MANAGING AND MONITORING OF PUBLIC TRANSPORT CONTRACTS IN KWAZULU-NATAL

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BACKGROUND

The majority of subsidised public transport services in South Africa are a legacy of the apartheid policy of separate development. This policy was one of racial separation where different race groups were settled in separate areas. The result of this policy was the growth of cities along spatial planning principles where black (ethnic African) communities were kept geographically separate from white (ethnic European), Indian and coloured (mixed race and minority races) communities. Many black communities were forcefully removed to “homeland” areas that were far from urban employment centres. Similarly, black residential townships in many cities were situated at significant distance from employment centres. This has created sizeable communities living far from work and unable to afford the full cost of transport to their workplace. In order to support this policy heavily subsidised public transport had to be in place connecting these distant and displaced communities to employment and service centres.

Up until 1997 the majority of subsidised public transport services in South Africa operated with practically no management or monitoring by the subsidising authority. Subsidy was determined according to the number of multi-trip tickets sold and the subsidy per ticket was determined by the costs and losses claimed by the operator. No service specifications were placed on the subsidised operator and there was no obligation placed on the operator to service the needs of the public transport passenger. Operators tended to be unresponsive to passenger needs and as a result an informal public transport sector began competing with the subsidised public transport using minibuses. In the 1980s government gave the green light to the minibus industry and effectively deregulated the public transport industry. Disgruntled passengers gradually moved from the subsidised bus service to the more responsive, flexible and reliable minibus industry.

The result of this was a subsidised public transport system characterised by escalating subsidy costs and declining patronage. The industry was in a state of rapid decline. In 1997 a tendered contract system was instituted with appropriate monitoring and management of the contracts in an attempt to address the situation.

Subsidised public transport used to be administered centrally by the National Department of Transport. In 1997 this function was devolved to the provinces. This coincided with the change of the subsidy allocation system. The old operating permits on subsidised routes were lifetime permits that could be traded by operators. The new system was established on agreement with the industry and organised labour and required that existing subsidised operating permits be cancelled and new limited term permits for the services be tendered for.

Previously the subsidy was allocated according to the redemption of subsidised coupons or multi-trip tickets sold by the operator with very little control over service provision. The new tendered contracts have strict contract specifications detailing service timetables, vehicle standards and routes amongst other things. Subsidy is paid according to the live kilometres travelled to service the timetables and government, through monitoring, verifies this.

The new tendered or negotiated contracts are designed, put out to tender and administered in a ‘hands on’ fashion by the KwaZulu-Natal Department of Transport (the Department or the KZNDOT). The KZNDOT ensures that the public transport user is provided with a service that is reliable, safe, comfortable and affordable. The contract system also ensures that the Department subsidises a service which is cost effective and operated in a sustainable manner.

The KZNDOT enforces these standards and specifications by appointing independent monitors to ensure the quality of service and gauge the needs of

the commuters. Where the operator does not provide a service that complies with the contract the KZNDOT fines the operator. If buses don't operate, are late, are badly maintained, don't display duty numbers, etc. the operator is fined according to penalties specified in the contract.

Management and monitoring systems were deemed necessary on the part of government in order to ensure that value for money was attained in the contracts and that data driven planning and management were possible. The use of technology in the management and monitoring of the contracts was deemed desirable. For this reason electronic ticketing systems are a requirement of most contracts and certain services are being monitored for compliance with the timetables and routes using satellite monitoring.

MANAGEMENT SYSTEMS IN USE

Electronic Ticketing Machines

For service contracts consisting of more than 10 peak vehicles the Department specified that electronic ticketing systems be used to capture information of patronage of the services. The Department specifies that operators provide information on the utilisation of services to the department. The following extract from the tender documents shows the specifications.

INFORMATION AND ELECTRONIC INFORMATION AND TICKET EQUIPMENT (EE)

16.1 To support the Operator's monthly claims and to enable proper monitoring of performance, the Operator shall supply the Employer with the following daily statistical data and information for each route in the format required by the Employer:

(a) actual departure and arrival time of each trip and late and early trips, with proper identification of trip;
(b) revenue kilometres of each trip;
(c) cash and multi-journey ticket passenger numbers for each trip;
(d) detail of trips not operated and reasons therefor; and
(e) any other information that may reasonably be required from time to time by the Employer which may be relevant to the contract.

…

16.2 To collect and supply that portion of the required data and information (as listed in Clause 16.1) which is capable of being electronically collected, the Operator shall, within the time specified in Clause 5.5.9 of the Special Conditions, have installed and use on all vehicles the EE equipment. …

16.3 If the Operator fails to install EE or keep it in a working condition, penalties shall be imposed as stated in Clause 5 of the Special Conditions.

16.4 While EE has not yet been installed or has become defective, the Operator shall provide the information and data by means of an alternative system which has been approved by the Employer and is capable of providing all the required information and data. The Employer may decide not to pay any claim without adequate documented proof of the required information and data.

16.5 If in the opinion of the Employer the Operator provides incorrect, false or fraudulent information which may prejudice the Employer, then … all future payments to the Operator or a portion thereof as determined by the Employer may be withheld until the *quantum* of the Employer's damages can be determined. …

…

(c) the onus of proof shall be on the Operator to prove that his officials, servants or agents did not act in a collusive manner or with fraudulent intent or in a negligent manner.

[1]

The intention of these specifications is firstly to ensure that services provided are being utilised, and secondly to enable the Department to do effective data driven management, monitoring, planning and modelling of the public transport services.

Due to the lack of management from government under the old subsidy system there was an atrocious lack of information on public transport. Very little was known about the services provided and the nature of the demand. By specifying electronic information systems it was intended that the detailed

[1] Standard tendered contract – General Conditions of Contract – October 2000

data made available could greatly improve the management and planning of the service contracts.

The benefit to the operator of having modern, turnkey revenue management systems installed on the contracts is obvious. The ability of the operator to monitor their services and reduce fraud and theft would be greatly improved through using such systems.

Satellite Monitoring

To ensure that the operators provide service in compliance with the contracts the Department has employed monitoring agencies. Monitors check that services operate according to timetable and verify the passenger numbers on the services. The majority of the monitoring is done by manual methods. Inspectors are positioned at strategic timing points and at major termini to check that buses keep to timetable, vehicles are in good condition and they verify passenger numbers. Where it is noted that passenger numbers are low or high, on board surveys are performed. Services are then investigated to identify what solutions could be employed to address the low utilisation.

This type of monitoring provides point monitoring of between 30% to 60% of the trips operated. The point monitoring provides a reasonable indication of compliance with timetables and passenger numbers on urban services and short distance services. It cannot verify route compliance, and on long distance services it is a very unreliable estimate of timetable compliance and passenger numbers.

The Department has installed a satellite monitoring system on certain rural operations as a pilot project. Satellite monitoring provides detailed route and timetable compliance reports for 100% of the services. This allows for extremely accurate monitoring and can verify that all services comply with the timetable and routes specified.

Electronic Vehicle Monitoring Systems

Certain operators have installed modern electronic vehicle monitoring systems to reduce vehicle abuse and fraud. Such systems were not specified by the KZNDOT. Operators can use the information from the systems to reduce vehicle abuse and fraud. The information could also be used as evidence should the Department require proof of operation of any vehicle under the contract. The information can also be invaluable in calculating safe operational timetables that ensure that vehicles will not need to speed.

TECHNOLOGY AND THE VALUE OF INFORMATION

The trade off between the cost of the technology employed in monitoring and the value of the information gathered has not been sufficiently examined either by government or the operators. The specification of monitoring systems was to a large extent done without an examination of the cost to government versus the benefit, or value of the information. Similarly, operators have to a large extent invested in systems without a full understanding of the value of the information provided by the systems. Operators have tended to install systems merely to comply with the contract specifications.

It has been found that the majority of operators don't use technologically advanced monitoring and management systems effectively. This has resulted in government being unable to use a lot of the information gathered due to unreliability of the information. The general lack of skills amongst all operators as well as within government has meant that the effective use of electronic management and monitoring systems has been severely hampered. In certain cases it is clear that electronic management and monitoring systems have in fact reduced the quality of operations management and monitoring.

Electronic Ticketing Machines (ETM)

In South Africa there are two major turnkey revenue management systems. These are the ALMEX and Wayfarer systems. The operational conditions for the bus services are extreme and thus the ETM systems have needed to be

designed for the conditions. The majority of the roads operated are gravel roads and some are in an atrocious state of repair. Systems have thus needed to be shock and vibration resistant as well as dust resistant.

In the Province only the large parastatal bus company and the Durban municipal bus service ever used ETM systems prior to the implementation of the contract system. The parastatal operator had used the Wayfarer system for a number of years and so remained with this system. The municipal operator has used the ALMEX system for several years and ALMEX has thus established a centre in Durban. The majority of the new, small-scale operators have opted for the ALMEX system.

Both systems have very similar capabilities and hardware costs. The single largest deciding factor between the two systems has been the support offered. The Wayfarer agent is based in Johannesburg and provides remote support, software development and maintenance. The running maintenance and programming of routes, fares and duties are done by the operator who must employ suitably trained personnel. The ALMEX agent is based in Durban, the economic centre of KwaZulu-Natal, and they have been able to offer extensive on site support down to the level of simple programming of fare levels.

This has meant that the small operator has not seen the need to invest in their own specialists to maintain their ETM systems and use the information to the companies benefit. Some operators have even reduced their inspection services and administrative checks, on the misguided assumption that the ETM systems will on their own reduce the opportunity for fraud.

These operators have not seen the need or value of the ETM systems for their business. They have merely installed them because the Department specified them. When systems have broken down, not worked or provided unhelpful reports, the operator has seen no urgency in rectifying the situation. Instead operators have tended to blame the system, or support from the agents, for any identified failures. Operators have on several occasions

expressed the opinion that it is the Department's responsibility to ensure that the systems work since they specified them. Information provided to the Department from the ETM systems has therefore been highly unreliable and in some cases completely useless.

Initially the Department attempted to penalise the operator for having inoperational ETMs. Operators countered that they were not to blame since the systems were faulty due to lack of support from the agents. For some time the Department gave significant leeway to operators and entertained their accusations against the ETM systems and agents. However after several discussions with the agents and investigation of the operators technical capabilities and knowledge of the system it became increasingly obvious that the blame rested largely on the operator.

The Department thus started implementing penalties against operators not providing accurate information as allowed for in the contract. The Department withheld 3% of the subsidy for the provision of inaccurate information. If the information provided was still unsatisfactory after 3 months the monies were forfeited.

In the majority of cases this has significantly improved the operational reliability of the equipment and the quality of information on passenger numbers provided to the Department. Certain operators have clearly seen the value of information for their own business. When they were forced to examine the information they provided to the Department it became clear to them that there was significant fraud on their services. More effective inspection was procured and daily checks of the ETM information resulted in a significant increase in revenue to the operator.

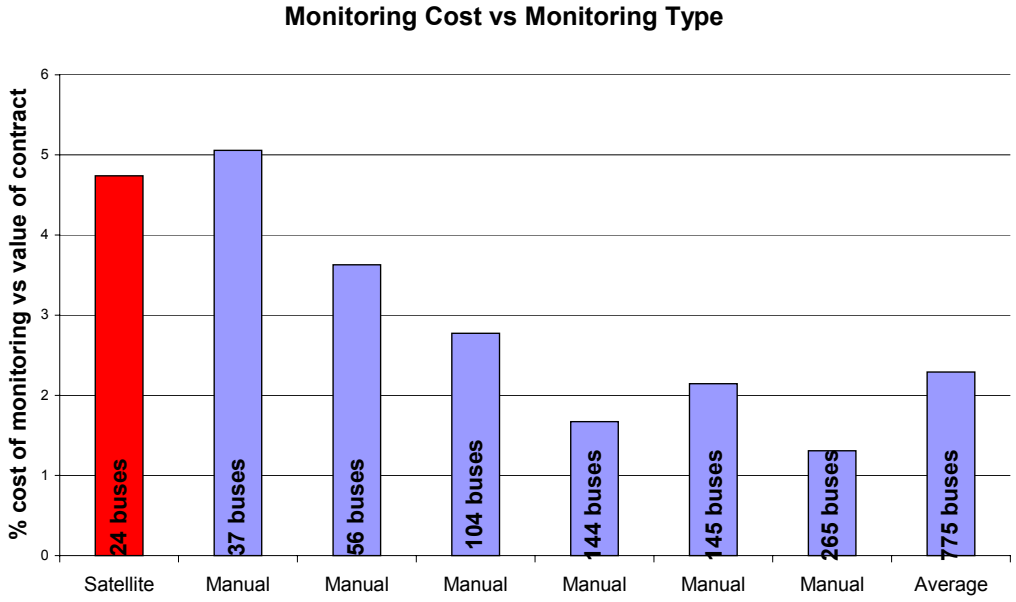
The largest operator in the province initially provided relatively reliable information from their ETM system because of their experience with such systems. Unfortunately conditions within the operator resulted in a mass exodus of skilled personnel. The result was that the middle and junior management levels lost their understanding of the value of information and

hence the accuracy of information provided by the operator decreased. Even where more accurate information was provided managers were unable to interpret this information where it clearly showed irregularities.

Satellite Monitoring

Satellite monitoring has proved successful in providing accurate information on the services monitored. Through automation of the penalty reporting a 100% accurate report on the quality of the whole bus service can be produced. Deviations from routes and speeding can be identified without extensive investigation.

The pilot project has definitely shown that satellite monitoring does work in the rural African context. The equipment can be designed to withstand the harsh conditions and the information produces is reliable and not prone to human error or bribery.



When compared to other monitoring the cost effectiveness of the satellite monitoring must be questioned. When comparing the cost of the monitoring in comparison to the value of the public transport contracts the satellite monitoring costs just under 5% of the value of subsidy. Since it is not possible to monitor the services purely through satellite monitoring a degree of manual monitoring has to be employed. This raises the cost of monitoring to over 5%

of the value of the contracts monitored. On average monitoring costs approximately 2.5% of the value of the services monitored. Manual monitoring costs range from approximately 1.4% to just over 5% of the value of the services monitored.

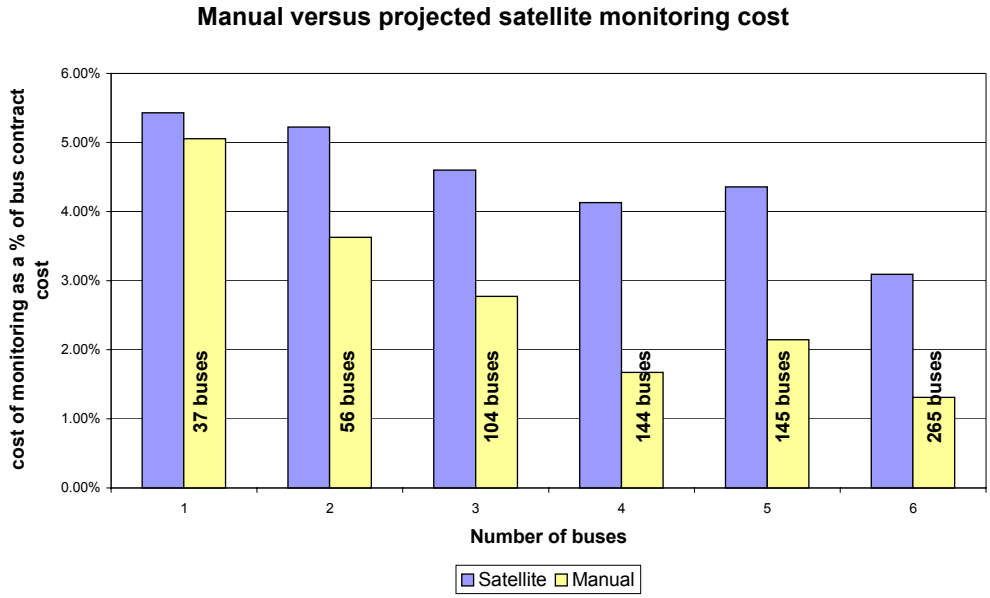
Since monitoring results in penalties being levied against operators a good indication of the value of the monitoring is the level to which penalties cover the costs of monitoring. When comparing the cost coverage, the penalties levied due to satellite monitoring cover between 10 and 70% of the cost of monitoring. Manual monitoring has consistently covered its costs to a value of between 150% to 500% of the cost of monitoring.

Satellite monitoring thus far has proved the most expensive type of monitoring. However the comparison is based on a small pilot project covering 24 vehicles in comparison to manual monitoring contracts covering services exceeding 120 vehicles in total. With economies of scale it is projected that costs should reduce by half.

The pilot project was also relatively small and only monitored 3 small operators on a total of 24 buses. Small operations are simpler to manage than large services and the proportional value of penalties on such small contracts has tended to be small. For larger services the proportional value of penalties are higher. The cost coverage should be higher if satellite monitoring were employed on larger contracts.

Despite this it is not expected that much of an improvement in cost competitiveness would be attained through a larger rollout. Satellite monitoring costs are almost directly proportional to the number of buses in the services monitored. This is due to the need to install a receiver in each bus and the resultant communication cost. Manual monitoring on the other hand benefits from economies of scale with larger contracts. A single monitoring inspector can log one bus per day past a point or 100 for the same cost.

Despite this reduction in cost it is found that satellite monitoring is only cost competitive for monitoring areas of less than 35 vehicles. The economies of scale of manual monitoring tend to be much greater than for satellite monitoring.



A solution to this would be to reduce the cost of the in vehicle system. Such a system could use fixed transponder beacons placed at strategic points and in vehicle receiver which would register and record the information on the ETM system. This system could be employed on services using ETM systems and would be very cost effective since the communication cost would be drastically reduced. All information would be downloaded when the driver cashes up at the end of the day. It could then be automatically sent to the monitoring agency via the Internet or downloaded weekly or daily from the operator's depot.

Such a system would however be limited in use to formalised contract services with ETMs installed. Since such services are the minority of public transport services provided another method could be employed. By reversing the system the transponder could be installed on the vehicle and the beacon could gather the information. If the transponder were a requirement for operating any public transport service this would enable authorities to monitor all public transport services. This would help improve the effectiveness of

enforcement since illegal operators could be identified easily. It would also improve the information on the level of public transport supply. It could also be used to provide real time information for passengers as is done in several European cities.

This system largely mimics the manual monitoring method of point monitoring. It however allows for more accurate, 24-hour monitoring without the security and reliability risks associated with using monitors for 24-hour monitoring. It also reduces the risk of fraud. This system would be ideally suited to the urban environment. Unfortunately due to budgetary constraints the Department have been unable to test any of these proposed monitoring systems.

Electronic Vehicle Monitoring Systems

These systems have not been effectively used by the operator who installed them. in interviews with senior management in the company it emerged that this has not been mainly due to any fault in the system. The fault has largely been on the part of the operator. Due to an exodus of skilled persons from the operator, the depot management staff have been unable to use the information and unwilling to institute disciplinary action. Senior management recognised this and attempted to address this through head office with limited success.

This situation is a symptom of the uncertainty inherent in the prevailing system with the operator at the time. What it does emphasise though is that such systems are a wasted investment unless there is the ability and the will within the organisation to employ the information effectively.

THE ROLE OF TECHNOLOGY IN PUBLIC TRANSPORT MANAGEMENT IN A THIRD WORLD CONTEXT

The role of technology in any business application should be determined by the task that technology is required to perform and the environment in which it is required to perform the task. In a developing third world country like South

Africa there are several environmental factors which need to be taken into consideration when evaluating the role of technology in the monitoring and management of public transport.

Climate

As business globalises these considerations are, to a large extent, being taken care of. Electronic system should no longer be developed for small, country specific climatic conditions. Instead they should be able to cope with the mild wet weather of England, the constantly high humidity of Malaysia, the heat and dust of Africa and the cold of Iceland.

For example, satellite communication aerials and GPS receivers placed in the roof cavity of a bus in rural KwaZulu-Natal will constantly experience temperatures well above the maximum temperatures measured in the same installation in Germany.

Infrastructure

Road infrastructure in South Africa is the best in Africa. The primary road network is comparable to most first world countries. However, due to the legacy of public spending under apartheid the road infrastructure servicing the majority of the population is well below the first world level. Government is addressing this and the KwaZulu Natal Department of Transport is recognised as innovative leaders when it comes to the provision of good quality, cost effective road access to communities. However, funding constraints mean that a vast portion of public transport services will operate on gravel roads. Dust and vibration are thus a common problem.

For example, up till twenty years ago one subsidised service area could only operate using four wheel drive buses. Presently several services throughout the province cannot operate when it rains due to roads being impassable. The combination of dust and moisture is commonly cited for magnetic stripe readers not working. Contact-less smart card technology would be more appropriate but there are other considerations that militate against this.

Education

In KwaZulu Natal 15% of the economically active population have no schooling at all. A further 24% have completed, or have some primary school education [2]. This situation is improving thanks to the policies of the new democratic government but there is still a severe backlog. Education in financial matters is similarly limited and can be seen by the fact that over 50% of the population are "un-banked" and operate purely on a cash basis. It must be remembered that a sizeable portion of small scale, unsubsidised public transport operators also fall in these categories. The introduction of technologically advanced systems have to take this into account.

For example, smart card technology has been proposed as the final solution for public transport in South Africa. If it is to be employed extensively it has to be accompanied by an extensive education campaign to convert over 60% of the commuting public and public transport operators from a purely cash basis to using smart cards. Without such a campaign smart card technology would not be used because it would not be understood by either the passenger or operator.

Electronic ticketing systems were introduced to operators as part of the tendered contracts. Several operators still have no more than a basic understanding of how the systems work several years after implementation.

The availability of skills

Less than 10% of the population of South Africa have any tertiary education and a further 18% [3] have either a senior or junior certificate (equivalent to A- and O-level school exams). Once again this situation is improving thanks to the policies of the new democratic government but there is still a severe backlog. Skilled labour is thus scarce. Technologically advanced monitoring and management systems which require high skills levels in administration, operation and maintenance need to be carefully studied for their applicability based on the skills available to operators.

[2] South African Population Census - 1996
[3] South African Population Census - 1996

Excessive automation can also be detrimental if skills levels within an organisation are low. The opportunity for fraud and gross errors is high when a low skills organisation works on the assumption that the technologically advanced system will always tell the truth.

In contrast the example can be given of one of the provinces most successful bus operators. This family owned bus operation provides an extensive, high quality bus service. The services are profitable and sustainable reinvestment occurs despite the majority of the services being unsubsidised. The operator employs no electronic management or monitoring systems but instead employs the management and monitoring skills used by generations of bus operators before him. His organisation does not possess the skills necessary to use technologically advanced systems and they have seen no need to invest in such skills.

Funding availability

The road based public transport subsidy budget for KwaZulu-Natal is just over R300 million per annum. Subsidised road based public transport carries less than 30% of the province's public transport passengers. Therefore to justify any investment in technologically advanced systems the monitory cost of implementing such monitoring and management systems has to be exceeded by the monitory benefit.

Poverty and job creation

Just under 40% of the economically active population in KwaZulu-Natal are unemployed [4]. There is thus understandable opposition to systems which could result in the loss of unskilled or semi-skilled labour. The applicability of technology must be weighed against the effect on local employment.

Also linked to poverty is the issue of the “voicelessness” of poor communities. Many poor communities cannot complain about public transport services due to lack of access to telephones or illiteracy. Other communities will not

complain because they are wholly reliant on an operator for service and are afraid of what the consequences of making a complaint may be. By employing manual monitoring at major termini the opportunity exists to engage communities regularly on a personal basis. This enables the community to communicate with the Department and vice versa in an informal, but direct manner. By placing too much emphasis on automated monitoring systems one can easily overlook the needs of the voiceless poor.

The nature of the service

Public transport is the only form of transport for the vast majority of the population of the province. The role that public transport plays is thus very varied. A large portion of the subsidised services in the rural regions of the province provide the only transport service into areas. They thus transport a significant amount of parcels and freight. This includes 50kg bags of cement, 20kg bags of flour, doors and window frames, zinc roof sheets, chickens and goats. Installing technologically advanced ticketing systems which improve the rate at which passengers can board would be a wasted investment. Rapid loading of passengers is not a priority. Certain services take over 30minutes to load at the end of the month due to that fact that so much freight needs to be transported along with the passengers.

THE ROLE OF GOVERNMENT IN SPECIFYING TECHNOLOGY SYSTEMS

This question has no simple answers. From the experience gained in the KwaZulu-Natal Department of Transport in public transport tender design and contract management I have come to the following conclusions.

Electronic Ticketing Machines (ETM)

Government should specify the information required or the desired operation and enforce this. Tenderers for the services must investigate systems to collect the information or provide the service (such as integrated ticketing systems) and then choose the appropriate system. Where appropriate government can advise on suitable technology or specify that systems be of a

[4] South African Population Census 1996

certain universal standard. Tenderers should evaluate what their information needs are and identify suitable systems to supply the information taking into account the cost versus benefit for themselves. In this manner the responsibility rests with the operator to ensure that their systems are operational.

This would place a greater responsibility on government to know what their information requirements are and what such information is worth. In the evaluation of tenders there would need to be a greater ability to evaluate whether systems proposed by tenderers would have the capability to provide the information required.

With regards to the advancement of industry in using the latest developments in technological systems such as smart cards and integrated ticketing. I also maintain government should merely specify what service or fare structures should be offered to the passenger. How the operator manages and monitors this should be evaluated against the cost. Development should take place gradually as the operator identifies the need to acquire technologically advanced systems.

Satellite Monitoring

The methods of monitoring employed should suit the services monitored. Further research is required into this but from initial investigations the following would appear suitable solutions:

For services in isolated, deep rural areas and/or long distance services satellite monitoring in conjunction with limited manual monitoring.

For shorter distance, simple services to smaller urban areas manual monitoring would be most cost effective.

For complex services in large urban areas advanced monitoring technology as proposed above in conjunction with manual monitoring at termini and transfer points would be ideal.

Electronic Vehicle Monitoring Systems

Presently government should not specify vehicle monitoring systems. I do believe that in future such systems should be specified for all public passenger-carrying vehicles and suitable reporting and enforcement systems should be put in place as a way to improve safety.

At all times we as government have to ask the following question. Can government justify investing millions in technologically advanced systems on subsidised public transport which carries less than 30% of public transport passengers and leave unsustainable operators and isolated communities desperately in need of subsidised public transport without support? Similarly, can one justify investing millions in a world-class public transport system when other basic services such as housing, education and health have only rudimentary facilities? These are very uncomfortable questions but have to be asked since transport is merely a part of the development equation.

(Note: This paper was presented at the THREDBO International Conference on Competition and Ownership in the Public Transport Industry 2001.)