RTIG

UK Real Time Information Group

RTIG Monitoring: Case Studies Report on ETM OBU Bi-directional Links

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1 Introduction

1.1 About this document

1.1.1 This document has been produced for the Real Time Information Group (RTIG) by Centaur Consulting. It is one of the deliverables to be completed under RTIG Government Task 1.3: Evaluation of implementations. It details the results of a number of case studies into bi-directional (or two-way) data exchange between ETMs (Electronic Ticketing Machines) and RTI system OBUs[1] (On-bus Units).

1.2 Background

1.2.1 Amongst the services that RTIG provides is a range of monitoring studies, reviews and surveys that utilise its ability to connect with a broad base of UK implementers. Within this remit, DfT has commissioned RTIG to undertake a review of bi-directional data exchange between ETMs and RTI system OBUs.

1.2.2 RTIG has held an interest in the link between ETMs and RTI system OBUs for some time. Initially this was focused through a working group set up by the Suppliers Forum in "old" RTIG and more recently through a new working group set up in November 2004. The principal activity of these working groups has been the development an open bi-directional specification for RTIG Members.

1.2.3 The aim of this study is to present the experiences of local authorities and bus operators with direct experience of doing this from a customer perspective. The report compiles their experiences and draws conclusions from them. It is hoped that this will assist future installations and highlight implementers' needs and requirements to industry in this area.

1.3 Document status

1.3.1 This document is the draft version for review by Keith Tompson, RTIG Executive Member for Monitoring and Louise Barnett of the Department for Transport.

[1] OBUs are also known as In Bus Units (IBUs), Intelligent Bus Devices (IBDs) and Automated Vehicle Location (AVLs) computers

2 Overview of RTI system and ETM links

2.1 Introduction

2.1.1 Increasing levels of Information and Communications Technology equipment is being added to Public Transport vehicles to improve services and operations. These include voice radios (which are often part of an RTI system), OBUs, destination blinds, CCTV, on bus passenger information displays, entertainment systems and ETMs or other passenger counting/revenue reconciliation systems. Currently there is a growing desire to create an integrated platform for this equipment that will enable the pooling of data and shared functionality.

2.1.2 As the amount of in-cab equipment grows, drivers are increasingly in danger of being provided with an information overload which could have implications for road safety. In order to reduce the number of electronic displays which are on view to the driver, the ETM display has increasingly been used as a driver interface for other systems.

2.1.3 Two key devices that are regularly installed on vehicles are OBUs and ETMs. Within the marketplace there are a number of suppliers of RTI systems OBUs and a number of different suppliers of ETMs. Each of these uses its own proprietary protocols which are bespoke to the particular supplier or manufacturer.

2.1.4 Primarily, OBU's provide vehicle location data that is used to support:

- real time management of bus fleets;
- historical assessment of service performance;
- real time information services delivered to the public (eg through at-stop signs and other methods);
- driver information.

2.1.5 ETMs provide data on:

- the number of issued tickets;
- the cost of tickets issued;
- the fares received during the course of a service;
- journey time information for the driver.

2.1.6 Also, newer ETMs provide a screen interface with the driver.

2.2 Functionality delivered through a bi-directional interface

2.2.1 Linking ticketing information to the GPS location information provided by the OBU allows a variety of different functions to be delivered. In addition, the ticket machine display can be used as a driver interface for the OBU. This duel use of this equipment can provide:

Schedule adherence

2.2.2 Real time information is fed to the ETM which can then indicate directly to the driver whether they are running to schedule via the ETM screen. Typically this is shown by a - or + sign and then the number of minutes early or late.

Bus headway adherence

2.2.3 Similarly, if headway is required to be maintained between services rather than adherence to a timetable, the ETM can indicate whether the driver needs to increase or decrease the gap between the bus in front or behind.

Route adherence

2.2.4 Route adherence indication can be used to alert the driver if they move away from the designated geographical route which they have to follow. This can be performed via the ETM display and is based on real time geographical information from the GPS receiver in the OBU.

Automatic fare stage updating

2.2.5 If the ETM picks up its location on a scheduled route from the GPS device in the OBU it can then automatically update the fare stage indicator to the correct stage. This eliminates the possibility of error due to the driver incorrectly marking fare stages. This function can assist the driver in issuing the correct tickets and reduces fraud.

Text messaging to drivers

2.2.6 This function allows controllers to send text messages to the fleet which can be displayed on the ETM. The service allows drivers to read and respond to messages when they are stationary rather than receiving disruptive voice messages over the radio system whilst driving. It is also possible to set up standard messages and responses to ease the communication load.

Automatic blind changes

2.2.7 By linking the destination blinds to location information from the OBU and ETM fare stage information, they can be automatically updated at appropriate stages during the buses journey. Automatically updating destination blinds reduces driver workload and decreases the number of errors, thereby assisting the public in knowing the correct bus to catch.

Automatic trip validation

2.2.8 When a driver logs on to a trip through the ETM, part of the handshake process involves trip validation. This verifies that the trip is correct and activates the information the ETM requires for this trip. In some circumstances this is linked to the OBU and this process also logs the driver onto the RTI system.

2.3 Analysis of bi-directional RTI and ETM data

2.3.1 Data from RTI systems and ETMs can be used by bus operators and local authorities to obtain useful information about the bus services being undertaken at a local level. Additional information can also be obtained by performing analysis of data combined from both sources. Some examples are:

Separate analysis of historical RTI and ETM data

2.3.2 Examination of separate historical RTI and ETM data can be used to capture valuable statistics. Historical RTI data can be used to analyse:

- schedule adherence over time (useful for improving timetables and creating reliability statistics in line with the Traffic Commissioners Criteria;
- dwell times at-stops (however this is of limited value if not tied to ticketing information).

2.3.3 ETM data can be used to analyse:

- patronage breakdowns by time, passenger type etc;
- revenue streams over time;
- commercial viability of services.

Joint analysis of historical RTI and ETM data

2.3.4 Linking ETM data to geographical data from an RTI system GPS information can allow bus operators to perform detailed analysis of dwell times at bus stops in relationship to tickets issued. This information can be used to identify stops which are under used. When a large dwell time is incurred for a low patronage movement, this may indicate poor stop design or location (eg in a position where the bus finds it hard to move away from the stop).

2.3.5 When the GPS data is combined with the ETM transactions a stage timetable analysis can be performed for individual journeys. This report will assist operators in preparation of new timetables and published schedules.

3 Analysis of Case studies

3.1 Introduction

3.1.1 In order to examine the practicalities of implementing this relatively new kind of link, a number of different case studies have been investigated. Table 3-1 details four sites examined in this report. It lists the local authority and bus operator partners involved as well as RTI system supplier and ETM manufacturer.

3.1.2 The case studies were selected to cover implementations that contain a mix of different RTI system suppliers and ETM manufacturers. This was done to help capture a marketplace overview rather than analyse implementations between parties that had repeatedly worked together on this type of link.

3.1.3 In three cases (Manchester, Plymouth and Preston) local authority officers where interviewed and for one site a bus operator employee was interviewed (Poole). Therefore the commentaries detailed in Annexes A-D may reflect their particular user requirements.

Site	Local authority	Bus operator	RTI system supplier	ETM manufacturer	ETM model
Manchester	Greater Manchester PTE	Stagecoach	Infocell	ERG	ERG TP5000
Plymouth	Plymouth City Council	Citybus & First	AIM	Wayfarer & Almex	Wayfarer TGX150 & Almex Optima
Poole	Borough of Poole Council	Wilts and Dorset	AIM	Wayfarer	Wayfarer TGX150
Preston	Lancashire County Council	Preston bus	ACIS	Wayfarer	Wayfarer TGX150

Table 3-1 Case studies overview

3.2 Functionality deployed at case study sites

3.2.1 Table 3-2 below details the different functionality deployed at the various sites. The functionality that was deemed most important to the project is marked with a star. The three most used functions are:

- schedule adherence;
- automatic fare stage updates;
- text messaging to drivers.

Site	Fare stage updates	Schedule adherence	Route adherence	Text messaging	Automatic Boards	Trip validation
Manchester	Y	Y	N[2]	Y	N	Y
Plymouth	Planned	Y*	N	Planned	Planned	N
Poole	N	Y*	N	Planned	N	N
Preston	Y*	N	N	N	N	N

Table 3-2 Functionality used at sites

3.2.2 Analysis of the sites shows that different functionality is desired at different sites and this is reflected in what functionality has been installed locally. Also, across the different sites the functionality most wanted by users is different, for example, the only functionality installed by Preston was automated fare stage updates whereas this has not been installed by Poole.

Manchester

3.2.3 In Manchester, many different functionalities have been installed:

- trip validation;
- text communications with the driver;
- schedule adherence;
- automatic fare stage update.

3.2.4 Trip validation is achieved when the driver logs on to the RTI system as part of the handshake process. This allows the ETM to display the relevant schedule adherence information and perform automatic fare stage updates based on information from the RTI system's OBU.

3.2.5 Text communications between depot managers and drivers for operational purposes was also needed in Manchester. The smaller operators are using this to replace some of their mobile phone communications and the larger operators are using it as part of a migration strategy for the removal of their radio networks.

3.2.6 Geographical route adherence is measured by the RTI system but if deviation occurs, an alert is not directly relayed to the ETM screen; instead the controller notifies the driver. Real time at-stop revenue information is collected by the system, based on information from the OBU. However, this function has been disabled at the request of operators as GMPTE were also able to see this commercially sensitive data.

[2] Route adherence can be monitored in real-time at the depot and the driver is then notified over voice communications if they are deviating from the route. Drivers are not alerted through the ETM.

Plymouth

3.2.7 The primary functionality desired by Plymouth is schedule adherence information for the driver to improve service performance. Once in place the system will display this information by indicating how many minutes early or late the driver is on the ETM screen. Importantly, the presence of this information on the ETM screen will also inform the driver that the bus has logged on correctly to the RTI system.

3.2.8 When this is operational, it is likely that additional functionality will be added in the future, namely:

- text messaging to the driver;
- automatic fare stage updates;
- automatic blind changes.

Poole

3.2.9 The main piece of functionality desired by Wilts and Dorset was the display of schedule adherence information to the driver. This indicates to the driver how early or late the driver is running by showing - or + followed by the number of minutes (eg +1 for one minute late or 0 for on time) on the ETM screen.

3.2.10 A second function currently being considered by Wilts and Dorset is text messages to drivers. This is in development and has been proven to work over the bi-directional OBU/ETM link. A standard set of messages for this service is now in production.

3.2.11 Automatic fare stage updates is not seen as a pressing requirement, although this may be implemented at some stage in the future.

Preston

3.2.12 The main functionality wanted by Preston Bus and Lancashire County Council was automated fare stage updates as this simplifies procedures for the drivers. No additional functionality was desired.

3.3 Additional functionality

3.3.1 All case study sites were asked whether there was any additional functionality that they desired that was not implemented by project stakeholders due to reasons of cost or technical viability. All confirmed that there was no additional functionality that is currently unavailable.

3.4 Implementation of the bi-directional link

3.4.1 In general bus operators and ETM manufacturers have fitted the ETMs into the buses. In some cases the ETM manufacturers have demonstrated how this should be done to bus operator engineers, who have done the bulk of the fitting; in some cases the ETM manufacturer has done the majority of the fitting.

3.4.2 Integration into the RTI system has been jointly approached by ETM and RTI system suppliers in Poole and Plymouth. In Manchester and Preston the onus for implementation of this link has been mainly on the RTI system supplier, once specifications have been received from ETM manufacturer.

3.5 Technical difficulties

3.5.1 All the case studies show that some level of technical difficulty was encountered during the implementation of the bi-directional link. Given the novelty of this interface to many of these projects this is not surprising.

3.5.2 The technical problems that arose in Manchester centred on the physical interface rather than protocol or data issues. These were caused by power surges from ETM which caused the OBU to malfunction. This has been resolved by fitting an in-line resistor into the connecting cable. In Poole, the main technical difficulty encountered related to the speed of updates received and displayed on the ETM (eg schedule adherence information).

3.5.3 Plymouth is currently having their bi-directional link installed. Based on the problems that arose during the deployment of the uni-directional interface for this project, it is likely that further difficulties will be encountered.

3.6 Management difficulties

3.6.1 As OBUs and ETMs are procured from different suppliers, coordination must take place between them if a bi-directional link is to be successfully installed. If different parties have purchased the kit (eg the local authority purchasing the RTI system/OBU and the bus operator purchasing the ETM) then this may be a complex matter. Most case study participants commented that management difficulties are most easily reduced through the allocation of clear responsibilities when the link is being implemented. In some cases this has been done by making the RTI system supplier solely responsible for delivery.

3.7 Implications for other standards

3.7.1 There are many standards in place in the RTI marketplace. These include data exchange standards, such as TransXChange and RTIG-XML, and stop location standards such as NaPTAN. The case studies reported that no implications for other data standards were encountered during the implementation of their bi-directional link.

3.8 Rotation of buses

3.8.1 One concern raised by the bus operator community is whether they will need to refit ETMs if they rotate buses between depots with different RTI systems. For some of the operators captured by these case studies, rotation of buses is not an issue as they have a small number of depots where all ETMs are configured to the same RTI system (eg Preston Bus and Citybus), for others this is a regularly encountered problem.

3.8.2 The medium sized operator Wilts and Dorset can move vehicles between the AIM RTI systems in Poole and Salisbury and their OBU and ETM can interface with the local RTI system after reconfiguration. Larger operators who rotate buses between RTI systems from different suppliers will encounter more significant problems and it is likely that they will have to refit ETMs and OBUs to buses.

3.9 Other comments

3.9.1 Local authorities and bus operators raised the concern that they may be paying for the same system developments in different implementations. It was suggested that RTIG could assist by producing an open specification that once taken up by suppliers, would reduce development costs. It was also commented that this open specification would make bi-directional links easier to install for RTI system suppliers and ETM manufacturers.

3.9.2 Finally, it was suggested that consolidation of software across different systems and concentrating on getting the basic system functioning well should be the goal for the next 12 months rather than future expansion of system functionality.

4 Conclusions and Recommendations

4.1 Conclusions

4.1.1 The case studies analysed in this report show that currently bi-directional interface links are implemented on a project by project basis. Because of this, there is the danger that each link will be effectively bespoke to that system. This will mean that:

- link development costs will be repeatedly incurred as bi-directional links are implemented across the country;
- interoperability when buses are moved will be limited, therefore further cost will be incurred from refitting buses when they are rotated or cascaded;
- best practise accrued from implementing a single link may not be passed on to others;
- technical difficulties will reoccur across many projects.

4.2 Recommendations

4.2.1 This report confirms the need for RTIG to develop an open specification for this bi-directional interface. As with many RTI services required at local level, the functionality desired is varied and should not be prescribed. Therefore this specification should be able to support a mix of functions that may be required by local authorities and bus operators. This report also indicates that there is no additional functionality desired over this link within the marketplace.

A Manchester case study

A.1 Introduction

A.1.1 The interview for this case study was conducted, on 1 March 2005, with Peter Simm, Assistant Quality Bus Corridor Co-ordinator for GMPTE.

A.2 Systems overview

A.2.1 Over recent years GMPTE and a number of local bus operators have witnessed the installation of a local real time system delivered by Infocell. It currently captures information on 324 vehicles and covers 251 at-stop signs, with further expansion planned in the future. The system will also have bus priority provided through Peek Traffic equipment. By the end of 2005, it is estimated that nearly £5million will have been spent on the system as a whole, with over £1million coming from Transport Direct funding.

A.2.2 As part of the RTI project, a bi-directional link between bus ETMs and OBUs has been installed. This links ERG ETMs to the Infocell RTI system. Currently all of the 324 buses are fitted with this bi-directional link out of a combined fleet total of 2300 vehicles in the Manchester area. This is split as follows: First North West (251 vehicles), Stagecoach Manchester (50 vehicles), Bluebird Buses (7 vehicles) and Blue Bus and Coach Services (16 vehicles). The bi-directional link was developed in 2002 and has been in operation for over 2 years.

A.2.3 Prior to installation of the RTI system, the operation and management systems used by the bus operators were mainly paper based. It is anticipated that following installation of the RTI system, more modern approaches will be adopted.

A.3 Functionality

A.3.1 In Manchester, different functionalities have been installed:

- 1) Trip validation: The act of logging on to the RTI system performs trip validation as part of handshake process. This allows the ETM to display the relevant schedule adherence information and perform automatic fare stage updates.
- 2) Text communications with the driver: One of the desired functions was text communications between depot managers and drivers for operational purposes. The smaller operators can use this to replace some of their mobile phone communications. The larger operators (First and Stagecoach) are using it as part of a migration strategy for the removal of their radio networks.
- 3) Schedule adherence: The driver is informed of schedule adherence through the ETM which indicates how early or late the driver is running by showing - or + followed by the number of minutes (eg -1 for one minute early).
- 4) Automatic fare stage update: Over the course of the journey the ETM automatically delivers fare updates based on location data from the RTI system OBU. This helps the driver issue tickets correctly and prevents incorrect charging to passengers.

A.3.2 Route adherence is measured by the system but this information is not directly relayed to the driver. Instead, if the driver deviates off-route then an alert is flashed at base and the controller can then notify the driver.

A.3.3 Real time revenue information can be collected by the system and is recorded on a stop by stop basis. The geographical information is taken from the OBU. However, due to confidentiality issues, this system has been disabled at the request of operators as GMPTE were also able to view this commercially sensitive data.

A.3.4 The contracts signed ensure interoperability with future software upgrades and any additional functionality that comes on-line at a future date.

A.4 Implementation of the bi-directional link

A.4.1 The ETMs were fitted by ERG and were integrated into the RTI system by Infocell. Technical problems that did arise during the implementation centred on the physical interface rather than protocol or data issues. These were caused by power surges from ETM which caused the OBU to blow. This has been resolved by fitting an in-line resistor into the connecting cable. No significant management issues were encountered during the installation and no implications for other standards were identified.

A.5 Other comments

A.5.1 The bi-directional link would have been easier to install if there was an industry standard in place that was used by the suppliers of RTI systems and ETM manufacturers. This could be developed by RTIG.

B Plymouth Case Study

B.1 Introduction

B.1.1 The telephone interview for this case study was conducted, on 2 March 2005, with John Townsend, RTPI Project Manager, Plymouth City Council.

B.2 Systems overview

B.2.1 Since mid-2003, Plymouth City Council, First (Devon & Cornwall) and Plymouth Citybus have seen the installation of a local bus real-time information system procured from AIM Ltd. When the current phase of expansion is complete, the system will cover 109 Citybus vehicles, 62 First vehicles and will deliver information through 41 at-stop signs, SMS and a website. £765k SCA was received for the project from Transport Direct and a total of £1.25m is expected to have been spent on the system by the end of 2005.

B.2.2 As an addition to the implementation process, Plymouth Citybus has upgraded their Wayfarer 3's to Wayfarer TGX150's and First plan to upgrade their Almex A90's to Almex Optima machines, in early Summer 2005. It is intended that a bi-directional link between OBU and ETM will be implemented on all RTI buses.

B.3 Functionality

B.3.1 The primary functionality desired by Plymouth to enhance the real time system and service performance is:

- 1) Schedule adherence information for the driver: Once in place the system will display schedule adherence information by indicating how many minutes early or late the driver is by showing - or + the number of minutes in a box on the ETM screen (eg +1 for one minute late). Importantly, the receipt of this signal will also inform the driver that the bus has logged on correctly to the RTI system. Currently the only method of notifying drivers who have failed to log on is through calling them over the radio system.

B.3.2 In the future, additional functionality may be added, namely:

- 2) Text messaging to and from the driver: This service will allow managers to send text messages to the fleet. In the main, the service will be used for operational purposes, such as managing working hours etc. This service will allow drivers to read and respond to messages when they are stationary rather than receiving disruptive voice messages over the radio system whilst driving. It will also be possible to set-up standard messages and responses to ease the communication load. (Note: This system can only be fully effective when all the fleet is RTI fitted.)

- 3) Automatic fare stage updates: This will automatically update fare stages on the ETM based on location determined by the RTI system OBU, thereby assisting the driver in issuing tickets correctly.

- 4) Automatic blind changes: Automatically updating destination blinds will reduce the driver workload and reduce errors, thereby assisting the public in knowing the correct bus to catch.

B.3.3 In addition, passenger information can be downloaded from the ticket machine regularly; however this information is unlikely to be linked to geographical information from the OBU.

B.3.4 Plymouth Citybus use a single depot and therefore rotation of buses is not an issue; however if First wish to rotate their buses to another depot, perhaps in a different part of the country, then it is likely that they will have to uninstall the OBU.

B.3.5 As the bi-directional link is not yet installed, the degree to which it is future proof in terms of expanding functionality and software upgrades remains unclear. Functionality provided in each of the types of ETM (Wayfarer and Almex) is also not clear and may well be different.

B.4 Implementation of the bi-directional link

B.4.1 The fitting of Wayfarer ETM to Citybus vehicles has been achieved jointly by the bus operator and ETM supplier. The Almex Optima fitting to First buses has not yet started. Integration into the RTI system is currently taking place and is being addressed by both RTI and ETM suppliers.

B.4.2 So far, only a one-way interface has been achieved between the Wayfarer TGX150 and the AIM RTI system in Plymouth, and this with some difficulty. It is the intention to achieve a two-way interface by the end of March 2005. The level of difficulty in establishing the interface was unexpected. Particularly so, because there is an agreed interface specification for the Wayfarer/OBU link and the same interface has been implemented for some time in Poole and Salisbury.

B.4.3 It is anticipated that the problems in integrating the Almex Optima with the RTI system will be significantly greater. No agreed interface specification exists and, currently, it appears that little progress is being made in establishing one.

C Poole Case Study

C.1 Introduction

C.1.1 The telephone interview for this case study was conducted, on 4 March 05, with Paul Hartigan of Wiltshire and Dorset buses.

C.2 Systems overview

C.2.1 AIM Ltd commenced their installation an RTI system for Wilts and Dorset Bus Company Ltd and the Borough of Poole Council in 2002. Currently the system covers 157 vehicles out of a fleet of 266 buses and delivers RTI at 134 at-stop signs. Wilts and Dorset have paid for all on-bus equipment including ETMs and OBUs. Wilts and Dorset use the real time system to manage their fleet.

C.2.2 In the summer of 2001, Wilts and Dorset upgraded their Wayfarer 2's to TX150's. As part of this contract they stipulated that the Wayfarer ETMs should be able to interface with the planned RTI system from AIM. The bi-directional link has been operational since 2002 and all 157 buses have been fitted with it.

C.3 Functionality

C.3.1 The main piece of functionality desired by Wilts and Dorset was the display of schedule adherence information to the driver. This indicates to the driver how early or late the driver is running by showing - or + followed by the number of minutes (eg -1 for one minute early) on the ETM screen.

C.3.2 The capability of sending text messages to drivers is in development. This has been proven to work over the link and a standard set of messages is now in production. Automatic fare stage updates is not seen a pressing requirement; however this may be implemented at some stage in the future. There is no other functionality that Wilts and Dorset desire that is currently not available.

C.3.3 As with most operators, Wilts and Dorset analyse their ETM data. This is done on a geographical basis by linking to fare stages. Currently this is not automated, with fare stages being manually inputted into the ETM by the driver.

C.3.4 Wilts and Dorset rotate their buses to other depots. When vehicles are moved between Poole and Salisbury, the OBU and ETM can interface with the local AIM RTI system after reconfiguration.

C.4 Implementation of the bi-directional link

C.4.1 The ETMs were fitted by Wilts and Dorset and were integrated into the RTI system by AIM and Wayfarer. The main technical difficulty encountered during integration related to the speed of updates received and displayed on the ETM (eg schedule adherence information). There were few problems in coordinating different parties during the integration.

C.4.2 No implications for other data standards were encountered during the implementation of the bi-directional link.

C.5 Other comments

C.5.1 In general the system works well, although in some areas communications with buses is limited by radio coverage.

C.5.2 Rather than future expansion, consolidation of software across different systems and concentrating on getting the basic system functioning well should be the goal for the next 12 months.

D Preston Case Study

D.1 Introduction

D.1.1 The interview for this case study was conducted on, 24 February 2005, with Larry Pope, Network Development Manager at Lancashire County Council.

D.2 Systems overview

D.2.1 In 2002, Lancashire County Council and Preston Bus procured their real time information system from ACIS. Following installation, this was launched to the general public under the name of "realtime" in 2004.

D.2.2 The system was part funded by £1.8 million of SCA from DfT's Transport Direct programme and covers all of the 124 buses in the Preston Bus fleet and over 75 stops in the Preston area. Expansion to fit all of the 30 buses run by a second local operator, Fishwicks, is currently underway.

D.2.3 The ticketing machines used by Preston Bus are Wayfarer TGX150's. These were purchased prior to the implementation of the RTI system.

D.2.4 As part of the implementation, Lancashire County Council purchased Omnitimes and Omnibasic to assist Preston Bus in scheduling and data management. Before these purchases, a paper-based system was used to manage services.

D.3 Functionality

D.3.1 The main functionality desired by Preston Bus and Lancashire County Council was automated fare stage updates. This functionality was required as it simplifies procedures for the drivers. No additional functionality was desired.

D.3.2 Schedule adherence data is monitored through the ETM but this information is not delivered to the driver in real time; rather it is downloaded later for historical analysis. Any geographical information on where tickets have been issued is carried out entirely by the ETM, rather than through links to the RTI system GPS unit. Also, as all of the Preston Bus fleet in their single depot have been fitted, rotation of buses is not an issue.

D.3.3 Lancashire County Council have yet to determine the degree to which the link is future proof in terms of expanding functionality and software upgrades as the link is relatively new.

D.4 Implementation of the bi-directional link

D.4.1 Wayfarer instructed Preston Bus on how to install its TGX150s and so that the operator could perform the majority of the fittings. Integration into the RTI system was mainly undertaken by ACIS, with some assistance from Wayfarer. FATs on the link were performed by ACIS.

D.4.2 Technical difficulties were encountered during implementation. These led to significant delays to FATS. Coordination between the different stakeholders was problematic at times, particularly getting parties round the table to discuss matters.

D.4.3 No implications for other data standards were encountered during the implementation of the bi-directional link.

D.5 Other comments

D.5.1 There is concern that local authorities and bus operators are paying for the same system developments many times for different implementations. RTIG could assist by producing an open generic specification that once taken up by suppliers, would reduce development costs.