services to the public.)

- The contract predominantly focuses on equipment standards and compliances, rather than service standards.
- Compliances emphasise what the system “should do” – supported by potential penalties of up to \$6.7m per annum. The system does not encourage innovation, adaptation and development – with maximum incentives of only \$400k per annum. Since June 1999, OLT has reported performance against their assessment of the contract criteria, effectively meeting the contract

definition of “equipment availability”. This is reflected in OLT being penalised only \$244k during the 21 months from February 1999 to November 2000.

- Compliance requirements are not able to ensure a high quality customer service for the travelling public. Under the contract, ticketing equipment is required to be 99.85% “available”. The definition of “availability” excludes equipment with faults or malfunctions caused by “vandalism” and “non-relevant failure” (defined on page 28). Notwithstanding the data OLT can capture, our audit identified that a significant number of incidents and some equipment features (incorrect change) are not able to be automatically captured on the OLT system, as it is currently programmed.

3. Summary of issues inhibiting ATS performance problems being solved:

The auditors formed the view that:

- The OLT contract does not foster solutions to problems, rather the KPIs focus OLT on limited equipment requirements rather than the needs of public transport operators and users.
- The current ticketing system is not making efficient use of possible management data and is not collecting key data that will assist in improving the operational standards of the system. Decisions on what data is required should be made in conjunction with the current operators, and other stakeholders with an interest in the future of the system and its continued integration.
- There are no effective incentives in the ATS contract to encourage innovation and strategic thinking between OLT, the operators and other interested parties.
- There is currently no focus or priority given to resolving and reducing equipment defects created by vandalism, or equipment malfunctions (other than where it impacts on the OLT contract).
- The OLT system collects a significant amount of data, however, faults and alarms that are not defined as affecting “availability” are not currently reported.
- The presence of active commercial disputes between OLT and the PTC/RCH over contractual issues (including repairs for vandalism) has inhibited parties from developing practical solutions to the problems being experienced by the travelling public; and
- Delays in assigning the OLT contract from the PTC to the RCH (and the Franchisees) is effectively inhibiting the operators from properly addressing the problems their customers are experiencing.

4. Recommended actions to improve customer satisfaction with the ticketing system

Following on from the audit process, the auditors developed the view that the main parties to the future successful performance of the ATS (One Link, Franchisees and RCH) have the technical capabilities, skills, will and commitment to improve the

ATS to meet customer expectations. However a range of contractual agreements, disputes and issues have created a ‘log jam’ inhibiting effective cooperative action. It is also clear that cooperative action by these main parties is the only way that improvements will be achieved. Accordingly the auditors recommend to the Minister for Transport that:

1. A forum be convened by Government, facilitating One Link, Franchisees and the RCH to address customer needs and improvements to existing ATS arrangements.
2. All parties involved in the forum agree that the forum, any information or data submitted to the forum, or action plans and outcomes determined by the forum, will not be used in any existing contractual disputes between the parties.
3. Initial tasks of the forum should be :
 - to identify how best to ensure integrated management of continuous improvement actions by Franchisees, One Link and RCH, and
 - to agree meaningful customer oriented performance reporting for the travelling public.
4. As a parallel but separate activity, resolution of the existing PTC/RCH – OLT dispute be progressed as a matter of “responsible commercial urgency”, and
5. RCH, Franchisees and the PTC be encouraged to finalise assignment of the OLT contract as a priority, to enable improved system management.

INTRODUCTION

The Miller Network Group was contracted by the Department of Infrastructure to undertake an independent audit of the ATS in March 2001. The Miller Group assigned Mr Michael Wright and Ms Liz Maddison to undertake the audit and prepare the analysis required.

The audit had four terms of reference. These are outlined below:

1. Analyse contractual documentation and arrangements with OneLink Transit Systems P/L (OneLink or OLT) and identify:
 - System performance standards and compliance requirements.
 - Equipment faults/malfunctions not covered for contract compliance.
 - Provisions which ensure availability of fully functioning ticket vending and validating machines.
 - Contractual arrangements for bonuses and penalty payments to or by the contractor.
2. Report on performance by the contractor against those standards and contractual requirements including arrangements in place to:
 - Manage, monitor and report on the performance of the ATS.
 - Identify causes of ATS equipment failure and the incidence of failure by type including vandalism.
 - Identify if any, machine malfunctions that are not electronically relayed to OLT including how they are reported and programmed for rectification.

- Rectify all faults to return equipment to full functionality in the earliest possible time; and
 - Respond to public complaints about the ATS.
3. Make recommendations on actions required to:
 - Correct any shortcomings in equipment availability; and
 - How performance should be monitored and processes required to cost-effectively report on the on-going performance of ATS to Government.
 4. Identify current obligations on train and tram franchise operators, the Revenue Clearing House (RCH), the Public Transport Corporation (PTC), the Director of Public Transport (DPT) and Department of Infrastructure (in relation to buses) to ensure that the APS is effective; report on changes which will occur when the contract with OneLink is assigned from the PTC to RCH.

Note:

On-site surveys of ATS equipment functioning will be conducted on all public transport modes and real-time reconciliation of results with fault reporting and rectification systems will be carried out.

Appendix 8.2 RCH Report – Availability of On-Line Ticketing Equipment Field Survey, September-October 2002 Summary Report

Availability of On-Line Ticketing Equipment

Field Survey, September-October 2002

Summary Report

Prepared By

Revenue Clearing House

Level 1, 607 Bourke Street

Melbourne 3000

GPO Box 3693TT Melbourne 3001

11th February 2003

Executive Summary

From 30 September 2002 through 11 October 2002, a field audit of fixed on-line Automated Ticketing System¹ equipment was carried out by Revenue Clearing House P/L. The method was to test by actual purchases the availability of random pieces of equipment at random inspection-timings. “Available” was understood in terms of an agreed definition². This definition was stringent and customer-oriented. Where machines tested were not available at the time tested, the “type of unavailability” was recorded.

For each equipment type, the data set determines the *percent of time* equipment of that type was available to the customer. Put otherwise, the *probability that equipment will be available to a customer* is measured.

The survey was designed to support two functions:

- (i) to check the performance of an automatic on-line “Availability Engine” (AVE) being developed by ERG-OLT³; and
- (ii) to provide, for the survey period, equipment availability figures that are independent of the AVE.

The sample comprised 915 observations of Ticket Vending Machines (TVM), 986 observations of Validators (VAL), and 591 observations of Barriers (BAR). The 915 TVM observations were made up of 490 TVM1⁴ and 425 TVM2.⁵

Ticket vending machine availability was 93%⁶. This compares with 73% as given in the “Automatic Ticket System Field Surveys” of March 2001⁷.

¹ Automated Ticketing System, ATS

² Agreed for the audit purpose by the train operators, the RCH, and ERG-Onelink Transit Systems.

³ ERG-Onelink Transit Systems, the ATS provider.

⁴ TVM1 are the smaller type railway station TVM. They do not accept notes and they do not accept debit cards.

⁵ TVM2 are the large TVM that accept notes and debit cards.

⁶ (as defined)

⁷ *Automatic Ticket System Field Surveys of March 2001*, Steer Davies Gleave 2001

Validator availability was 96%,⁸ compared with 94% in March 2001.

The commonest fault in Ticket Vending Machines (TVM) was non-acceptance of coins without loss of coins. There were no cases of blockage leading to loss of coins. Formerly this was a more common problem, a high 4% in March 2001.⁹ Incorrect change, 3% in March 2001,¹⁰ was improved but still 2%.

⁸ (as defined)

⁹ *Automatic Ticket System Field Surveys of March 2001*, Steer Davies Gleave 2001 p. 4

¹⁰ *Automatic Ticket System Field Surveys of March 2001*, Steer Davies Gleave 2001 p. 3

1. Rules And Definitions

- i. Purchases with “exact change” were not required. Indeed ticket purchases were done with non-exact money so that change was always expected (except as provided in Rule XVII).
- ii. Before commencing each ticket purchase, audit surveyors checked under the coin return flap to see if any coins were already there.
- iii. All change was counted; under change and over change are defined as forms of “unavailability”.
- iv. In the event of apparent rejection of coins and/or notes, a second batch of notes and/or coins was tried. In case of continuing rejection, “unavailability” was recorded only after two unsuccessful attempts with each of two batches of money.
- v. With TVM2s both coins and notes were tested.
- vi. Suspect coins and notes were removed from the audit process.
- vii. All test purchases were of low value.
- viii. Separate testing of full fare and concession was *not* included. This means that the audit cannot guarantee detection in all cases when full fare tickets are not available. The tester bought concession tickets. Similarly, unavailability of tickets in zones other than the local zone can go undetected. Nevertheless some button faults can be detected without making purchases.
- ix. In the event of any EFTPOS malfunction, the transaction was tried again with a different EFTPOS card. Up to two attempts were made with each of two cards.
- x. When machines to be audited are in continuous use, it is sufficient to observe customer usage.
- xi. Before recording BAR or VAL failure, a retry was made with a different ticket.
- xii. To count as available, BAR must open for a valid ticket and stay closed when challenged with an expired ticket.
- xiii. BAR can only be audited when they are in normal “mostly closed” service operation. BAR that had been turned off by the train operator were not sampled.
- xiv. A validator was “available” if it *appeared* to validate the ticket (no electronic “before and after” checks were taken).

- xv. A validator which failed to reject “passback” attempts was still considered “available” provided it worked *for the customer*.
- xvi. Touchcard testing was not included.
- xvii. By definition, a machine which disavowed any function lacked that function. Thus, a machine which shows an “exact fare only” message on its read-out was considered “exact fare only” without further test. Similarly a machine showing “debit card only” was not tested with coin or notes. However, any residual functions (apart from claimed disabilities) were still checked. Thus, a machine which shows “exact fare only” was still tested using exact fare, to make sure it works at all. And a machine showing “debit card only” was still tested with a debit card.
- xviii. Machines with “out of order” signage were considered out of order by definition.
- xix. Machines affected by vomit or other unpleasant substances are unavailable by definition.
- xx. “Unavailable” includes cases where decals are so completely missing, or TVMs so defaced, that a person without local knowledge would be unable to get a ticket.

2. Data Collection

Machines were observed in the field by a team comprising an audit-survey contractor selected by RCH, and an observer selected by ERG-OLT. Results were logged to paper and signed off by both parties.

The data logging form is shown overleaf.

3. Types Of Unavailability

The following categories were recognized:

AVAILABLE
coin jam, correct message
coin jam, message not OK
can't insert coin due to slot trouble
"exact fare", correct message
"exact fare", message not OK
out of service, correct message
out of service, message not OK
out of service, "dead"
money taken but no ticket
coins drop straight through
being serviced or attended
added sign showing "out of order"
machine not there at all!
no concession for sale, full fare only
no tickets for the zone TVM is in
machine fouled
change was short
change was long
Frustrated access
impossible to read essential signs
impossible to read screen
OTHER

Table 1: Availability Categories Recognized: September-October 2002 Audit

Equipment At Electric Train Stations, Melbourne

4 Sampling

The sample comprised (with very small variations) two complete circuits of all electric train stations in the Melbourne metropolitan system.

A number of procedures were agreed to control costs.

- Audit observers circulated through the system on a convenient route at convenient times.
- Each station was visited exactly once on each of two “circuits” of all stations (this “systematic” sample is in some respects better than random).
- All fixed machines were checked at the same time, at any location visited.
- The sample was confined to, and spread equally over, the weekday daytimes; no data were collected evenings or weekends.¹¹

¹¹ ERG-OLT has supplied strong grounds to accept that so far, availability is evenly spread over days and times, both inside and outside the survey times. On this basis the method used would not introduce any harmful bias.

5. Tabulated Results

The tables that follow show results of the September 30th to October 11th audit.

	TVM1	TVM1
	<i>n</i>	percent
AVAILABLE	465	95%
coin jam, correct message		
coin jam, message not OK		
can't insert coin due to slot trouble		
"exact fare", correct message	2	0.4%
"exact fare", message not OK		
out of service, correct message	3	0.6%
out of service, message not OK	2	0.4%
out of service, "dead"		
money taken but no ticket	1	0.2%
coins drop straight through	9	1.8%
being serviced or attended		
added sign showing "out of order"	1	0.2%
machine not there at all!		
no concession for sale, full fare only		
no tickets for the zone TVM is in		
machine fouled		
change was short	6	1.2%
change was long	1	0.2%
Frustrated access		
impossible to read essential signs		
impossible to read screen		
OTHER		
TOTAL	490	100%

Table 2: Ticket Vending Machines "TVM1": Average Availability:

30 September through 11 October 2002:

Melbourne Electric Railway Stations

	TVM2	TVM2
	<i>n</i>	percent
AVAILABLE	381	90%
coin jam, correct message		
coin jam, message not OK		
can't insert coin due to slot trouble		
"exact fare", correct message**	5	1.2%
"exact fare", message not OK**		
out of service, correct message		
out of service, message not OK	1	0.2%
out of service, "dead"		
money taken but no ticket		
coins drop straight through	4	0.9%
being serviced or attended		
added sign showing "out of order"		
machine not there at all!		
notes only TVM2, coins not accepted		
coins only TVM2, notes not accepted	5	1.2%
no concession for sale, full fare only		
no tickets for the zone TVM is in		
message reads "Enter PIN"		
debit card only, no cash accepted	4	0.9%
change was short	10	2.4%
change was long	3	0.7%
no EFTPOS, message "Exceed Pin Tries"		
EFTPOS not working, message OK	1	0.2%
no EFTPOS, message not OK	11	2.6%
Frustrated access		
impossible to read essential signs		
impossible to read screen		
OTHER		
TOTAL	425	100%

**This line item included here for completeness, although "exact fare" failures in TVM2s are handled and penalized separately

Table 3: Ticket Vending Machines "TVM2": Average Availability:

30 September through 11 October 2002:

Melbourne Electric Railway Stations

	TVM all	TVM all
	<i>n</i>	percent
AVAILABLE	846	92%
coin jam, correct message		
coin jam, message not OK		
can't insert coin due to slot trouble		
"exact fare", correct message**	7	0.8%
"exact fare", message not OK		
out of service, correct message	3	0.3%
out of service, message not OK	3	0.3%
out of service, "dead"		
money taken but no ticket	1	0.1%
coins drop straight through	13	1.4%
being serviced or attended		
added sign showing "out of order"	1	0.1%
machine not there at all!		
notes only TVM2, coins not accepted		
coins only TVM2, notes not accepted	5	0.5%
no concession for sale, full fare only		
no tickets for the zone TVM is in		
message reads "Enter PIN"		
debit card only, no cash accepted	4	0.4%
can't insert ticket		
machine fouled		
change was short	16	1.7%
change was long	4	0.4%
no EFTPOS, message "Exceed Pin Tries"		
EFTPOS not working, message OK	1	0.1%
no EFTPOS, message not OK	11	1.2%
Frustrated access		
impossible to read essential signs		
impossible to read screen		
OTHER		
TOTAL	915	100%

** For completeness, this line item includes "exact fare" failures in TVM2s, which are handled and penalized separately

Table 4: Ticket Vending Machines Both Types: Average Availability:

30 September through 11 October 2002:

Melbourne Electric Railway Stations

	VAL	VAL
	<i>n</i>	percent
AVAILABLE	951	96%
out of service, correct message	4	0.4%
out of service, message not OK		
out of service, "dead"	1	0.1%
being serviced or attended		
added sign showing "out of order"	2	0.2%
machine not there at all!		
can't insert ticket	13	1.3%
VAL keeps ticket		
won't validate	1	0.1%
keeps saying re-try	13	1.3%
machine fouled		
Frustrated access		
impossible to read essential signs		
impossible to read screen		
OTHER	1	0.1%
TOTAL	986	100%

Table 5: Ticket Validators: Average Availability:

30 September through 11 October 2002:

Melbourne Electric Railway Stations

	BAR	BAR
	<i>n</i>	percent
AVAILABLE	588	99%
out of service, correct message		
out of service, message not OK		
out of service, "dead"		
being serviced or attended		
added sign showing "out of order"		
machine not there at all!		
can't insert ticket	1	0.2%
won't validate		
keeps saying re-try	1	0.2%
BAR won't open for good ticket	1	0.2%
BAR opens for expired ticket		
machine fouled		
Frustrated access		
impossible to read essential signs		
impossible to read screen		
OTHER		
TOTAL	591	100%

Table 6: Barrier Gates: Average Availability:

30 September through 11 October 2002:

Melbourne Electric Railway Stations

	BarVal	BarVal
	<i>n</i>	percent
AVAILABLE	1539	98%
out of service, correct message	4	0.3%
out of service, message not OK		
out of service, "dead"	1	0.1%
being serviced or attended		
added sign showing "out of order"	2	0.1%
machine not there at all!		
can't insert ticket	14	0.9%
VAL keeps ticket		
won't validate	1	0.1%
keeps saying re-try	14	0.9%
BAR won't open for good ticket	1	0.1%
BAR opens for expired ticket		
machine fouled		
Frustrated access		
impossible to read essential signs		
impossible to read screen		
OTHER	1	0%
TOTAL	1577	100%

Table 7: All Validating Equipment: Average Availability:

30 September through 11 October 2002:

Melbourne Electric Railway Stations

	All <i>n</i>	All percent
AVAILABLE	2385	96%
coin jam, correct message		
coin jam, message not OK		
can't insert coin due to slot trouble		
"exact fare", correct message**	7	0.1%
"exact fare", message not OK		
out of service, correct message	7	0.3%
out of service, message not OK	3	0.1%
out of service, "dead"	1	0.0%
money taken but no ticket	1	0.0%
coins drop straight through	13	0.5%
being serviced or attended		
added sign showing "out of order"	3	0.1%
machine not there at all!		
notes only TVM2, coins not accepted		
coins only TVM2, notes not accepted	5	0.2%
no concession for sale, full fare only		
no tickets for the zone TVM is in		
message reads "Enter PIN"		
debit card only, no cash accepted	4	0.2%
can't insert ticket	14	0.6%
VAL keeps ticket		
won't validate	1	0.0%
keeps saying re-try	14	0.6%
BAR won't open for good ticket	1	0.0%
BAR opens for expired ticket		
machine fouled		
change was short	16	0.6%
change was long	4	0.2%
no EFTPOS, message "Exceed Pin Tries"		
EFTPOS not working, message OK	1	0.0%
no EFTPOS, message not OK	11	0.4%
Frustrated access		
impossible to read essential signs		
impossible to read screen		
OTHER	1	0.0%
TOTAL	2492	100%

** For completeness, this line item includes "exact fare" failures in TVM2s, which are handled and penalized separately

Table 8: All ATS Ticketing Equipment Combined: Average Availability:

30 September through 11 October 2002:

Melbourne Electric Railway Stations

6. Results Of The Audit In August 2002

Table 9 gives results of a similar size audit survey conducted 12th-23rd August 2002. There is no significant difference between the August and September-October audits.

	August 2002							
	TVMs				BAR/VAL			
	TVM1	TVM2	TVM1	TVM2	VAL	BAR	VAL	BAR
	n	n	%	%	n	n	%	%
AVAILABLE	466	380	94%	90%	954	795	97%	98%
coin jam, correct message								
coin jam, message not OK	2	1	0%	0%				
can't insert coin due to slot trouble	1		0%					
"exact fare", correct message	1		0%					
"exact fare", message not OK								
out of service, correct message	7	2	1%	0%	4		0%	
out of service, message not OK	1		0%					
out of service, dead					5	2	1%	0%
money taken but no ticket								
coins drop straight through	11	7	2%	2%				
being serviced or attended						2		0%
added sign showing "out of order"		1		0%	2	1	0%	0%
machine not there at all!								
notes only TVM2, coins not accepted								
coins only TVM2, notes not accepted		6		1%				
no concession for sale, full fare only								
no tickets for the zone TVM is in	1		0%					
message reads "Enter PIN"								
debit card only, no cash accepted		5		1%				
can't insert ticket in VAL					4		0%	
VAL keeps ticket								
won't validate								
keeps saying re-try					13	1	1%	0%
Bar won't open for good ticket						7		1%
Bar opens for expired ticket								
Machine functionally fouled					1		0%	
change was short	2	3	0%	1%				
change was long		1		0%				
no EFTPOS, msg "Exceed Pin Tries"		3		1%				
EFTPOS not working, message OK		7		2%				
no EFTPOS, message not OK		4		1%				
Frustrated access		1		0%				
Impossible to read essential signs		1		0%				
Impossible to read screen								
OTHER	2		0%			1		0%
TOTAL	494	422	100.00%	100.00%	983	809	100%	100%

Table 9: All ATS Ticketing Equipment: Average Availability:

12 August through 23 August 2002:

Melbourne Electric Railway Stations

Statistically, the improvement to barrier figures is significant, but it may not mean anything about the barriers. Train operators had turned more of them out of “mostly closed” mode at the time of the September-October survey.

While it is true that the August and September-October surveys returned the “same” result within the limits of statistical uncertainty, they are *also* consistent with a long trend of improvement since the time of the “Miller Report”.

7. Distribution Of Faults Over TVM2s

The August and Sept-Oct 2002 audits provide data on four “circuits” of railway station equipment. This is an opportunity to see if there is significant variation of reliability across the system, for example are there “good” TVM2s and “bad” TVM2s.

Data from the two audits together show a distribution of problems over TVM2s that looks very random. That means that generally, any TVM2 is about as likely to give trouble as any other TVM2! There isn't a range from low to high “fault proneness”.

In the graph below, the green line shows theoretical numbers of machines getting 0, 1, 2, 3, or 4 detected faults. It was calculated from the assumption that all TVM2s are the same. For comparison the blue columns are what actually happened. The fit is very good. If many machines were significantly more fault prone than the rest, then the blue graph would be more “spread out” than the green.

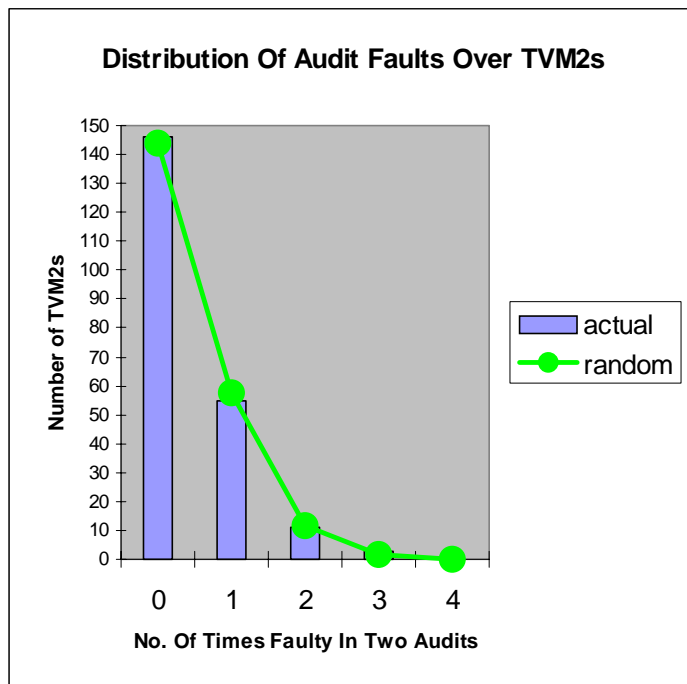


Figure: Actual TVM2 Recorded As Faulty (Blue)

Compared With Theoretical Expectation If Accidents Are Random (Green)

Appendix 1: Tram Ticketing Equipment

Appendix 2: Bus Ticketing Equipment

Bus Ticketing Equipment: during the period 12 August through 21 August 2002, ticketing equipment on 501 buses in service were observed by auditors. This covers ticket issuing machines (TIM) and validators (VAL). In the case of buses, availability was high. Bus operators are quick to take buses out of service when equipment is faulty.

SUMMARY OF RESULTS: BUSES IN SERVICE				
Condition of Equipment	TIM	TIM	VAL	VAL
	n	%	n	%
Functional	498	99%	498	100%
Not Functional				
	501	100%	501	100%

**Table 11: Bus Ticketing Equipment: Average Availability:
12 August through 21 August 2002**

Appendix 8.3 Continuous Improvement Program

Some of the areas in which continuous improvement activities may be directed are listed below, and a number of these have already identified by the stakeholders. These need to be evaluated, prioritised and an implementation program agreed.

Extend Improvement program to mobile equipment	CDA Measurement & Reporting	Expanded Involvement of Operators	Improved Communication
Extending real time data acquisition to the tram and bus networks.	Continuing the development of the AT systems measurement and reporting framework, including refining the business rules to: * Strictly measure availability; * Allocate responsibility for loss of availability; * Review weighting of faults to ensure prioritised corrective action; * Review the principle that all faults are of equal weight. Eg. Unavailability of EFTPOS vs. unavailability of cash purchase facility.	Improved access for servicing ATS equipment on trams and buses	Formalising communication channels and associated processes to facilitate the exchange of ideas and expectations, including regular expediting of progress on all agreed action plans.
Extending some equipment features to the tram and bus networks.	Adoption of a formal problem-solving process including “root cause” analysis, full stakeholder involvement in development and assessment of alternative solutions, and post-implementation evaluation of all corrective actions to verify that the desired results are delivered.	Increased “ownership” of the ATS by all Operators, especially tram and bus drivers, control room and station staff	A positive marketing campaign to draw attention to the improved performance of the ATS & seeking support for initiatives to minimise vandalism.
	Refinement of the measurement and reporting framework to cover other aspects of the AT systems operation eg: Monitoring of EFTPOS sales		Improved understanding of the systems architecture and of data currently collected.
	Investigate relationship between Customer Satisfaction Survey results and the definitions used for CDA for trams to determine whether either or both need further refinement		Pursuing a positive marketing and public relations campaign to increase validation of tickets
	Optimisation of the provision of redundant equipment at the busier stations		

Appendix 8.4 Progress on the Miller Recommendations

The Miller Report contained a number of very useful comments in the body of the report and some specific recommendations as to actions required. Not all of these were of equal weight or priority and some are more difficult to achieve than others. It is however useful to record the progress made to date on achieving those recommendations or responding to the comments. The recommendations are dealt with first in the following table.

Miller page ref	Recommendation/Comment (1)	Progress Achieved	Comment
42	R1. Collect better data, improve OLT data systems, sensors or programming	Substantially complete	See comments in Sections 4.2 & 4.3
42	R2. Better analyse the data	Substantially complete	See comments in Sections 4.2 & 4.3
43	R3. Link maintenance strategies to minimising impact during peak periods	Well advanced	Larger workforce in peak periods, polling of usage data to detect any un-alarmed incidents
44	R4. Improve capture of data on faults affecting the public but outside the contract	Substantially complete	Contract amended to make these OLT's responsibility
14	C1. Contract is dense, complicated, inflexible, not focussed on overall service outcomes, and lacks incentives	Substantially complete	At agreed HOA stage and being implemented. On schedule to meet commitments
14	C2. Operators need to be encouraged to develop clear statement of requirements	Partial	RCH and PTC are still leading the drive. Further Franchisee involvement reqd.
18	C4. Reporting obscured by NRF and Vandalism issues	Complete	Now fully reported
20/21	C6. Management Information & data <ul style="list-style-type: none"> • Align reports to meet management requirements • Provide data on actual equipment availability • No weighting for unavailability at peak periods 	Substantially complete Fixed - substantially complete. Mobile - modest improvement Weightings now apply	Priority was on the fixed equipment which was worst performing

Miller page ref	Recommendation/Comment (1)	Progress Achieved	Comment
33	C8. Data not provided on: <ul style="list-style-type: none"> • How long machine unable to deliver a ticket • Number of travellers inconvenienced • Regularity of faults and affects on purchase patterns • Did fault affect all or some sources of tickets 	Fixed yes, mobile no No No Yes	
38	C9. Gap in capacity of ATS to identify faults as experienced by the public	Yes, substantially complete except for duration data on mobile equipt	Identified as an area for improvement
41	C10. Improvement required on issues relating to coin mechanisms, coin collection and incorrect change	Progress on coin mechanisms, work continuing on other aspects	

- (1) In addition there were a number of comments/recommendations made in relation to off-system sales and the customer service centre that were not included in the scope of this report.

Appendix 8.5 Customer Satisfaction Monitoring Surveys

The public perception of customer service quality has been monitored by a sampling process since July 1997 for trams and trains and for buses since 1999.

The survey samples both users and non-users of public transport. A sample for telephone interviews is selected at random from the telephone directory for areas served by train, tram, bus and regional coach services. Interviewees are asked about their usual public transport use and to rate public transport on a satisfaction scale that categorises whether the person is totally, very or somewhat satisfied or dissatisfied with the service.

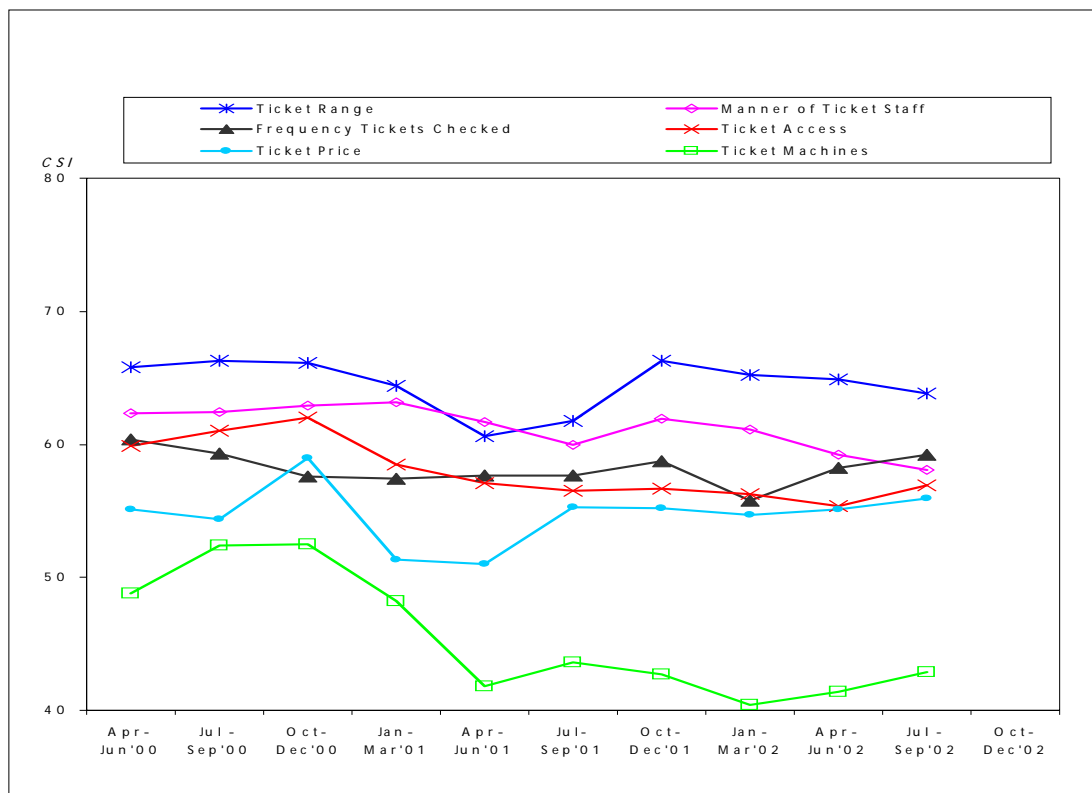
The survey includes questions about a number of aspects including ticketing.

The summary level of the results of these surveys is published quarterly in the Track Record bulletin, accessible as hard copy or from the DOI website.

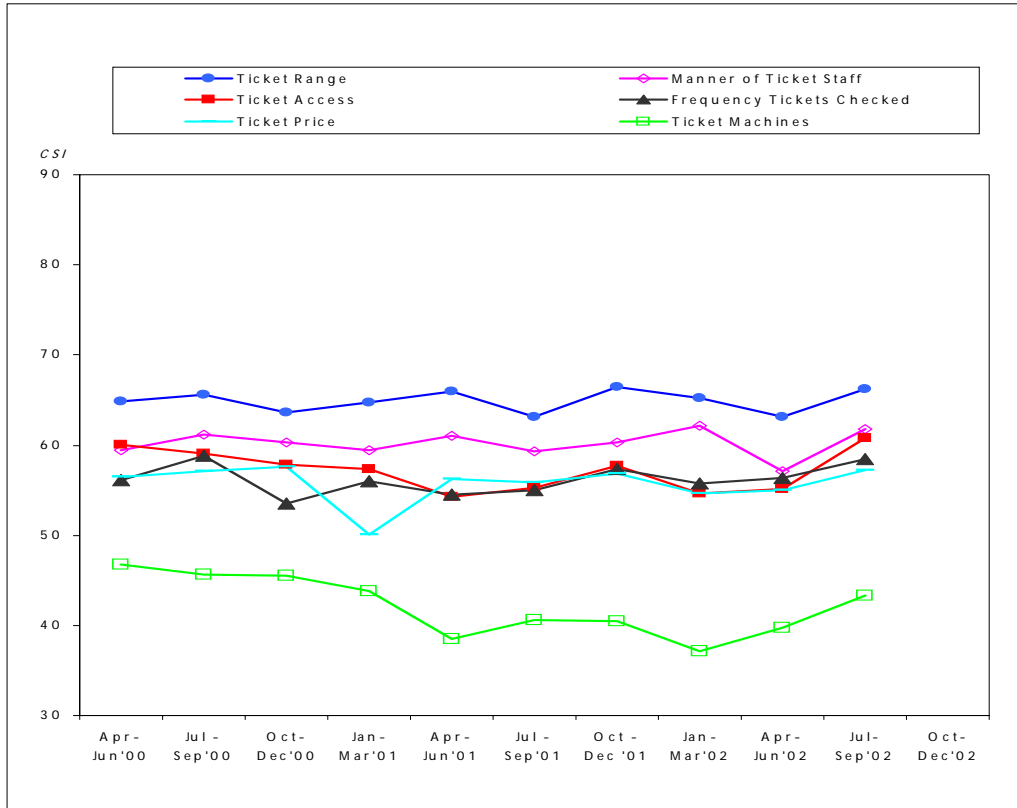
The following graphs derived from the Customer Satisfaction Monitoring Survey (CSI) show an improvement over 2002 in customer perceptions, and this is consistent with the more objective measures derived from the audits.

Surprisingly, of the ticketing activities associated with trams, ticket vending machines are the area with the lowest level of satisfaction by this measure. This may have been related to the inability to buy full-price all-day tickets on trams and if so, the recent introduction of a wider range of tickets on trams may help improve this perception. It may be that it is more related to physical access to ticket machines on trams or some other factor, and this would be worth more detailed investigation.

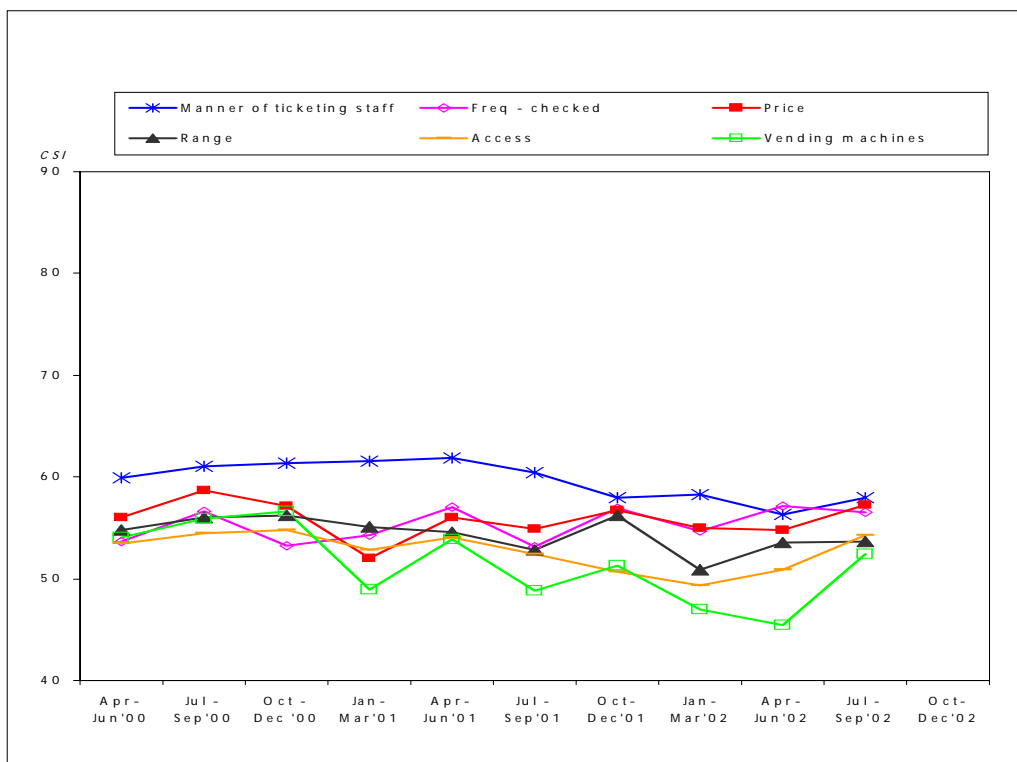
Connex



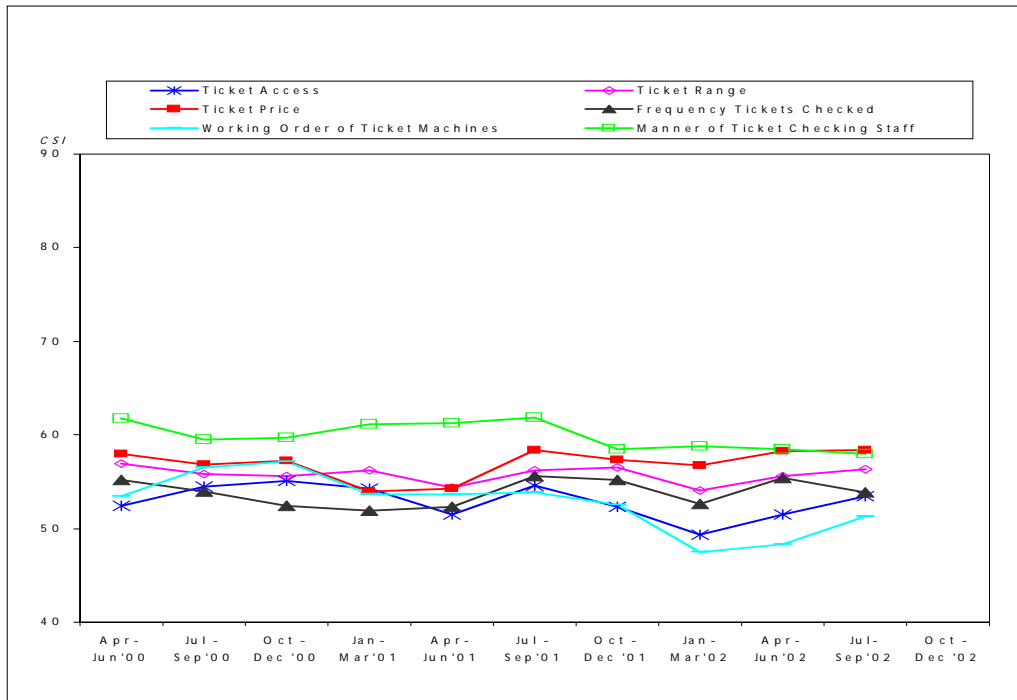
M>Train



M>Tram



Yarra Trams



Buses

