Real time passenger information: the benefits and costs

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ABSTRACT

In Ireland the government is about to initiate institutional and regulatory change in Dublin, resulting in the eventual establishment of a single authority with control over land use and transport planning and public transport regulation, which for the purposes of the paper will be called the Dublin Transport Authority (DTA). The government is also planning the introduction of competition in the bus market. Under this new structure it is unclear as to who will be required to invest in certain passenger information services, the DTA or the public transport operator. This paper focuses on the provision of on-street Real Time Passenger Information (RTPI) displays and discusses how RTPI could be funded. This paper will look at European examples of RTPI systems and draws from existing practice in Europe with regard to which body should pay for the RTPI system. The paper will detail a hypothetical costing of implementing a citywide RTPI system and discuss the results.

1. INTRODUCTION

Bus services in Dublin are provided by a state owned operator Bus Átha Cliath (BAC). However in recent years private operators have won licences to operate routes within the city. The introduction of private bus operators into the bus market in Dublin has been made government policy and the Minister for Transport announced in 2002 that by 2004 25% of bus services would be operated on a franchised basis (Department of Transport, 2002).

The Department of Transport (DoT) in Ireland is also in the process of establishing a Dublin Land Use and Transport Authority (DTA) (Department of the Environment, 2001). It is planned that this authority will also have the role of public transport regulator and therefore will have the responsibility of setting service standards. In this role it is anticipated the provision of Intelligent Transport Systems (ITS) will be included such as Real Time Passenger Information (RTPI) and electronic ticketing via smart card technology. This paper will discuss the DTA, its roles and how they will impact upon the provision and financing of RTPI.

The first sections of the paper detail the proposed institutional and regulatory changes proposed for Dublin. The following sections detail the system of RTPI that is operational in Dublin; this leads on to a preliminary costing of a citywide expansion of the system. The purpose of the costing is to provide a rough estimate as to the cost of implementing the system and a sensitivity analysis examines the potential revenue to the operator in terms of increased patronage. A survey of European cities is also presented to show the benefits these cities have realised from introducing similar systems, and which actors derive benefits from the system. .

2. PROPOSED INSTITUTIONAL AND REGULATORY CHANGES IN DUBLIN

Ireland is currently mid-way through a National Development Plan (NDP). This NDP 2000-2006 is set to spend €2,012million on public transport in Dublin (Department of Finance, 1999). This investment will see the extension of the Quality Bus Network (QBN), construction of a Light Rail Transit System, increasing capacity on the existing urban heavy rail system the Dublin Area Rapid Transit (DART) and a Metro system.

In Ireland the regulation of public transport is the responsibility of central government through the DoT. In Ireland a state company, Córas Iompair Éireann (CIÉ), provides the majority of public transport services. CIE is broken down into three operational companies as follows:

1. Bus Átha Cliath (Dublin Bus): provides urban bus services in the Dublin Metropolitan area.
2. Iarnród Éireann (Irish Rail): provides inter-city and urban rail services, in Dublin with the DART (heavy rail/Urban service).
3. Bus Éireann (Irish Bus): provides commuter services, rural and inter-city bus services for the rest of the country.

Under this structure, the DoT regulates, plans and sets policy. In recent years the DoT has sought to move the current situation and establish its self as setting policy and introduce competition into the public transport market.

2.1 Regulatory Change

As is becoming common across the European Union, Dublin is to establish a city level transportation planning authority (European Commission, 1999). The proposed regulatory change in Dublin will see the introduction of a ‘Strategic Land Use and Transportation Body’ (Department of the Environment, 2001). The primary functions of this DTA will be to: regulate public transport in the GDA, produce strategic land use and transport planning (with statutory powers to enforce its plans), allocation of state finance, and to ensure the integration of the public transport system (Department of the Environment, 2001). Under the role as market regulator, it will set out in service contracts minimum levels of service required of the operators. This may include details with regard to headway,

scheduling, minimum vehicle standards and the requirement to co-operate with RTPI and integrated ticketing initiatives.

Another key role of the DTA will be to provide integrated public transport information in much the same way as the Hovedstadens Udviklingsråd (HUR) in Copenhagen and the Helsinki Metropolitan Area Council (YTV) in Helsinki. To this extent the DTA will provide passengers with an integrated source of information with regard to all operators and all modes within the GDA. One of the aims of this function is to provide information that is not biased towards any mode or operator and it provides the passenger with information that is fully integrated. As part of this role the DTA is likely to have responsibility for RTPI.

2.2 Institutional Change

The details of the proposed institutional change is laid out in a policy document called the 'Blue Book' in 2000 (Department of Public Enterprise, 2000). This was a public consultation document in which the proposed Institutional changes were outlined. In 2002 the Minister of Transport detailed the steps by which the institutional changes would be introduced. The first step was to abolish the CIE holding companies and to establish the operating companies outlined above as independent companies.

It is also intended to introduce competition into the bus market in Dublin. This is to be done on a controlled competition basis with 25% of the market in competition in 2004. Contracts will be awarded to tenders to operate specific routes in the existing network for contractual periods. It is anticipated that such contracts will be for five years periods (Department of Public Enterprise, 2000).

3. DUBLIN BUSES RTPI PROGRAME

'Q-time' is a three-year pilot programme to introduce RTPI to the BAC network. In this pilot programme all of the services that operate out of the Conyngham Road bus depot (operating bus services to the south west of the city) have been fitted with Automatic Vehicle Location (AVL) systems. This introduction stage was financed by the State under the NDP.

The AVL system BAC uses is based upon a system of Differential Global Positioning System (DGPS). In the BAC system this is done with three sources of data; namely the GPS co-ordinates, the odometer and a door sensor signal feed into an onboard computer that relays the information to the RPTI on-street information display. The GPS signal is updated every 20-30 seconds and the RTPI is updated with the same frequency (Bus Átha Cliath, 2003c). This information is then relayed to a control centre at the Coyngham road BAC depot, and after differential corrections the information is sent to the RTPI displays at bus shelters. The displays provide information on the route e.g. if it is a route

variant, destination and the minutes to arrival as seen in Figure 1. It displays route, route variant destination and minutes left to arrival.

Figure 1 Bus Átha Cliath Passenger Information Display

The first stage of deployment was on the Lucan Quality Bus Corridor (QBC), which was completed in 2000. The Lucan corridor extends southwest from the city centre to the fastest growing residential area in the city. The patronage on a typical month on the Lucan corridor from November 2002 figures was 27,514 (Dublin Transportation office, 2002). The second stage of 'Q-time' was implemented on the Ballyfermot and Clondalkin QBCs in January 2002. The Ballyfermot and Clondalkin QBCs both extend from the city centre to the west of the city. The patronage on these corridors on a typical month on the corridors from November 2002 was 16,395 on the Clondalkin QBC and 22,152 on the Ballyfermot QBC (Dublin Transportation office, 2002).

The pilot Q-time programme when finished will have 30 RTPI display units, 8 on the Lucan QBC 12 on the Clondalkin / Ballyfermot QBC and 10 more to be decided upon. Overall there has been 170 GPS bus installations.

4. BENEFITS FROM THE RTPI SYSTEMS

When focusing on the benefits that would normally accrue to a public transport operator from the introduction of an AVL/RTPI system, the benefits would normally fall under two headings: scheduling/monitoring and improved passenger satisfaction. With regard to monitoring, most of the benefits should accumulate to the DTA, as it will be in control of monitoring and timetable issues such as

headway, scheduling and quality of service. Therefore the benefit that would amass to the operator will be that of passenger benefits, of increased patronage and improved image.

The pilot RTPI system in Dublin as outlined above is the first time a bus operator in Ireland has operated such a service. Internationally similar projects have been operational for many years, such as in Gothenburg for 10 years, and 5 years in Helsinki and 4 years in Stockholm. Most of the evaluations of these systems have reported a positive passenger response and indications of increased patronage.

One such evaluation is that of the RTPI system in Turin, Italy (Lethonen *et.al*, 2001). The Cost Benefit Analysis (CBA) results reported that the system could be 'paid off' in 131 days. This figure took passenger benefits such as timesavings, reliability, and essentially how much they were willing to pay for the system into consideration, but if these were not taken into account the operator would pay off its investment in less than 3 years solely from operator benefits.

In Helsinki RTPI was introduced in 1998 on a bus corridor and a tramline in the city centre. In Helsinki a similar evaluation of bus and tram RTPI showed an increase in patronage of 4% on trams and 10% on buses (Lethonen *et.al*, 2001). This was calculated using previous studies on the bus and tramlines as baseline. This system has been quite successful and there are plans to extend the system and offer the data through different mediums such as on the Internet and via mobile phones.

The COUNTDOWN system introduced by Transport for London is one of the largest RTPI systems in operation in the world. An evaluation of its introduction included a stated preference study. This study evaluated that passengers placed a value of 2 pence per journey (Transport for London, 2003) and over. This value while recognised by Transport for London will not materialise in a fare box increase, but is used as an indication as to how much passengers will benefit form the system. Therefore this value was used to justify the extension of the COUNTDOWN system in London. The plans to extend the COUNTDOWN system include the introduction of 4,000 new displays by 2005. This will result in 60% of bus passengers in London having access to RTPI (Transport for London, 2001).

The SCOPE and the QUARTET projects carried out economic evaluations of several RTPI systems, under the CORDIS programme for the 4th Framework Programme for RTD&D 1994-1998 (European Commission, 1997). The results of the benefits of some of the cities are detailed below.

The following systems reported positive passenger acceptance of the RTPI systems. Sutton Coldfield (UK) reported that 16% of respondents found the information provided was useful and that it would result in them making more

public transport journeys. The STOPWATCH system in Southampton (UK) reported that 81% of passengers found the Passenger Information Display (PID) useful and 3.7% said it would result in them making more public transport trips. In Birmingham (UK) 16% of respondents said they use public transport more due to the benefits they derived from the PID and the RTPI system. In Madrid a similar survey reported that 77% of respondents found the information reliable and 90% said it improved the public transport operators image.

5. INDICATIVE COSTING OF IMPLEMENTING A CITY WIDE SYSTEM

The purpose of this costing is to give policy makers a rough indication as to the costs and some of the operator benefits of implementing a citywide RTPI system in Dublin. This is an indicative costing completed in order to get an indication as to the pay back period to the operators should Dublin introduce a citywide RTPI system.

It should be noted that the benefits have been derived from operator benefits, namely increases in revenue, using information on revenue provided in BAC final accounts for the year ended 2002 (Bus Átha Cliath, 2003a). Passenger benefits such as, improved reliability, improved image of the system, reductions in congestion and all the external costs associated have been ignored, which undoubtedly if included would indicate higher benefits as seen in the examples in Turin, Helsinki and London. Initially the following assumptions have been made in the costing;

- 10% (570) of the bus stops in Dublin have been selected to have RTPI displays installed. This 10% represents an initial stage of citywide introduction. In the other European cities examined, the number of stops having RTPI displays ranged from 0–40%. Providing a costing for only 10% is perhaps on the low side in terms of this analysis and what might be considered optimal for the bus user but in terms of available resources in the short term it is considered to be a realistic estimate of what might be provided.
- A citywide rollout of RTPI will require that all of the vehicles be fitted with GPS technology. Based upon the figures of the bus operator used in the analysis this would require that 1100 buses be fitted with GPS technology.
- The calculations of the benefits in this analysis has been done using the revenue figures published by Dublin Bus in their annual accounts as a baseline.
- For the percentage increases in revenue in the sensitivity analysis in Table 2 conservative increases of between 0.5 – 1.5% were chosen. They are significantly less than the results realised in cities such as Helsinki (10%), Birmingham (16%) and Southampton (3.7%). Conservative estimates were chosen so as not to over estimate the benefits of the system.

The costs and the benefits were derived as follows:

5.1 On-Board Physical Infrastructure

A citywide implementation of a RTPI system requires that all buses be fitted with a GPS system. Currently BAC has a fleet of 1100 buses (Bus Átha Cliath, 2003b). The costs of the AVL components of this system have been estimated using mid-range figures from an Irish provider of AVL technology. The cost of this system includes fitting buses with on-board PID relaying information to passengers and the components of an AVL system consisting of an odometer, GPS receiver and drivers unit the costs are detailed in Table 1.

5.2 Bus Stops

In this paper it is assumed that 10% of stops are fitted with RTPI displays similar to those shown in Figure 1. The Geographic Information System (GIS) locations of 570 bus stops, equally distributed across Dublin, are used in the analysis. The cost of the street stop PIDs was estimated in the same manner as the on-board physical infrastructure in the previous section. The costs are detailed in Table 1 are mid-point costs from an Irish ITS supplier WS2 who are based in Dublin.

	Units	**Per unit cost***	**Total Cost**
Cost per Stop			
RTPI Display	570	€2,173	€1,323,357
Cost per vehicle			
GPS Receiver	1100	€2,173	€2,390,300
Destination Display	1100	€2,606	€2,866,600
Odometer	1100	€1,500	€1,650,000
Total		**€8,452**	€8,230,257

* Costs are mid-range estimates from an Irish ITS supplier WS2

Table 1 Indicative Costs of City Wide Roll out

5.3 Benefits

The paper assumes that the provision of RTPI will accrue a 0.5 –1.5% increase in revenue to the operators, emanating from increases in passenger numbers. The increases have been broken down into three increments in a sensitivity analysis. The three increments examined were a 0.5%, 1.0% and a 1.5% increase in revenue. BACs revenue figures of €160million from 2002 were used (Bus Átha Cliath, 2003a) as baseline.

5. 4 Analysis

The scenario examined was that which would occur as a result of implementing a citywide RTPI system. In the analysis, see Table 2, the increases have been discounted by 5% each year in order to provide a present value for the investment, complying with Irish Department of Finance guidelines (DKM Consultants, 1994).

Percentage Increase	0.5%	1.0%	1.5%
Years			
1	€796,440	€1,592,880	€2,389,320
2	€1,513,236	€3,026,472	€4,539,708
3	€2,194,192	€4,388,384	€6,582,577
4	€2,841,101	€5,682,201	€8,175,457
5	€3,455,664	€6,911,327	
6	€4.464,709	€8,078,997	
7	€5,504,805	€8,211,737	
8	€5,986,182		
9	€6,443,491		
10	€7,239,931		
11	€8,06,371		
12	€8,169,111		
Total	12 years 2 Months	6 years, 1 month	3years, 8 months

Table 2 Sensitivity Analysis of City-wide implementation

The results in Table 2 show that with as little as a 0.5% increase in revenue over 12 years the system will have returned the initial investment. In the Turin example, it was shown to return the cost of investment in under three years when only operator benefits are taken into account. A similar result was found for Dublin using the 1.5% increase in revenue scenario; the system would be paid back in 3 years and 8 months.

6. EUROPEAN EXAMPLES OF GOVERNANCE OF RTPI SYSTEMS

For the examination of the European examples of RTPI, a survey of European cities was completed (see Appendix A). The questionnaire was sent to Public Transport Authorities (PTAs) across Europe in order to ascertain the planning, financing, ownership and integration of ITS applications. The response rate was 56% and the cities that responded are listed in Table 3. The purpose of the survey was to indicate from European examples current practice with regard to the regulation and management of ITS.

Table 3 details the governing situations with regard to the financing, ownership and planning of RTPI systems. The results show that in the majority of cases the state or a Public Transport Authority (PTA) is responsible for each of the RTPI systems.

City	Organisation	Regulatory System
Aberdeen (UK)	Aberdeen City Council	Local Government
Athens (EL)	Athens Urban Transport Organisation	State Run
Barcelona (E)	Transport Authority of Barcelona	PTA
Basle (CH)	BVB Basler Verkehrs-Betriebe	Local Government
Brighton (UK)	Brighton – Hove City Council	State/Local Government
Cardiff (UK)	Cardiff Bus	State/Local Government
Copenhagen (DK)	HUR – Hovedstadens Udviklingsråd	PTA
Edinburgh (UK)	Edinburgh City Council	Local Government
Freiburg (D)	Breisgau-S-Bahn	PTA
Geneva (CH)	Transports publics genevais (TPG)	PTA
Gothenburg (S)	Göteborgs Stad Trafikkontoret	PTA
Groningen (NL)	RuG	State/Private Sector
Hamburg (D)	Hamburger Hochbahn AG	PTA
Helsinki (FIN)	Helsinki City Transport (HKL)	PTA
London (UK)	London Buses	PTA
Manchester (UK)	GMPTE	PTA
Prague (CZ)	Dopravni Podnik - DP Praha	PTA
Stockholm (S)	Swerco	Local Government
Swansea (UK)	Swansea City and County Council	State/Private sector
Tampere (FIN)	Tampereen kaupungin liikennelaitos	PTA
The Hague (NL)	HTM Personenvervoer N.V.	PTA
Trondheim (N)	SINTEF	PTA
Turin (I)	ATM Torino	PTA
Utrecht (NL)	Openbaar Vervoer Reisinformatie B.V.	State/Private sector

Table 3 Survey responses

The results indicate that the PTA/State finances the majority of RTPI systems. The same can be said for ownership and planning arrangements as seen in Table 4.

	Number of Cities	Cities
Financing		
Public Transport Authority	14	Athens, Copenhagen, Tampere, Geneva, The Hague, Swansea, Barcelona, Stockholm, Helsinki, Aberdeen, Prague, Gothenburg, Brighton, Groining
Government Body	3	Cardiff, Basel, London
Public Transport Operator	3	Hamburg, Trondheim, Freiburg
Ownership		
Public Transport Authority	14	Gothenburg, Copenhagen, Swansea, Stockholm, Helsinki, Tampere, Geneva, Barcelona, London, Brighton, Manchester, Prague, Aberdeen, Edinburgh
Government Body	3	Athens, Cardiff, Freiburg
Public Transport Operator	6	The Hague, Turin, Hamburg, Basel, Trondheim, Groningen
Planning		
Public Transport Authority	12	Helsinki, Geneva, Athens, The Hague, Barcelona, Gothenburg, Trondheim, Manchester, Swansea, London, Copenhagen, and Tampere
Government Body	9	Copenhagen, Helsinki, Tampere, Geneva, The Hague, Barcelona, Gothenburg, Turin and Trondheim
Public Transport Operator		

Table 4 Survey Results

When a RTPI system is installed the operator benefits from new, additional information from the GPS system and because of that the operator may decide to install some of the following Intelligent Transport Systems (ITS) to maximise the potential of this data.

- Computer Aided Dispatch (CAD) is a system whereby the operator has information on the locations of all vehicles while on route, and a CAD is used to dispatch vehicles on to the route to maintain an even headway and reduce bunching.
- Automatic Passenger Counting (APC) is a system where a sensor counts the number of passengers as they enter and exit the vehicle.
- Signal Priority is a system where buses approaching a traffic junction are given priority over other on-street traffic.

In the questionnaire questions 13, 14 and 15 cover the perceived benefits of implementing RTPI systems.

> Question 13 asks 'If your system includes a Bus RTPI system does it have any of the following? Automatic Passenger Counting, Computer Aided Dispatch or Signal Priority'.

These applications have implications to the PTA in that they can provide valuable information on passenger movements. In the results the following numbers of cities have the aforementioned ITS applications 2 with CAD, 4 with priority signals and 6 with APC and 10 cities have applied all three ITS applications.

The next question in the questionnaire asked 'In your organisations opinion who benefits the most from the provision of your RTPI/AVL system? The passenger, Public Transport Operator or the State/Public Transport Authority'.

The results indicated that 11 cities said passengers benefited the most, 6 indicated that the operator benefited the most and 4 cities said the PTA benefited the most.

Question 15 asked the cities to list in order the benefits most highly rated by the public transport operator.

- Reduced fleet operation
- Improved on-time performance
- Reduction in operating costs
- Increased patronage
- Improved overall performance of the system

The results, as seen in Table 5, demonstrate that improved on-time performance was rated most highly by the city respondents. Looking at the preference one ratings, improved overall appearance of the system received the next highest

score followed by reduction in fleet costs and operating costs at the same score with increased patronage receiving the least amount of Rank 1 ratings.

Number of City Respondents	Reduced fleet operation costs	Improved on-time performance	Reduction in operating costs	Increased patronage	Improved overall appearance of the system
Rank 1	3	7	3	2	4
Rank 2	2	6	3	4	3
Rank 3	2	3	5	4	3
Rank 4	4	-	6	4	2
Rank 5	5	1	1	4	5

Table 5 Results for Question 15

The benefits detailed in Table 5 are those that accrue to the public transport operator and the passenger. The results demonstrate that the operators and passengers have realised benefits from the introduction of the RTPI systems.

7. DISCUSSION

The results of the sensitivity analysis, presented earlier in the paper indicated that the existing operator could recoup their costs from between 12 years and 3 months with assuming a 0.5% increase in revenue as a result of RTPI, and 3 years 8 months assuming a 1.5% increase in revenue. However benefits from the system will not just be realised by the operator via the passenger. The DTA will also have a vested interest in increasing passenger numbers and therefore some of these benefits will also accrue to the DTA.

The European examples discussed in the paper show that substantial benefits were realised from using implementing RTPI systems. The SCOPE and QUARTET projects both reported positive passenger perceptions of the system and increases in patronage. The results from the survey of European cities also demonstrated that operators and passengers could also derive significant benefits from the system.

As the benefits from the RTPI system will accrue to both the DTA and the operator some system of leasing or shared ownership could be made between the operator and the DTA, in such a way that the parties involved see their investment returned within the contractual period.

In Dublin the Irish Government is currently funding the pilot introductory programme of RTPI under the NDP. In a recently unpublished document commissioned by the DoT it was recommended that the state (Government) or the DTA should pay for the expansion of the system. This paper demonstrates from results in the European survey that both the operator and the passenger benefit from RTPI systems. Further research into funding arrangements and a

more detailed cost/benefit analysis would help to ascertain in more detail who would derive benefits from the RTPI system and as a consequence who should be asked pay for the cost.

8. CONCLUSIONS

The aim of the paper was to analyse the revenue potential to the operator as a result of RTPI in the case of Dublin using three different but conservative levels of potential revenue increase. A review of current practice in relation to RTPI in European cities was also undertaken to help inform the current debate in Dublin.

The following are the conclusions of the paper:

(1) The results of the survey of European cities with an implemented RTPI system found that the passengers and operators had benefited the most after the RTPI system had been installed. The indicator receiving the highest rating was 'improved on-time performance'.
(2) The indicative costing and the sensitivity analysis to demonstrated that operators would be able to recoup the cost. The analysis showed that on the basis of relatively low benefits compared to those realised in the European cities the operator could pay for the system within 3 – 12 years depending on the benefits realised.
(3) The paper has raised questions as to who should be required to pay for RTPI. There have been some suggestions that the DTA would have this responsibility but given the sizeable benefits that would appear to accrue to the operator, this question may require further research in the context of Dublin.

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APPENDIX A

Intelligent Transport Systems (ITS) Survey

The Transport Study and Research Group (TSRG) Trinity College Dublin is completing the following survey, for a project focusing on the evaluation of Real Time Passenger Information (RTPI)/Automatic Vehicle Location (AVL) in Dublin. This research is being carried out with funding from the Irish Department of Transport.

Please fill in the following fields:

City _____ Organisation _____

1. How would you define the governing of Public Transport in your City?

State Run ☐ Local Government Level ☐
State / Private Run ☐ Private Sector Companies ☐
Public Transport Authority/Regulator Other _____

2. In your city which of the following bodies has responsibility for the following ITS systems:

	RTPI/AVL	**Electronic Ticketing**
Planning		
Public Transport Authority	☐	☐
Government Body	☐	☐
Public Transport Operator	☐	☐
Ownership		
Public Transport Authority	☐	☐
Government Body	☐	☐
Public Transport Operator	☐	☐
Integration		
Public Transport Authority	☐	☐
Government Body	☐	☐
Public Transport Operator	☐	☐
Financing		
Public Transport Authority	☐	☐
Government Body	☐	☐
Public Transport Operator	☐	☐
Maintainence		
Public Transport Authority	☐	☐
Government Body	☐	☐
Public Transport Operator	☐	☐

4. Are these ITS applications integrated between

Mode	**Yes** ☐	**No** ☐
Operator	Yes ☐	No ☐

5. How long has the implementation process taken for the following systems planning to implementation?

	Planning	Year Introduced
RTPI/AVL	_____	_____
Electronic Ticketing	_____	_____

8. Which modes does this RTPI system cover?

Bus ☐
Rail ☐
Bus/Rail ☐

9. What percentage of each mode stops is equipped with a RTPI passenger displays?

_____Bus _____ Light Rail
_____ Heavy Rail _____ Metro

12. Is the information provided by the passenger information displays, integrated between modes?

Yes ☐ No ☐

13. If your system includes a Bus RTPI system does it have any of the following?

Automatic Passenger Counting ☐
Computer Aided Dispatch ☐
Bus Signal Priority ☐

14. In your organisations opinion who benefits he most from the provision of your RTPI/AVL system?

Passenger ☐
Public Transport Operator ☐
State/Public Transport Authority ☐

15. Has the public transport operator realised the benefits of the RTPI/AVL system? Please rate the following 1-5 in order of importance (starting with the highest)

___ Reduced fleet operation
___ Improved on-time performance
___ Reduction in operating costs
___ Increased patronage
___ Improved overall performance of the system

Thank you for taking the time to fill out our survey. All responses should be saved and sent to Brian Caulfield (TSRG).