White Young Green

SEStran

RTPI SYSTEM - FEASIBILITY STUDY

Report

RT/ A035560 / 01

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Terms & Abbreviations

Term or Abbreviation	Definition
AF	Audio Frequency
APCO 25	US Digital Public Safety Radio Standard
AVL	Automatic Vehicle Location
Bluetooth	Low power frequency hopping spread spectrum communications system at 2.4 GHz
CCTV	Closed Circuit Television
CDMA	Code Division Multiple Access
dB	decibel
dBm	decibel relative to 1 milliwatt
FEC	Forward Error Correction
FFSK	Fast Frequency Shift Keying
GPRS	General Packet Radio Service (GSM)
Hz	Hertz
ISM	Industrial, Scientific and Medical
Mesh Radio	A system of interconnected nodes and access points using spread spectrum (CDMA) techniques at 2.4 GHz and 5.8 GHz.
MPT 1327/43	Analogue Trunked Radio Standards
PC	Personal Computer
PTT	Press-to-talk
RF	Radio Frequency
RSSI	Received Signal Strength Indication
RTPI	Real Time Passenger Information
Rx	Receive
TETRA	TErrestrial Trunked Radio
Tetrapol or Rubis	French Digital Public Safety Standard
TSC	Trunked System Controller
Tx	Transmit
VoIP	Voice over Internet Protocol
W	Watt
WAP	Wireless Application Protocol
Wi-Fi	Generic name for IEE 802.11 standards
Zigbee	Low power dynamic frequency control system at 2.4 GHz

1 Introduction

SEStran wish to provide real-time passenger information across the SEStran area.

This report explores the delivery options that exist taking due account of:

- the aspirations of the various local authority and public transport stakeholders
- real-time passenger information systems and products currently available in the marketplace
- existing real-time passenger information systems throughout the area and within SEStran's immediate neighbours
- existing schedule based passenger information system throughout the area SEStran's immediate neighbours
- the varied nature of public transport operations throughout the SEStran area
- existing communications platforms
- existing data management systems
- existing administrative arrangements, financial agreements and partnerships.

The report ultimately recommends an appropriate strategy to deliver effective, robust and economically viable RTPI across the SEStran area. The recommendations include:

- an appropriate administrative structure and the basis for Stakeholder Agreements
- a procurement strategy
- an outline data management strategy
- an outline communications strategy
- proposals to accommodate existing systems
- a possible financial model to manage future capital and revenue costs
- Phase 1 scheme proposals, budgetary costs and programme.

The report is the result of extensive consultation with potential system partners throughout the SEStran area.

2 RTPI System Review

2.1 Suppliers within the UK

There are a wide range of suppliers offering RTPI systems within the UK. The features and facilities they offer vary considerably. Historically, the systems could be categorised as:

"UK" RTPI Systems - developed with the aim of delivering RTPI to satisfy the needs and aspirations of local authority led RTPI projects. Such systems would track vehicles to get sufficient location to enable predictions to be made. The needs of bus operators were a secondary issue but they would generally provide historic data and, if required, a voice capability. These were effectively by-products of delivering RTPI. The fleet management tools and benefits available to bus operators were generally limited. In many of the early UK projects, bus operators often concluded that the system was a burden rather than a benefit.

European Public Transport AVL Systems – developed to satisfy the fleet management requirements of large public transport providers. Such systems therefore accommodate the complex and varied operational requirements of bus operators. Normally, the driver will have an on-bus display so that they can easily monitor their own progress against the planned service. (Not normally the case in simpler UK systems) In "European AVL" systems RTPI could be considered as a by-product of the fleet management system.

The above paragraphs explain that the origins of RTPI systems available in the UK can be significantly different. However, the market does seem to be maturing. Some suppliers of "UK" style systems have enhanced their products to recognise the needs of bus operators and enhance the fleet management tools available. Some "European" suppliers have recognised that their fleet management tools may be over-specified for some UK bus operators and are seeking to offer lower spec / lower cost entry in to their systems.

In the UK, the dominant suppliers are:

Acis – UK style RTPI supplier with most UK systems installed. ACIS were an early supplier of UK RTPI offering an RTPI based product but they have now increased the fleet management tools available to bus operators. Projects include Centro (West Midlands) and the West Yorkshire / South Yorkshire consortium. They also supply the Dundee RTPI system.

Siemens – European AVL supplier with 4 UK systems including the major TfL project.

Ineo – European AVL supplier with 3 UK systems including Edinburgh BusTracker

Init – European AVL supplier with 2 UK systems, StarTrak (Leics / Notts / Derbyshire) and Metroline (procured by a bus operator solely for their own needs)

AIM – relatively new to the RTPI market but are supplying the RTPI component of the Glasgow BIAS project.

Telenor – supplied system within the West Bromwich area of CENTRO

Infocell – were supplying Manchester prior to going into receivership. Current position unclear although they were purchased by Connexions, a New Zealand based AVL supplier.

JMW Systems – a small UK RTPI supplier in comparison to the above with systems in East Lothian and Wales.

Appendix A includes background information on suppliers including examples of hardware etc.

2.2 Key System Features & Functionality

The key system feature can be summarised as:

Central servers and software – the heart of the system. The servers can be hosted by the client or within a server "farm". Some suppliers, particularly ACIS, have traditionally offered a fully managed service hosting the servers and up-loading the data on the Clients' behalf.

Databases - Data is a major issue. It has undermined the success of many UK systems through basic inaccuracies or delays in uploading new data sets. As systems expand the data burden quickly increases. Late registrations can pose particular problems, especially if data is being entered manually. Some authorities are finding that the data administration burden is unsustainable. Robust and accurate data sources should be identified and management processes automated whenever possible, particularly for the larger operators.

A fundamental data issue to be considered is whether a system is "timetable" based or "running board" based. With a timetable based RTPI system, there can be no cross-service predictions. This is because the system does not know the "running board", the programmed

work for an individual bus throughout the day. This means that passengers waiting on street will only get real-time predictions once the driver logs on to begin an individual trip. Effectively, if you are at or near the beginning of the route you will never get valuable real-time information. In contrast, a running board based system knows the planned working for an individual bus throughout the day, including any lay-over periods. Running board based systems can therefore predict up to 1 hour in advance for all stops, irrespective of whether they are at the beginning, middle or end of an individual service or trip. They can also recognise when a driver will cut short a planned lay-over to make up lost time.

The benefits of "running board" based systems for passengers are already significant at bus stops with RTPI signs but they increase still further when users access the data via web, wap or SMS services. If the passenger has to allow 10 – 15 minutes to get to the stop, the value of real-time information from "timetable based" systems may be extremely limited. Running-board systems will, of course, continue to give predictions up to 1 hour away for all stops on the web, maintaining a high level of service across the network.

White Young Green strongly recommends that SEStran only considers "running board" based systems.

Data Transfer to Vehicles

The extent of data transfer to vehicles depends on the nature of the system.

European style AVL systems - in typical European systems, the bus holds a complete set of current running boards and any upcoming network changes. This means that the driver can work in "autonomous" mode i.e. they can use their driver display module to track and monitor their own progress against the planned bus "working" even if they have lost communication with the control centre. The system is very flexible allowing the control centre dispatchers to instruct the driver to change to another service or running-board. As soon as the driver logs on the bus knows exactly what is planned because it holds all possible running boards.

This means that a lot of data has to be reliably transferred to the vehicle. It is normally achieved via wireless LAN facilities in the depot. Note – WLAN systems can also be used to download on bus video images at the end of the day.

"UK Style" RTPI Systems – these will typically try to keep minimise the data held on the bus. In their simplest form, the control centre receives driver log-on, service details and location information taken from the ticket machine and sent over the communications network. The control centre then monitors the progress of all buses against their timetables or running boards which are held in the central database. A minimal amount of data is sent from the control centre to the bus over the normal communications network. The amount of data sent to the vehicle will increase if the system includes on-bus signs or bus priority but it is still considerably less than the data held on-bus by the European style systems. In large "UK style" systems, the implications of communicating on-bus sign and bus priority information to individual vehicles may have capacity implications for the communications system.

On-Bus Facilities

European style systems typically provide:

- a driver console – giving information to the driver about current running board, service number, next stop, progress against schedule (mins ahead / behind), up coming driver relief's / lay-overs.
- Audio alarms for the driver to signify when to depart
- - Data messaging facilities – free-test message display from the control centre to the bus and defined data message options from the bus to the control centre e.g. bus full / half-full; lost property; a variety of maintenance messages. These can all be user defined. They provide a quick means of communication without the need for a voice call request.
- The ability to manage on-bus signs, voice messages and destination blinds automatically using the data held within the on-board computer (again irrespective of any communications with the control centre)
- Options to monitor and communicate engine management details in real-time (e.g. oil / water pressure; temperature warnings etc)
- Voice radio communication is normally provided in systems of this type but it is not an absolute requirement.

UK Style systems do not normally offer the above features as standard. The concept of "keeping things simple" on the bus means that a driver will normally not have a driver console with the ability to monitor their own progress. The facilities can, however, be provided by transmitting messages back out from the control centre to individual vehicles. In some systems, a real-time indication of timetable adherence can be provided on a simple, standalone display or via the display on a modern ticket machine with a 2-way interface. Of course, if communication is lost, the driver will not receive any updates. Similarly, on-bus signs can be managed, if required. Voice radio is a common feature of these systems but again it is not an absolute requirement.

Security – both UK and European systems will provide emergency "panic button" facilities which will locate the vehicle on a control centre screen and automatically open voice communications, if available.

Traffic Signal Priority – most systems will provide this option allowing requests to be filtered according to the degree of lateness. The priority request is made from the vehicle using a short range radio. Some systems will utilise the existing on-board data radio and simply change frequencies temporarily to deliver the priority request.

Vehicle Location

There is again a distinction between how UK and European systems achieve this.

UK systems will typically use GPS as the sole means of locating a vehicle. During the early roll-out of commercial GPS applications, there was some concern about the accuracy and consistency of the information due to US decisions to vary the system configuration. To increase accuracy and help mitigate any detrimental effects, UK RTPI systems tend to use differential GPS. This includes a fixed, land based reference point within the system. There is still some concern about the availability of reliable GPS positioning in the heart of urban areas with canyons of tall buildings. For example, TfL are deploying GPS based, mobile bus lane cameras to enforce the Red Routes. They are confident that the system will provide positional data which is reliable and accurate enough to issue and defend enforcement penalties along the Red Routes. The Red Routes are, however, in the suburbs and do not suffer form "canyoning" effects. TfL did not intend to use the cameras in the heart of London because of concerns about GPS accuracy and reliability.

European AVL / RTPI systems actually pre-date the widespread availability of GPS. Many would have originally used roadside beacons. Today, most European suppliers use a combination of location techniques:

- Odometer readings – a bus service is effectively a chain of stops along a route with known distances between stops. The current position is calculated by measuring the distance travelled along the route using the odometer. The system automatically recalibrates the odometer for tyre wear. This is often the primary location technique.

- Door Opening Contacts – this provides a secondary location check. If the vehicle is in considered to be in the immediate vicinity of a bus stop and the doors open, this provides confirmation of that the position is correct. (NB: it is worth noting that some UK suppliers also utilise door contacts in addition to GPS if they are managing on-bus "Next Stop" signs.)

- GPS – European systems typically use GPS to check whether a vehicle is off-route. The system compares the expected distance to the next stop (by subtracting the current odometer reading from the known database distance between the start of the service to the next stop) with the straight line distance between the current GPS co-ordinates and the known stop co-ordinates. If the straight-line distance exceeds the expected distance, the bus is considered off-route.

The European suppliers believe their approach to vehicle location is more reliable and robust offering a number of options in the event of a system failure or the lack of sufficient satellite signals to allow an accurate GPS fix. The UK suppliers are confident that GPS is sufficient for RTPI / AVL systems, particularly when there are no canyoning effects or large tunnels. They also highlight that odometers and door contacts increase the maintenance burden considerably compared to using GPS in isolation. This is true but it is important to note that bus operators already have to use and maintain odometers to prove mileage for tax rebates.

This area should be considered in more detail at the tender stage.

Communications between the Bus and the Control Centre

The communications systems options are considered in detail in later sections. In principle, however, RTPI systems will typically update the control centre every 30s, particularly if they are using a private data radio network.

Early GPRS systems used to operate on exception reporting i.e. they would only report information when the status of the service had changed e.g. if a bus had changed from being 4 minutes late to 3 minutes. (Of course, that judgement can only be made if the bus has sufficient on-board data to monitor its own progress before reporting back. It would not be possible in some UK systems). This approach was taken to minimise GPRS data costs. The cost of GPRS data is falling but it can still be a significant revenue cost over a large fleet. There are, however, examples of RTPI systems which communicate every 30s over GPRS.

Control Centre Functionality

There is again a considerable variation in the functionality offered by the various system suppliers. There is also a considerable variation in the aspirations of the public transport operators regarding fleet management tools. At one extreme there are operators who "send their vehicles out in the morning and hope they come back at night". At the other, there are operators who staff dispatcher work-stations 24 / 7 providing radio contact and operational control.

Some major European system suppliers offer systems which fully reflect and manage the range of complex tasks and actions required by a bus operator managing their fleet in real-time e.g. planning and activating diversion in real-time; turning vehicles short; adding in extra vehicles; protecting connections etc. This is combined with comprehensive historic data. Other suppliers offer little more than a tracking facility. Between these extremes are systems offering some real-time management tools with historic data records available for off-line analysis.

When developing the SEStran project is essential that the short and long term fleet management aspirations of the bus operators are clearly understood. Decisions are, of course influenced by cost, administration and other consideration but the aim should be to procure a system that is capable of satisfying the highest common denominator in terms of functionality.

Real-Time Information Signs

Sign Technology – LCD remains the most popular sign type in Europe whilst ultra-brite LED's are most popular in the UK. Lower cost high brightness TFT screens are now available and are being deployed outdoors as well as indoors.

Signing Strategy – there are fundamental issues to consider. Many are, ultimately, a subjective decision but there are a number of factors to consider:

- Under what circumstances will signs be provided? Some large authorities have provided minimal signs on-street relying instead on web and sms options. This may not be acceptable to some authorities on the grounds of inclusion.
- Are shelters being renewed under the scheme? If not, the cost of upgrading shelters to accommodate RTPI signs can be considerable.
- Does the visibility of pole mounted signs have an impact on car drivers and passengers thereby promoting public transport?
- How many services will the sign have to accommodate? Traditional 3 line LED signs may have to scroll too rapidly and become confusing for passengers.
- Are there any planning or conservation issues which will limit either the size of the sign or the display technology?
- Should services be listed in service number or chronological order? Normally chronological but Edinburgh chose service number listings due to the density of services.

Quick clear down of signs – this is included in the RTIG guidance. Local radio communication between the bus and the signs ensures a quick cleardown of the "due" message.

Audio Messages – it is possible to trigger audio announcements using the RNIB "REACT" system key-fob. The BusTracker project in Edinburgh is trialling this. It also utilising the Scottish Concessionary Travel Card to allow the elderly and those with a registered disability to trigger audio messages at stops. RNIB also plan to trial Bluetooth based systems to deliver information to blind and partially sighted users. "Voice Server" facilities are available from some suppliers. These provide blind and partially sighted users an alternative means of accessing public transport information at all stops in the network. This effectively replicates the options available to sighted passengers using mobile web, wap and SMS text based services.

RTIG guidance is available to help deliver effective signing which is compliant with the Disability Discrimination Act. As in many other areas, it is often difficult to deliver a solution meeting the competing demands of all users and interested parties.

2.3 Communications Options

Section 3 considers communications issue in a SEStran context. A brief overview is provided below.

Private Mobile Radio (PMR) – an OFCOM licensed radio solution which is the preferred communications option for the majority of UK RTPI systems. Trunked radio (MPT 1327) is particularly good for managing voice communications across wide areas and multiple base stations. It is possible to make calls to individual vehicles and to undertake group calls to all buses on a service, all buses from a depot, the entire fleet or the buses that fall within an area selected on a map display. The systems are well proven, robust and scalable. It is possible to segregate a number of operators on a shared system, only providing allowing them to communicate with their own fleet.

Systems exist which have added RTPI data channels alongside the trunked voice channels to carry AVL and RTPI data. These are successful but some of the functional benefits of the trunked voice systems are lost, or at least, eroded. However, MPT 1327 trunked systems are now available which have overcome this issue, maximising the voice and data benefits.

Trunked radio does have the advantage that the user is in control of their own network. The ongoing revenue costs are therefore known and not subject to market pressures that could affect the GPRS / 3G systems in the future. The capital costs of establishing a significant trunked network is often thought to be a potential barrier. However, it should be noted that –

- Many private sector bus operators have already bought private radio systems to meet their own voice needs
- Public sector projects tend to be capital rich and revenue poor so the PMR cost model can be an advantage.
- A private radio network may be viewed as a valuable resource during times of emergency or disaster.

GPRS – this is an option that has been chosen for several UK systems. The advantages are:

- Reduced capital set up costs, particularly when trying to cover wide areas with a low density of users
- Quicker implementation and access to the network (although it is debatable whether establishing a PMR system is on the critical path for major RTPI projects. Data management, vehicle fitting can be the key issue)
- Wide area coverage using existing Vodafone, Orange, O2 networks etc
- Not constrained by the inherent limits of a radio base station transmission station. In theory, vehicles can roam anywhere although in practice Vodafone etc do not have 100% UK coverage.
- Ability to get some communication capability in marginal areas where PMR would be impractical and prohibitively expensive.
- No communications maintenance responsibilities

The potential disadvantages are:

- Networks can become overloaded and fail during unusual events e.g. if there have been road accidents / disruption; large numbers of people leaving an event and accessing using mobile phones etc
- Can be difficult to guarantee level of service with major suppliers
- Cannot replicate the group voice call facilities available with trunked radio – a possible issue for bus operators
- Although GPRS costs have fallen in real terms they may increase as networks become busier
- Can procure lower cost group data bundles but charges for any voice communication can be expensive.
- Increased usage will generally increase revenue costs whereas communication within a PMR network is revenue “free” subject to the capacity of the system

The option does, of course, exist to operate a hybrid system combining the best attributes of each.

Mesh – Mesh networks are private solutions offering high bandwidth communications across an area. Information is relayed through variable paths using fixed and mobile devices. It is unlikely that Mesh will be suitable for the SEStran AVL / RTPI project because:

- AVL /RTPI does not require high and width communications
- A Mesh network would be inordinately expensive and impractical over such a wide area.

Mesh trials that are underway have tended to focus on targeted, urban implementations where there are a number of high bandwidth users requiring access to the network.

2.4 UK Project Examples

2.4.1 Edinburgh BusTracker

Stakeholders – CEC & Lothian Bus (Other operators can join)

System Supplier: Ineo Systrans

Coverage – Edinburgh and the operational area of Lothian Buses

Communications – CEC PMR data radio managing RTPI signs; private Lothian Bus voice and trunked data radio for AVL and fleet management

Scale – 400 + buses fitted (570 total ordered). Effectively full fleet coverage in 12 months.

Data Entry – electronic output from Lothian scheduling software loaded directly onto Ineo system by Lothian Buses. Signs configured by CEC staff.

Signs – approximately 300 in CEC; 60+ ordered for Lothian Bus routes in East and Midlothian

Fleet management functionality – very high.

Web and Wap Facilities – developed and under test.

Funding – core system funded by CEC. Lothian Buses funded capital costs of all on-bus and depot equipment.

Maintenance costs: shared.

2.4.2 Dundee RTPI System

Stakeholders – Dundee City Council, Travel Dundee, Strathtay Buses (now Stagecoach owned), Stagecoach Fife (limited involvement)

System Supplier: Acis

Coverage – Dundee and operational area of main stakeholders

Communications – DCC owned voice and data radio for signs and buses.

Scale – approx 190 buses fitted (110 Travel Dundee, 70 StrathTay; 8 Stagecoach Fife). Effectively covers all local buses.

Data Entry – service registrations entered by DCC onto Routewise. Sent to ACIS who manipulate and upload data. Running boards added separately. Some service changes included within maintenance contract. Other paid for on ad hoc basis.

Signs - 340 predominantly 3 line LED

Fleet management functionality – Travel Dundee monitor the system part-time with dispatcher. (80 – 90% of journeys tracked) No driver information on bus. StrathTay do not manage fleet with the system. Much lower % tracked therefore resorting to scheduled time too frequently. Undermines public confidence.

Web and Wap Facilities – web operational. 500 hits per day. Want to deliver and promote Wap.

Funding – fully funded by DCC.

Maintenance costs: DCC pay maintain of system / signs. Operators responsible for their on-bus equipment maintenance costs.

2.5 Summary of Core Issues to be Considered by SEStran

The core issues to be considered are:

System Functionality – understanding the needs of the local users and defining the functional specification of a future system to meet the short and long-term aspirations of the potential partners.

Communications Platform – which communications platform is the most cost effective solution to meets geographical coverage and functional needs of the stakeholders.

Data Management – efficient and reliable data management procedures essential to support a SEStran wide RTPI project

Administration – building strong partnerships between the public and private sector stakeholders. Commitment required from both sides to realise the potential benefits and deliver a meaningful system for the public.

3 Data Collection & Review

3.1 Potential Partners

SEStran's potential partners are:

Local Authority Partners

- City of Edinburgh Council
- Fife Council
- East Lothian Council
- Midlothian Council
- West Lothian Council
- Falkirk Council
- Clackmannanshire Council
- Borders Council

Bus Operator Partners

- First Edinburgh
- Stagecoach Fife
- Numerous smaller operators

Appendix C includes plans showing the core operational areas of the major bus operators and the most significant "small" operators.

Others

- Traveline Scotland
- Lothian Bus (possibly if SEStran added value through enhanced public transport security systems)

3.2 Existing & Proposed Systems within SEStran Area

Figure 1 shows the location of AVL / RTPI projects within or adjacent to the SEStran area.

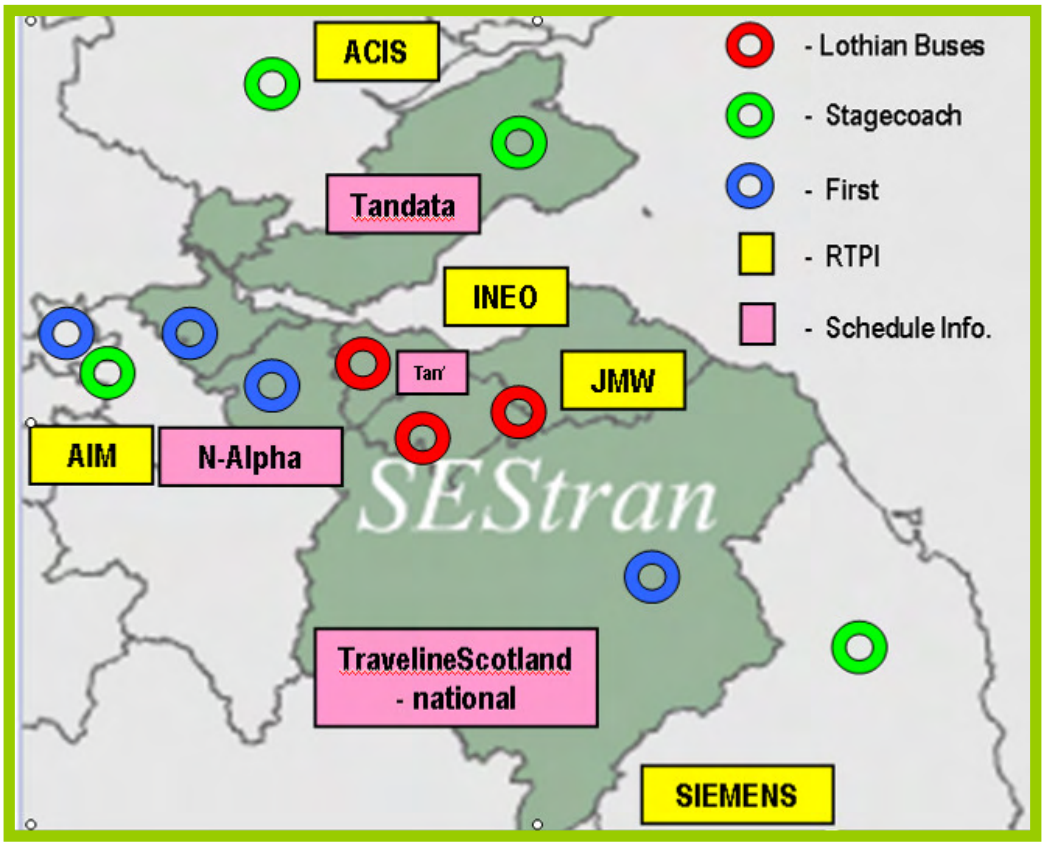

Figure 1: Overview of Major Operators and Relevant Systems

3.2.1 RTPI / AVL Systems

3.2.1.1 Edinburgh BusTracker - : System Supplier – Ineo Systrans, Paris

This is the dominant real-time and AVL system within the SEStran area. Lothian Buses are approaching full-fleet coverage across their whole operational area. There are no other bus operator partners at the present time although, in theory, others could join the system. At the moment, there are no other operators expressing an interest in joining the system. First Edinburgh were actively exploring opportunities to join the system in December 06 but have now decided to wait until SEStran's RTPI / AVL proposals are clear.

BusTracker sign installation is ongoing throughout the Edinburgh area and in East Lothian and Midlothian, where Lothian Buses are a major operator. This is a relatively easy

expansion requiring only a pole, power supply and RTPI sign. The CEC radio coverage reaches these areas and is therefore capable of driving the required signs. TFT screens are also being installed at key locations in Edinburgh. A number of private organizations have also expressed an interest in funding signs for their own premises.

The system includes bus priority facilities. This means that the entire Lothian Bus fleet will be capable of requesting bus priority at any traffic signal equipped junctions in Edinburgh, East Lothian and West Lothian.

Web and wap services will be live over the next few months.

3.2.1.2 East Lothian RTPI Trial – System Supplier – JMW Systems Limited, Edinburgh

JMW are commissioning a trial consisting of:

- 6 LED shelter displays on a trial route (Eves 120) from Dunbar to North Berwick
- 1 equipped “Eves” bus (no driver display or on-bus signs)
- A data radio network with 2 base stations and 4 channels covering all of East Lothian and Midlothian. Radio coverage extends into Edinburgh (east end of Princes Street). The system also provides some coverage in Fife. JMW gave the following overview: Good - Kirkcaldy, Buckhaven, North Queensferry; Incomplete: Glenrothes, Dunfermline, Borders
- no voice capability but can be added
- in-station servers housed and managed by JMW at their Loanhead offices
- timetable data input manually or from a Routewise file
- No bus operator or local authority workstations. (Eves already have a tracking facility which will soon be out of contract)
- web viewing will be possible over a broadband link

The trial has not yet started.

The East Lothian scheme includes a further 8 LED shelter displays at various locations in Tranent and Prestonpans. These have been modified to receive radio signals and information from the Edinburgh BusTracker project. They will display real-time information for any Lothian Bus services using those stops. Data for these services is not held on the JMW system.

A further 8 JMW LED signs have been installed at various locations throughout East Lothian. These will be commissioned when RTPI services use the stops.

East Lothian officers stated that no decision will be made on expanding the system until after the trial has been completed. East Lothian Council hoped that First Edinburgh would join the system. A decision is awaited.

East Lothian officers noted that Lothian Bus and First operate over 90% of the East Lothian services. They ultimately want to see server – to –server links between the JMW system and neighbouring systems such as BusTracker and any future SEStran project.

JMW have also supplied 3 “info-columns” for Midlothian. These utilize scheduled information. JMW state that these can be upgraded to RTPI, if required.

3.2.2 Scheduled Information Systems

A plan showing the location of scheduled departure information signs and systems throughout the SEStran area is included in Appendix B. The proposed JMW trial route is also included.

3.2.2.1 Fife Bus Stations – Supplier - Tandata

Fife Council has numerous Tandata bus station information management systems (BIDS). These include:

- Glenrothes – 16 No 3–line LCD stand signs and 1 TFT departure board.
- Leven – 8 No 3–line LCD stand signs and 1 TFT departure board.
- St Andrews – 1 large TFT sign
- Kirkcaldy – 14 No 3–line LCD stand signs and 1 TFT departure board.

- Dunfermline (due 2008) – 18 No 3–line LCD stand signs, 1 No. 48”TFT departure board and 6 No small TFT screens. Further 6 LCD screens external to the building.
- Markinch Railway Station – 1 No 3–line LCD sign.
- Leuchars Railway Station – 1 No 3–line LCD signs.
- Inverkeithing Railway Station – 1 No 3–line LCD sign.

Data Management – bus registrations and scheduled information are entered onto the Routewise database by Fife Council staff. This is loaded onto an FTP site and collected by Tandata at their offices in Newbury, Berks. Tandata convert the files to the required BIDS format and return the data to Fife. It is automatically loaded onto the Fife Council central computer in their Glenrothes Headquarters. This is linked via broadband connections to the individual bus stations. Communication with the 3 railway station signs is via GPRS. Fife staff can edit the data (“via” data etc) and post additional messages (cancellations, holiday messages etc) from the Glenrothes office or using terminals in each bus station.

The system is resilient in that individual bus station computers hold the current data set. Failure of a broadband link would only become an issue should it be a long-term problem spanning a new data upload. Local data transfer remains an ad hoc option in such circumstances.

At the moment, Fife Council officers do not see the need to fully integrate bus and train information sources at railway stations. Full integration is often confusing to the user. Separate screens and data feeds within an integrated housing is the preferred solution, if required.

Fife officers would give delivery of RTPI information to the various bus and railway station displays a high priority within in any future SEStran RTPI project. The new bus station facilities are high profile and would immediately disseminate RTPI information across 75 signs.

3.2.2.2 St Andrews Square Bus Station, Edinburgh. – Supplier Tandata

The information displays, which form the front end of the new facility, are driven by Tandata's BIDS system. The system drives the capture and dissemination of arrival and departure information.

Passenger information is compiled and consolidated by BIDS from schedule data sources and is transmitted to a combination of display screens around the concourse. These include 42-inch plasma screens showing summary departure data, and TFT flat panels at departure gates - each screen serving two or more bus stands.

In addition, a workstation allows bus station staff to input real time information and changes to services.

The BIDS system is designed for flexibility to meet current and future operational needs. There are links to the City of Edinburgh Council's central computer for exchange of key management information.

BIDS is equipped with real time links for smooth transition to full real time operation. There are no real-time links between the BusTracker system and the Tandata system at St Andrew's Bus Station. This was not a priority for City of Edinburgh Council as Lothian Buses do not use the bus station. It is, however, likely to be an issue for any future SEStran project as the bus station is used by Stagecoach Fife and some First Edinburgh services. It is, of course, fortunate that integration in Fife should, in principle, address St Andrew's Bus Station (notwithstanding any software release issues and contractual variations regarding maintenance and software upgrades between the Fife and CEC contracts.

3.2.2.3 West Lothian Bus Station Systems – Supplier: Nexus Alpha

West Lothian Council has implemented a Nexus Alpha ***scheduled*** information system at a number of bus stations. Information is provided at stances using the Nexus Alpha Maia information "posts" and Helios high brightness LCD panels. The installations are at:

- Livingstone Bus station – 7 stance displays & 2 LCD screens in MacArthur Glen Shopping Complex

- St Johns Hospital – 1 stance display & 2 LCD's in the hospital
- Livingstone North Railway Station – 2 stance displays & no LCD's
- Installations are also imminent at:
- Bathgate Medical Centre – 2 stance signs
- Wilkinston outside School for the Blind – 1 stance sign
- Whitburn Cross – 2 stance signs
- Broxburn (Strathbrock Medical centre) – 1 stance sign

The system provides scheduled information for the next 6 departures from individual stances showing service number, destination and scheduled departure time. In addition, there is an element of colour coding:

- Red – buses that have just departed
- White – next departure
- Yellow – departure within the next 15 minutes.

The following installations include audio facilities activated using a push-button. RNIB REACT key fob activation is an option.

- Livingstone Bus Station (7 stances & 1 LCD)
- All of the imminent installations listed above.

Once the above installations are complete, there are no plans for further expansion. West Lothian officers would like to add real-time information but there are no plans to progress a West Lothian project in isolation.

Data is managed by Nexus Alpha using ATCO_cif timetable information files issued to them by West Lothian Council. The ATCO_cif files are created from West Lothian's Routewise system. Nexus Alpha load the files over GPRS to the signs. West Lothian do not actively manage the signs e.g. sending additional messages in the case of special events or service

disruption. Nexus Alpha can send additional messages, if required, but this facility is not used.

Discussion with Nexus Alpha revealed that the proposed West Lothian signs will use the latest Nexus Alpha software and systems. These have special software and systems to minimize power consumption and are capable of operating on solar and wind generated power. (NB the West Lothian signs will be mains powered.)

Although their current client base is predominantly rail, Nexus Alpha has interfaced with a real-time bus information in Southampton (Infocell).

3.2.2.4 Midlothian Information Columns – Supplier: JMW Systems

JMW have supplied 3 "info-columns" for Midlothian. These utilize scheduled information and operate on broadband communications links. JMW state that these can be upgraded to RTPI, if required.

3.2.3 Radio Systems

In addition to any radio systems associated with above real-time projects, the following are worthy of note:

3.2.3.1 Fife Council Radio Network

Initially, the SEStran feasibility study was not considering other local authority radio systems (e.g. highways or housing departments). However, the Fife system has been highlighted because it represents a major local authority radio network which must be replaced by 2008 / 09.

The key points to note are:

- The system was originally shared by the Police and the local authority
- It provides full coverage of Fife from 6 masts and includes microwave links. (Appendix D shows the mast locations)
- The Police have vacated the system
- Fife Council has been granted an extension but must vacate the system by 2008 / 09.

- Fife track 800 vehicles (including gritters, highway maintenance vehicles etc) using the APD Inca system
- Fife has 1100 voice users on the system of which approximately 6% are hand-portables.
- Fife must find an alternative solution and are likely to consider radio and / or GPRS / 3G solutions. GPRS is currently the preferred option to provide communications with mobile workers within buildings
- A review of the functional requirements will be undertaken in advance of any procurement.
- SEStran and Fife Council may be able to cooperate regarding the use of existing radio mast site share agreements and a possible upgrade of microwave links.

White Young Green believe there are "best value" opportunities which are worthy of further, more detailed investigation.

3.2.3.2 West Lothian Council

West Lothian Council are currently commissioning a new voice and data MPT1327 trunked radio system. This utilises 3 (possibly 5) base stations and caters for approximately 500 radio partners. This includes a mixture of mobiles and hand-portables. The system was initially supplied by Radiocomms (now taken over by another supplier).

The system allows job details to be issued to staff who can update information and clear when appropriate.

3.2.3.3 East Lothian Council

The East Lothian JMW real-time project includes a 2 base station, 4 channel licenced data radio system. There is no voice capability but it could be added. JMW state that the system covers the whole of East and Midlothian. Coverage to the west extends as far as the east end of Princes Street. There is also limited coverage of the south of Fife and the Borders.

3.2.3.4 Borders Council

No private radio network in the Borders area.

3.2.3.5 Midlothian Council

Midlothian own a voice radio system, provided and maintained by Sitelink . It uses 1 mast and serves approximately 30 mobiles and 2 hand portables. Midlothian have no plans to expand or upgrade the current system but they would consider any opportunities arising from the SEStran project. Other departments who currently do not have a radio facility may express an interest.

3.2.3.6 Clackmannanshire Council

To date, White Young Green has been unable to make contact with the Clackmannanshire radio representative. Further attempts will be made. Should any "best value" opportunities exist, they can still be identified and pursued during the system specification phase.

3.2.3.7 Falkirk

Currently tendering for a replacement or upgraded communications network for important council vehicles. No further information available.

3.2.3.8 First Edinburgh

First Edinburgh already have an MPT 1327 trunked voice system which operates in 2 discrete parts (Central & Edinburgh). This is being expanded through the addition of more mobiles within the limits of the current core system architecture. The majority of the mobile radios only provide voice capability but new hardware in the Linlithgow depot (34 buses) can accommodate voice and data.

The system includes 340 buses (316 voice only; 34 voice and data) across 7 depots. Buses in Balfron depot and the Borders have no radio facility (69 buses). First would like to extend coverage to the Borders area around Galashiels. Ideally, they would also like seamless communications across their split operational area. The geography around the Bathgate area currently prevents this.

Having established a comprehensive radio system, it is likely that First will want to retain direct control, modifying the system to operate within an AVL / RTPI system. This is similar to the approach taken by Lothian Buses during the early stages of the BusTracker project. However, the issues, options and potential benefits of any future SEStran platform are likely to be carefully considered before any decision is made.

Irrespective of whether First modify their existing platform or adopt a new SEStran solution, migration will have to be carefully planned and managed to avoid unacceptable disruption to a significant operational system.

3.2.3.9 Lothian Buses

This comprehensive system is used exclusively by Lothian Buses. It cannot be used by SEStran.

3.2.3.10 City of Edinburgh Council

The Council's BusTracker radio network is used to deliver information to the BusTracker RTPI signs. In principle, it can be used to deliver "SEStran" RTPI data via the BusTracker central information servers. Radio capacity issues may have to be addressed.

3.3 Existing & Proposed Systems in Neighbouring Regions

The following systems are operating in neighbouring areas.

3.3.1 NE Real-Time Passenger Information System

Supplier – Siemens

Scale: 730 buses; 300 signs

Communications: PMR radio. 14 base stations covering the north-east but excluding the northern part of Northumberland.

Interfacing with this system will be a low priority because:

- the NE system does not cover the northern part of Northumberland at the present time
- It is adjacent to the Borders, a low density area within SEStran

The NE project does have some relevance to SEStran as it is a consortium of 4 local public sector bodies and 2 bus operators: Nexus, Durham, Tees Valley JSU (representing 5 Tees authorities), Northumberland, Go North East and Arriva North East.

3.3.2 Glasgow BIAS

Supplier: AIM

Scale: Ultimately up to 1500 buses, approximately 450 fitted at present.

Communications: PMR radio. The BIAS project also includes a trial of Mesh technology but this is not used by the RTPI system.

The major stakeholders within this system are Glasgow City Council and First Glasgow. Cross-boundary working is likely to be an issue at some point but it will not be significant in the early stages of any future SEStran project. This is because the management of First Edinburgh, a major SEStran partner, consider First Glasgow and First Edinburgh as discrete operational areas.

3.3.3 Dundee RTPI

System Supplier: Acis

Coverage – Dundee and operational area of main stakeholders

Communications – DCC owned voice and data radio for signs and buses.

Scale – approx 190 buses fitted (110 Travel Dundee, 70 StrathTay; 8 Stagecoach Fife) Effectively covers all local buses.

Data Entry – service registrations entered by DCC onto Routewise. Sent to ACIS who manipulate and upload data. Running boards added separately. Some service changes included within maintenance contract. Other paid for on ad hoc basis.

Signs - 340 predominantly 3 line LED

Fleet management functionality – Travel Dundee monitor the system part-time with dispatcher. (80 – 90% of journeys tracked) No driver information on bus. StrathTay do not manage fleet with the system. Much lower % tracked therefore resorting to scheduled time too frequently. Undermines public confidence. The Stagecoach Fife buses equipped with the Acis system were giving RTPI predictions are not working effectively on the RTPI system at present. This is due to an issue with ticket machine integration.

Web and Wap Facilities – web operational. 500 hits per day. Want to deliver and promote Wap.

Funding – fully funded by DCC.

Maintenance costs: DCC pay maintenance of system and signs. Operators are responsible for their on-bus equipment maintenance costs.

3.4 Bus operational areas

Appendix C shows the dominant operational areas for each of the major operators within the SEStran area including depot locations. An overview of how each operator manages their fleet and delivers their services is included in chapter 5.

Within the SEStran area, there are three major operators-Lothian Buses; First Edinburgh and Stagecoach who between them supply by far the majority of bus services. These are supplemented by a large number of smaller independents some of whom have only a very minimal input. Further detail regarding bus operators in the area is included in chapter 5.

3.5 Data Management Systems and Practices

High quality data is essential to successful RTPI system. In large systems, it can become an unsustainable burden undermining the success of the whole project. The potential data sources and data management issues within the SEStran area are discussed below.

3.5.1 Bus operator service registrations.

Local authorities continue to fulfil a role in this area, creating electronic timetable databases to support local public transport information as well as providing electronic feeds to traveline Scotland. This process is being streamlined within the SEStran area through the procurement of a regional, networked Trapeze Routewise system which will be utilised by all the SEStran partner authorities.

The system is being implemented at the moment. The system servers will be hosted at the Edinburgh Park server farm minimizing system maintenance and administration concerns.

Opportunities - The SEStran Routewise system can offer a complete timetable database for the RTPI / AVL project. This is particularly useful as it covers major and small operators.

Limitations / Concerns – Trapeze Routewise systems do not normally include running board details. White Young Green strongly believe that the SEStran system should be running board based, at least in terms Supplementary "running board" files would have to be added to any SEStran AVL / RTPI system to deliver the benefits of cross-trip prediction etc. Running Board information can only be supplied from the bus operators themselves, as the current legislation precludes any obligation to supply such information to Local Authorities

In theory, the 56 day service registration process does provide sufficient time to process the data and ensure a complete and accurate data set. However, this can be undermined by two issues:

- Late registrations
- Insufficient administration resources to complete the task on time

Throughout the UK, authorities do fail to deliver accurate and timely timetable datasets, particularly during periods of change e.g. Christmas and New Year. These are, arguably, the periods when the travelling public could greatest benefit from the system.

To minimize the administration burden, SEStran should seek to automate data feeds whenever possible. This can, of course, only happen if the there is confidence in the "all stops" source data from the bus operators. The SEStran real-time project could be a suitable vehicle to focus attention on data and deliver any necessary improvements.

At the moment, only Lothian Buses provide an electronic data feed to traveline. This is an output from their Hastus scheduling software. AIM, traveline's contractor, converts the file to ATCO-CIF format using a bespoke conversion tool. (NB: AIM may, ultimately, output this file to SEStran to ensure their dataset is complete.)

3.5.2 Lothian Buses - HASTUS

This item is included as an example only. The Lothian network is covered by the Edinburgh BusTracker project.

The successful operation of BusTracker is due, in part, to the fact that Lothian Buses take direct responsibility for their data. An electronic output from Hastus, including timetables and running boards, is loaded onto the BusTracker system by Lothian Bus staff.

The benefits of this approach are three-fold:

- The system fully reflects the Lothian bus network and bus fleet, including any planned changes and their implementation dates.
- The additional data administration burden is negligible
- Accurate data increases public confidence in RTPI

Working closely with their major partners, SEStran should seek to deliver data management systems with the same reliability and efficiency. It will benefit the project as a whole.

3.5.3 First Edinburgh – Omnitimes

First are using the Omnitimes Scheduling system for all internal scheduling output. This currently only delivers "standard" outputs. First use a bus board and duty card system, with most buses running on all-day services and driver relief's taking place on service at a number of convenient relieving points. Additionally they have access to the Omnibase and Omnistop products which compliment the Omnitimes database. The data set currently supplies timing points only, but is capable of delivering all-stops information.

Quite rightly, First are insistent that any output subsequently an input for an AVL/RTPI system must be automated, and stressed that they would assist wherever possible in promoting this aspiration.

It is recommended that SEStran and First work together to develop an all-stops database and electronic outputs of schedules and running boards. Such work can be undertaken now and will serve to compliment the AVL/RTPI system.

3.5.4 Stagecoach Fife – Trapeze

Stagecoach is currently using the Omnitimes Scheduling system. However, plans are well advanced for a move over to Trapeze shortly. Stagecoach also use a bus board and duty card system, with most buses running on all-day services and driver relief's taking place at a number of convenient relieving points. The Trapeze system will be all-stops compliant. Stagecoach is also well-advanced with plans for electronic-registration and expects to be involved with national trials in due course.

As with First above, it is recommended that SEStran and Stagecoach work together to develop an all-stops database and electronic outputs of schedules and running boards.

4 Communications System Review

4.1 Existing systems

A brief overview of existing radio platforms is included in chapter 3.

4.2 Radio technologies

The most common carrier for RTPI networks has been wide area radio networks conforming to The MPT1327/43 protocols. An example of this is London Buses which has the largest system and currently serves 7,000 vehicles and is set to expand to 10,000 in the near future. This system is soon going to be upgraded to include high speed polling for the AVL data as the existing 1200 bit/s system is approaching overload without extra channels. There are many other examples including Glasgow, Lothian & Borders, Centro etc. Other dedicated non-trunked radio schemes have been used but have suffered from a lack of redundancy and resilience.

In Europe TETRA digital radio has been implemented in voice and data networks and has been used in relatively small AVL schemes as the protocols limit capacity. In other parts of the world systems based on the APCO 25 (particularly in the US), Tetrapol or similar proprietary standards have been implemented and have proved successful but expensive.

Cellular telephone networks with their attendant data facilities e.g. GPRS have been used but come with rental and recurrent call charges.

Recently attempts have been made to use “Mesh” radio in various pilot schemes in Portsmouth, Coventry, Lowestoft, Glasgow and Edinburgh. In most cases the jury is still out because of the high cost but they have proved successful in the US for traffic light control.

4.2.1 Professional Mobile Radio (PMR)

4.2.1.1 Overview

PMR is generally understood to refer to wide area or on-site radio schemes which are privately owned and service is not supplied by a telco operator. It is now known as PBR (Private Business Radio) by OFCOM. PBR may take many forms from a single channel low power on-site system, multi-channel licence free systems such as PMR446 through to wide

area coverage networks such as operated nationwide by Network Rail and within the M25 by London Buses. PBR works in licensed frequency bands which are at 66 - 88 MHz, 138 – 174 MHz, Band III[1] and 450 – 470 MHz. Licensed channels have the advantage of predictable levels of coverage and interference which unlicensed allocations do not. Problems can occur due to unusual atmospheric conditions, illegal use of radio equipment etc. but grade of service is generally predictable.

For these reasons PMR is the most widely used of all technologies in public transport AVL systems. Historically many of the systems have located in Band III because the Radiocommunications Agency (the fore-runner of OFCOM) made an allocation in sub-band 2 to the Bus & Coach Council. One of the stipulations for the use of this frequency band was that a digital signalling protocol known as MPT 1327/43 be used. This protocol has since spread worldwide with great success. There are many sources of such equipment one of which is shown in APPENDIX H.

PBR can take many forms both analogue and digital. Two well known digital technologies are TETRA and Tetrapol. The former has now been deployed across the UK in the 380 – 400 MHz band for emergency service communication by the police, fire and ambulance services by the service provider Airwave which is owned by the cellular operator O_2. TETRA has to use 25 kHz separated channels which are not easily found except in certain parts of the UHF band. A recent government auction disposed of the now defunct Dolphin Communications TETRA allocation in the 420 MHz band. Tetrapol has been deployed in France by the Gendarmerie (where it is known as Rubis) in the 160 MHz band. It uses standard 12.5 kHz channels so can be accommodated relatively easily in any of the PMR bands. Similarly APCO 25 from the US can also be used but has as yet not found great favour in Europe.

Some of the existing RTPI systems use “plain vanilla” radio networks which simply use an analogue FM carrier and a suitable modem to carry data from the vehicles back to a control centre. In many cases this is sufficient if there are relatively few vehicles (< 300) and the

[1] Band III (174 – 225 MHz) is currently undergoing significant changes and part of the spectrum is being returned to Broadcasters for DAB and DVB. It is expected that sub-band 2 will be vacated by PMR is southern England after the Olympic games in 2012. Sub-band 1 will accommodate some of those moved.

whole area of operation can be covered by a single radio site, such as a medium sized town, but where there is greater mobility, such as coverage of a whole county with interconnecting town traffic then a communications system with some form of management control is required to ensure that all mobiles are logged on to the best available radio site. This is where multi-site trunked networks show their advantages both in capacity and resilience.

Whether analogue or digital wide area radio is chosen the coverage from radio sites will be similar as the analogue system will also be required to carry data. The main difference in coverage will be determined by the frequency band which is chosen and assigned. UHF channels will give better coverage in towns due to multiple reflections from buildings but will suffer from greater attenuation and path loss in rural areas. Low band VHF gives good coverage in the countryside but suffers from urban interference. This is one of the reasons that Band III has been the optimum for transportation as it represents a half way house between these extremes. To meet SEStran's need for both town and country coverage with the minimum number of base sites, channels should be sought in High Band or Band III.

4.2.1.2 Advantages.

- The main advantage of PMR is that it uses licensed channels which guarantee system integrity against other users particularly in emergency situations when traffic on public networks can cause blocking. Similarly, many rural cellular sites do not have back up in the event of grid power failures so areas can be left with no communication. It is cost effective to supply PMR base stations with UPS facilities as the power consumption is relatively low to maintain operation for several hours.

- There are multiple manufacturers of suitable equipment worldwide.

- The recurring costs are low relative to purchasing airtime from a public network. Site rentals, landline cost and maintenance constitute the major revenue costs once the initial capital cost has been met.

4.2.1.3 Disadvantages.

- Viewed by many as "old" technology unless digital equipment is used.

- Cost of landlines to remote sites. This can be mitigated by the use of microwave links or internet protocol (IP) connected virtual circuits.

- In house maintenance may be a problem but can be sub-contracted to experienced radio system suppliers

- Can only connect to a dispatcher (with "simple" PMR installations. Can set up mobile – to-mobile calls with trunked, MPT1327 radio systems. A PSTN connection is also possible with a suitable gateway).

NB: In some cases talking through a dispatcher can be viewed as an advantage as it stops the abuse of the radio facility. For example, driver – driver calls are normally not permitted in bus operator radio systems even if the technology can support it. However, in other local authority scenarios (highway maintenance teams / inspectors etc), it may be essential to allow mobile – mobile calls without a dispatcher.

4.2.2 GPRS / 3G

4.2.2.1 Overview

GPRS is itself an overlay, albeit integrated, network superimposed on GSM. Each GSM physical channel operates at a gross bit rate of 271 kbit/s. This is then subdivided into 8 time slots, each of which has an effective gross bit rate of 21.4 kbit/s. (The difference is made up by coding, overheads and switching times). GPRS data uses exactly the same physical resources as GSM voice and circuit switched data but in a different way. Data is packetised and transmitted through the GSM network via routers rather than setting up end to end circuits. This means that the call set up times over the radio link is very much faster but with the down side that data latency suffers in the fixed network as packets are forwarded through it. Not all packets associated with a particular session will necessarily travel by the same route so may arrive out of order at their destination and with significantly different time delays. This doesn't matter with most data communications as the packets are numbered and the data can be reassembled.

GPRS has been described as "always on" because there is no need to set up an end to end circuit before sending the data. In most cases this is how it will appear to a user. However, before data can be sent or received a call has to be set up between the radio and the base station using the PRACH (Packet Data Random Access Channel, uplink) or the PPCH Packet Paging Channel, downlink). The data itself is interchanged on the PDTCH (Packet Data Traffic Channel) which is the same physical resource as one or more time slots of the GSM

voice network. London Bus have negotiated with O_2 to allow a session to exceed the time of a polling period so that is not necessary to continually set up a call every time a position update is required. This significantly reduces the load on the random access channel but could cause problems of contention with other users at peak times.

In times of network congestion it is unlikely that more than one time slot would be allocated to either up or downlink. Because voice traffic has precedence (Network dependent) even these time slots are not always available. However, in a properly configured GPRS system the random access channel should always be available so a call request should be registered at the base station. Again this depends on the level of GPRS data activity that a particular cell is experiencing. If there are too many users attempting to access the network then congestion will occur on the PRACH. Thus if there are a large number of buses and other data users "camped" on a single cell, contention may become a problem. This will be exacerbated in future if the proposed GSM "Press to Talk" functionality is introduced which effectively uses packet data for Voice over IP operation.

The main problem for an AVL network is that some packets may arrive late and cause problems in the RTPI processing software. This will require more processing power than a simpler synchronous system which is immediately aware that a data packet is irretrievably lost and should be discounted.

Faster data rates are available by the use of "EDGE" (sometimes known as 2.5G) which is a multi-level modulation scheme which increases the basic 271 kbit/s channel up to 384 kbit/s but is only available relatively close to a base station. 3G uses a totally different modulation technique based on CDMA but is capable of higher data rates suitable for video transfer. Here again the cell sizes tend to be small because of the high operating frequency at 2.2 GHz.

However GPRS can be very useful in the updating of bus stop signs where data rate and absolute timing are not paramount. The radio coverage will generally be good and antennas and power consumption small. Even on-board bus signs could be updated quite easily using this technology.

4.2.2.2 Advantages

- Easily set up using existing public network.
- Almost ubiquitous coverage.

- No large capital costs for base station radio equipment.
- Effective for updating bus stop and road signs as timing is not critical and radio coverage can be pre-determined. Traffic light control is possible but account has to be taken of variable latency of operation.

4.2.2.3 Disadvantages

- If used for AVL fairly high running costs as data is charged per Mbyte/ month.
- Cost of connection to the cellular switch to transport data to AVL servers.
- Loss of real time data in times of crisis due to network overload.
- Delayed data packets at times of high load on the network.

4.2.3 Mesh

4.2.3.1 Overview

Mesh networks are relatively new and have evolved from both the battlefield and early attempts to displace the "last mile" of copper or cable. They are inherently self-healing so long as a reasonable overlap of node cells is allowed for in the original network design. The basic principles are outlined in Appendix I.

Unfortunately, although the principles are very well founded, the frequency bands in which the current networks are forced to operate are unregulated and unlicensed. In particular the 2.4 GHz ISM band supports multiple protocols and users including Wi-Fi (802.11 a-g etc.), Zigbee, Bluetooth, microwave ovens and other proprietary systems. The use of direct sequence spread spectrum techniques (also known as CDMA[2]) is a well known technique for combating such interference, hence its use by the military, but it cannot overcome reduction in range and/or throughput caused by the general increase in the spectrum noise floor introduced by multiple other users. The military maintain their connectivity by increasing the

[2] CDMA is used in 3rd generation cellular telephony but only has to coexist with similarly planned and regulated other operator networks within the allocated frequency band at 2.2 GHz

transmit power under such circumstances but this is not possible in this case as power levels are capped by international agreement to ensure all users get an equal chance of maintaining their communication links. The use of rake receivers and spread spectrum code division techniques certainly gives an advantage to its users without causing problems to others because much of the system gain is made at the receiver rather than by increasing the spectrum pollution at spot frequencies.

The claims of increased range relative to Wi-Fi for a given transmitter power is well founded but the range is still rather short for an AVL system and is likely to be even smaller in built up areas where there are other networks in the same frequency band. It is probable that if full throughput is required then urban ranges of 400m or less can be expected. Up to 1 km may be possible with reduced effective data rates (by the use of more powerful FEC). Manufacturer's claims of up to 1 mile in rural areas have to be treated with caution as weather conditions and wet foliage significantly increase the attenuation of signals in the 2 GHz band.

It is understood that around 500 nodes have been installed in the Portsmouth area to give blanket coverage. It is not known exactly what grade of service has been obtained as trials are on-going[3]. Assuming that adequate coverage has been achieved now there is always the concern that as more and more users install home wireless networks (Wi-Fi), remote control devices (Zigbee) and bus passengers use Bluetooth connected phones and games then the grade of service will get worse. Assuming the coverage in Portsmouth is good enough to track the buses within the urban area then if this is scaled up to meet the requirements of SEStran then on a conservative estimate some 5,000 nodes will be needed for urban areas and a further 5,000 to cover rural roads. It should be noted that on the rural roads the advantages of the "mesh" will be largely lost as the coverage and subsequent linking of nodes will be linear rather than two dimensional. The effects of self healing will then be limited.

Part of the appeal of using a high throughput mesh network is that may be spare capacity for other uses such as traffic light control, bus stop signs and on board display panels. Voice

[3] A recent RTIG report (RTIGP006-1.0 Portsmouth note.doc) indicates that RTPI has been suspended until the causes of unreliability have been determined.

communication may be possible using VoIP techniques if sufficient bandwidth is always available. Proprietary information on the Nowwireless system can be found in Appendix xxx

4.2.3.2 Advantages

- Very high capacity.
- Good coverage in local areas where there are a lot of nodes.
- VoIP is possible if the loading is restricted.
- Self healing should a base station fail.
- Can be fitted on standard street furniture.
- Uses military CDMA techniques to give advantage over other users in the band.

4.2.3.3 Disadvantages

- Very high cost to cover a large area.
- Uses the ISM band at 2.4 GHz so has to share spectrum with other users. Although more sensitive than Wi-Fi can still be blocked by other unlicensed users.

4.3 Licensing issues

PMR will require an OFCOM licence. This process is being rationalised and no significant increases in cost are visualised at present. The issue of Band III licences is also under review as broadcasters on mainland Europe have been given permission to operate digital terrestrial broadcasting (both audio and television) in that band. OFCOM have stated that users in the southern part of the UK will have to vacate Band III sub-bands 2 and 3 by 2012 or soon after and be relocated elsewhere. London Buses have come to an arrangement with the Joint Radio Company (JRC) of the fuel and power industry to use their allocation at 140 MHz as the JRC mainly use UHF frequencies in that area. It is not expected that operations in Scotland will be affected although UK broadcasters and mobile phone companies have made approaches for this spectrum. Even if such an approach is ultimately successful there is spectrum available in high band and parts of Band III sub-band 1. It is expected that ambulance and some police frequencies in high band will become available as they migrate on to the Airwave system

4.4 Radio Coverage

4.4.1 PMR Coverage

It is expected that reasonable coverage of the SEStran area could be made from between 11 & 13 radio site dependent on location, frequency of operation, base antenna height and permitted power. An indicative coverage radio plot is shown of the Fife area operating from known sites (Appendix E). The frequency is assumed to be in Band III which is still the most likely. In this case 6 sites give very good coverage up as far as Dundee to the north, west beyond Stirling and south of Edinburgh.

A further 6 to 7 sites should cover the rest of the Borders area as they will be directed from the tops of valleys down the main bus routes. Further work will be required to identify the exact locations of these sites.

4.4.2 Cellular Coverage

Also shown in Appendix E are plots derived from the cellular operators' web sites to give an indication of the available coverage in the more remote areas. In general the coverage is good but there are holes which are not covered by all. Both Orange and T-Mobile have quite large areas which are not covered. This is not surprising as they are both limited to frequencies in the 1800 MHz band whereas both O_2 and Vodafone have allocations at 900 and 1800 MHz. The lower frequencies allow greater coverage, particularly in rural areas.

4.4.3 Mesh Radio Coverage

Other than in cities and large towns Mesh radio coverage is unlikely to meet the requirements of an RTPI system unless several thousand base station nodes are installed. This means it is not economically viable for a wide area system. Each base station has a range of only about 400 m. The base stations have to be connected together with a backbone network operating at around 5.8 GHz so have to be in line of site with each other which further restricts deployment. For completeness, additional information regarding Mesh technology is included in Appendix I.

4.5 Indicative Budget Costs

Below are indicative costs of the key features associated with the above communications options.

4.5.1 Private Mobile Radio

Say, 13 Base station sites @ £50,000 each	£650,000
1 Node site control equipment (TSC) @ £60,000	£60,000
TOTAL	**£710,000**

The base station sites will have to be connected back to the control equipment either by land line or microwave. The annual cost of a landline varies depending on the distance from the control centre but is typically £3,000 - £5000 to establish with similar rental costs per annum. Microwave links for AVL / RTPI have a typical capital cost of around £15,000 to 20,000 but benefit from lower, long-term operational costs. They also offer higher bandwidth opportunities if other potential users exist.

If commercial sites are used then the annual rental per site should be around £2,000 each although these prices are volatile at the moment due to the cellular explosion and planning restraints.

These totals do not include the mobile unit. (NB: These have been included in on-bus hardware cost estimates later in the report.)

4.5.2 Cellular Options

Cellular options are recognised as having lower capital costs but the potential for increased revenue. This is explored in greater detail below.

The key components of capital costs are:

- GPRS module – typically £250 installed (excluding any RTPI supplier integration costs and mark-up)
- Leased line to connect to the service provider – typical installation cost £5,000

The key components of revenue costs are:

- Bundled data allowance covering numerous individual communications "partners" (buses , signs)
- Standing charge per SIM card per month
- The cost of providing voice capability within a "data bundle" contract

RTIG negotiated a national contract with service providers in 2004 but, to date, it has not been used by the members. Our research has shown that the RTIG rates for have not been updated for 2007. Members therefore have to negotiate with individual suppliers (or their re-sellers) using the RTIG Framework as a base to begin negotiations. Cellular cost scenarios have therefore been explored comparing the RTIG tariffs and current service provider packages and rates.

SEStran GPRS Budgetary Costs		
	Cellular	**Comments**
Capital Costs (£)		
- network connection to network provider	5000	
GPRS gateway	7500	
Capital Sub - Total	**12500**	
Annual Revenue		
- landlines	5000	NB Indicative only. Combines current O2 "group data" charges and previous O2 monthly SIM charge from RTIG Framework 2004 to create a "best case" scenario. O2 standing charge was recently quoted as £10.12 on the web.
GPRS charges :		
7Gb/month shared capacity	5,904	Based on approx data transfer figures from an RTPI system supplier.
Standing charges: 1000 SIM @ £3.50/month	42,000	NB: £121,440 per annum if standing charge is £10.12 / month. Assessment very sensitive to this figure.
Allowance for voice for 1000 mobiles	77,672	1 minute of "voice" per day per mobile
Revenue Total	**130,576**	With voice and £3.50 per month SIM standing charge.
	52,904	Cellular Revenue Sub-total if voice functionality excluded
	210,016	with voice and £10.12 per month SIM standing charge.
	132,344	without voice but including the higher £10.12 per month SIM standing charge

Figure 2 - SEStran GPRS Budgetary Costs

The above table illustrates widely varying revenue cost implications depending upon the base assumptions. Careful negotiation with network suppliers is essential before entering any long-term GPRS contracts. Functionality and more general stakeholder cost model issues associated with GPRS communications are explored in Chapter 6.

4.5.3 Mesh Network

The sample figures below are taken from another White Young Green commission covering an area which is considerably smaller than SEStran. In practice, it is unlikely that 7,000 mesh nodes would be sufficient. It does, however, provide a worthwhile illustration.

Urban network

5,000 wireless router nodes incl. of street housing @ £1,500 each	£7,500,000
Fitting @£300 each	£1,500,000
1,000 access points @ £300 each	£300,000

Rural Network

2,000 wireless router nodes incl. of street housing & pole@ £2,000 each	£4,000,000
Fitting @ £600 each	£1,200,000
400 access points @£300 each	£120,000

Control Centre Server

To include authentication and registration equipment	£150,000

TOTAL	**£14,770,000**

In addition there is likely to be annual landline costs of around £1,500,000 per annum to connect the routers to the control centre. Alternatively microwave link equipment could be purchased at a capital cost for around £4,500,000 but is likely to incur high installation costs as high sites will have to be found.

These totals do not include the mobile unit.

5 Stakeholder Consultation

5.1 Background

SEStran is one of the seven Statutory Regional Transport Partnerships in Scotland established under the Transport (Scotland) Act 2005. It comprises of eight Local Authority representatives (City of Edinburgh; East Lothian; Midlothian; West Lothian; Borders; Clackmannanshire; Falkirk and Fife) and in order to develop and foster a good working relationship between the Local Authorities and the bus operators it was recognised that consultation with interested parties, whether they be bus operators; interested bodies or Local Authorities was critical to the brief.

Part of the original specification for this project was to identify and quantify the bus operators' operations in the various corridors where the RTPI system is proposed, and additionally identify and cost any technical requirements needed to implement the RTPI system.

Furthermore, the successful tenderer was required to inform bus operators of the project and canvass them for their opinions and interest in joining the RTPI project and identify and inform other major stakeholders of the proposed project. It was thus decided that an early part of the project should consist of a workshop session designed to inform and educate representatives.

We invited all bus operators running commercial or tendered registered local bus services to attend the introductory workshop sessions, generally with little response. However, some contacts were developed and subsequently used to gather background information to assist in the scoping process.

5.2 Bus Operations

The three major operators Lothian Buses; First Edinburgh and Stagecoach supply over 90% of bus services within the SEStran area. These are supplemented by a large number of smaller independents some of whom have only a very minimal input.

5.2.1 Lothian Buses

Lothian Buses is the dominant and largest bus company in the SEStran area and operates over 50 bus services in the City of Edinburgh and the surrounding areas of Midlothian and East Lothian. The company also operates 12 Night Bus routes giving 24-hour service provision to many parts of the city.

The Lothian Buses name was formed in January 2000 and replaced the former LRT Lothian fleet name. The company remains publicly owned - the major shareholder being The City of Edinburgh Council.

In the last few years, the company has invested heavily in its bus fleet and now has over 650 buses, 460 of which are low floor buses and with an average bus age of 5.3 years. Lothian Buses now has one of the youngest fleets of buses in the country.

As well as over 650 buses for use on local services a further 60+ buses are used on Edinburgh Bus Tours services and specially branded Airlink vehicles for use on the dedicated Airport Express service.

Figure 3 - Route Diagram of the Lothian Buses Network

Lothian buses cover over 37 million kilometres per year and in 2006 the company carried over 108 million passengers, an increase of 5 million from the previous year. The Company employs over 2000 employees, 1500 of whom are drivers.

5.2.2 First Edinburgh

First Group is the UK's largest surface transportation company with revenue of over £3 billion per annum and some 74,000 employees across the UK and North America.

They are also the largest bus operator in the UK running more than 1 in 5 of all local bus services and carrying 2.9 million passengers every day. As the UK's largest bus operator, First Group runs approximately 9,000 buses operating in 40 towns and cities across the UK, carrying 2.9 million passengers every day.

As well as running bus services, First Group also operates passenger and freight services in the UK. The passenger operations include regional, intercity and commuter services - First Great Western, First ScotRail, First Capital Connect, First TransPennine Express and Hull Trains.

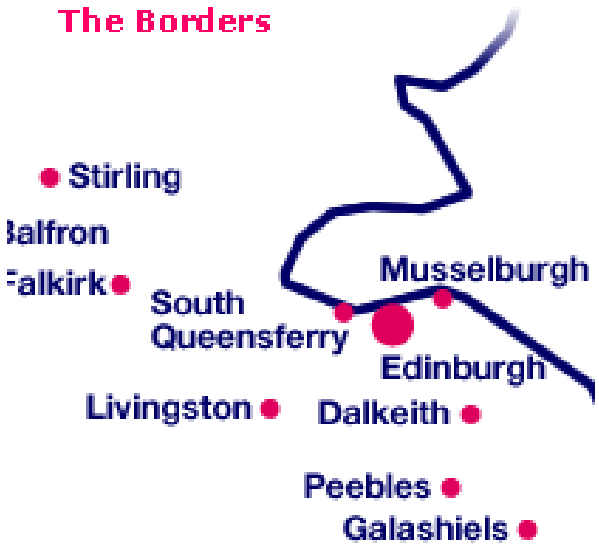

Figure 4 - Diagrammatic of First services in East Scotland

Although, by vehicle numbers, only the second largest operator in the region; First covers the largest geographical area stretching from Galashiels in the south to Stirling in the north. Outside of the Greater Edinburgh area, much of this is rural or semi-rural and hence demand for bus services is relatively low.

Within the SEStran area; First holds two 'O' Licences covering the operation of its fleet in Eastern Scotland and hence divides its operations in two – First Edinburgh (East) and First Edinburgh (Central and Borders). In total First has 421 vehicles based at 9 locations, of which 375 are required to maintain the service network.

Buses are based as follows:

First Edinburgh (East)

Depot Location	Peak Requirement	Spare Allocation	Total Allocated
Dalkeith	56	6	62
Musselburgh	35	6	41
North Berwick	10	0	10
Livingston	61	7	68
TOTALS	162	19	181

First Edinburgh (Central & the Borders)

Depot Location	Peak Requirement	Spare Allocation	Total Allocated
Balfron	16	2	18
Bannockburn	52	7	59
Larbert	69	7	76
Galashiels	46	7	53
Linlithgow	30	4	34
TOTALS	213	27	240

Figure 5 - Summary of First Edinburgh Depots

The depot at Balfron is historically maintained by First Edinburgh and the Borders as a sub-depot of Bannockburn, but the services operated from there are outside the SEStran area, generally running to either Glasgow or Stirling.

Additionally vehicles are out-stationed at Peebles, Hawick and North Berwick. These are allocations from Galashiels (Peebles and Hawick), Musselburgh (North Berwick).

5.2.3 Stagecoach

Stagecoach is one of the largest bus operators in the UK and is playing a leading role in driving passenger growth on public transport across the country.

The Stagecoach fleet is one of the most modern in the country and includes low floor easy access buses which feature step-free entrances, room for buggies and wheelchair access. These vehicles are dedicated to specific routes and provide high quality, high frequency services.

The East Scotland operating division consists of Stagecoach in Fife and Stagecoach in Perth.

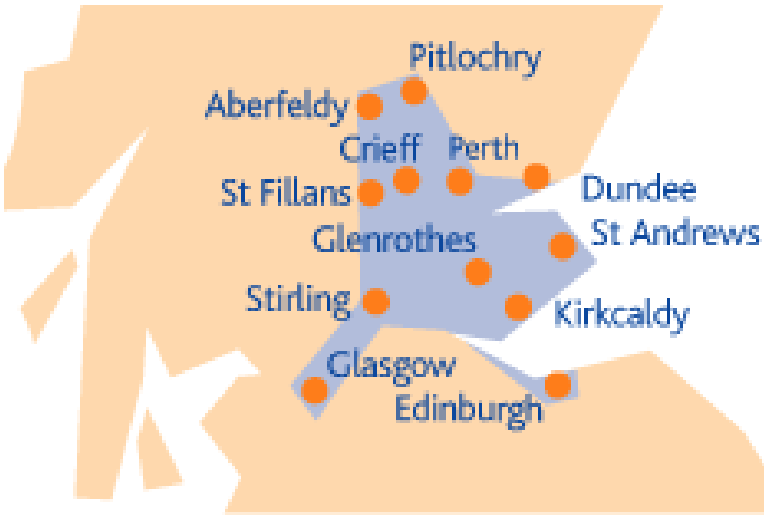

Figure 6 - Diagrammatic of Stagecoach territory in East Scotland

Stagecoach in Fife carries over 23 million passengers a year and operates over 15 million miles. With up to 710 employees and a fleet size of 392, this company is one of the largest operators in Scotland.

In Perth, Stagecoach operates a fleet of 79 buses and employs 164 staff. Over 15,000 people every day use Stagecoach buses in the Perth area.

This report and consultation does not include the Strathtay fleet, which was acquired in December 2005. Stagecoach Strathtay operates a fleet of 160 vehicles from five locations at Arbroath, Blairgowrie, Dundee, Forfar and Montrose. It is expected that over time; these operations will be progressively integrated with the existing Stagecoach network in the area.

East Scotland Stagecoach buses are based in the following locations:

Depot Location	Peak Requirement	Spare Allocation	Total Allocated
Aberhill (Leven)	68	8	76
Cowdenbeath	55	7	62
Dunfermline	66	9	75
Glenrothes	64	7	71
St Andrews	26	3	29
Perth	67	12	79
TOTALS	346	46	392

* - Some vehicles are also parked overnight at Newburgh (an outstation of Glenrothes).

Figure 7 - Summary of Stagecoach Depots within SEStran

5.2.4 Munro, Jedburgh

Munro's operates a network of services in the Scottish Borders, with some routes extending to Edinburgh and Newcastle. The majority of operations are tendered services, with a small number of commercial routes.

The peak vehicle requirement is 38 for which a fleet of 43 is required. Vehicles are generally based at the company's Jedburgh depot, though 2 are out-stationed; 1 each at Berwick and Galashiels for operational convenience.

Although mobile phones are used for contact between drivers and the office, radio communication is seen as being an advantage. GPS-enabled Wayfarer TGX electronic ticket machines are on order.

Figure 8 - Diagrammatic of Munro's network of bus services

5.2.5 Perryman, Berwick-upon-Tweed

Although based in England, a proportion of Perryman's operations involve cross-border services including a route from Berwick to Edinburgh via Dunbar. While contact was made with the operator it was not possible to arrange a meeting to determine more details of the company's operations.

5.2.6 Mackie, Alloa

Mackie's operate a small network of commercial local bus services throughout Clackmannanshire using modern low floor vehicles, connecting Alloa and Stirling to places such as Tullibody and Tillicoultry. Although contact was made with the operator it was not possible to arrange a meeting to determine more details of the company's operations.

5.2.7 E & M Horsburgh, Pumpherston

In addition to private hire and school services, Horsburgh operates a network of routes centred on Livingston, most of which are operated under contract to West Lothian council. The company's fleet is currently in the region of 80 vehicles. Although contact was made with the operator due to diary constraints, it was not possible to arrange a meeting to determine more details of the company's operations.

5.2.8 Moffat & Williamson

In addition to private hire and school services, Moffat & Williamson run a small number of bus services in Glenrothes and St Andrews. Although contact was made with the operator it was not possible to arrange a meeting to determine more details of the company's operations.

5.2.9 Minor Operators

A number of other companies provide tendered bus services on behalf of local councils and these are listed in Appendix F.

5.3 Workshop format

Two identical workshops were hosted by White Young Green and SEStran on 6th and 20th March 2007.

All 8 Local Authorities and representatives from any bus operator running either tendered or commercial local bus services within the SEStran area were invited to attend. In addition, Margery Rodger from the bus, coach and light rail trade organisation – the Confederation of Passenger Transport (CPT) in Scotland and John Elliot, Regional Manager for traveline Scotland were also invited. As neither could make either of the workshops and, recognising the importance of consulting with these organisations, separate meetings were held with both. A detailed list of invitees and their response is shown in Appendix G

The workshops consisted of a presentation concerning AVL/RTPI systems briefly explaining the aspirations of stakeholders; looking at the attributes of the different products and concentrating on exploring the relationship between system efficiency and the commitment of both the operators and Local Authorities involved. It was followed by a Question and

Answer session which allowed a frank exchange of views. A brief outline of the workshop is given below and the issues arising are addressed in later sections of this report.

The workshops were designed to cover the background to AVL/RTPI together with a few examples of systems in use in the UK. Consideration was also given to those systems which can be claimed to be successful and those which have failed. The reasons for the failures were also considered.

In the main, local authorities have been the drivers behind these systems and have contributed the bulk of the capital costs, and while bus operators have mainly contributed to revenue costs some have also invested. Local authorities are usually the system hosts with the bus operators as partners. Many were purchased mainly for RTI without considering operator issues, some bought because funding was available but without any long term plan for expansion.

The workshops considered three examples of current UK systems:

StarTrak which has been operating in Leicestershire since late 1998 and has now been adopted by Derby and Nottingham as their standard for real-time information The AVL base from a European supplier is considered to be sound. The reliability of signs has been less than ideal and there is no automatic fault reporting facility, relying on observation. The data burden is increasing, but it is hoped that automation will be implemented. StarTrak is seen as a good product with significant bus operator involvement.

Brighton was the first example where the project to implement the system received major input and funding from the operator, as in Edinburgh. It is expanding into the neighbouring local authority area and the bus operator (Brighton and Hove owned by Go-Ahead) is happy with the system.

Lothian. The BusTracker system in Edinburgh has now been in operation since 2003. The bus stop display network is managed by the City of Edinburgh Council, but it provides a platform for use by other operators. The system specifications and suppliers were decided by local bus operators at the consultation stage – however only Lothian went ahead with the project (First backed out during financial negotiations, but may decide to adopt the system at a later date). Although initially only part of the Lothian fleet was fitted with the relevant equipment, it was never viewed as being anything other than a platform for long term

expansion, rather than a "trial" with an unknown and potentially finite lifespan. Prior to the launch of the system, on-board units were retro-fitted to over 200 existing vehicles, with new deliveries since then coming ready equipped. Once current fleet replacement orders are fulfilled shortly, 570 of the 625-strong fleet will be AVL-equipped. At Lothian the data feed has been automated from the outset and double entry is avoided. Bustracker was structured so as the operator had a major input toward the system specification, unlike many systems hosted by LA's. It was important for Lothian to have operational control over the system. This involvement is viewed positively and considered to represent commitment on the part of the operator, while guarding against failures on the council's side. The stakeholders' approach to RTPI can help make the difference between success and failure.

The next part of the workshops considered Data Input. Systems that are administered by local authorities often rely on bus service registrations and can be subject to issues arising from late submissions. Double entry often imposes an unnecessary administrative burden. (We have made specific recommendations regarding data input elsewhere in this report).

Communications was the next area considered. Radio coverage in deeply rural areas is expensive to provide. Group calling is not practical with GPRS and as such this is a more likely solution for more rural areas with lower frequency routes such as the Scottish Borders. It is possible that GPRS may not provide perfect coverage in some areas if the topography of the area presents obstacles to signal quality such as valleys. The status of PMR roaming capability is to be investigated. Sufficient testing will be required to ensure that neighbouring systems can "talk" to each other, the Glasgow AIM system being an example.

The workshops recognised that tendered services need to be acknowledged. Fair and equitable treatment for all operators bidding to operate tendered services is a major issue.

Finally the workshops considered the way forward, and funding options. Site visits are recommended: Bustracker, other systems (for comparison) – but given the high regard for the Edinburgh system, this will possibly be less important for SEStran than for other RTPI projects.

The list of attendees and workshop programme is shown in Appendix G.

5.4 Issues Arising from Workshops & Site Visits

As part of the original specification, the successful tenderer was obligated to inform both the local authorities and the relevant bus operators of the project and canvass them for their opinions.

This section accounts the findings from the consultees. Some of the consultation took place during the two workshop sessions and some in the form of telephone discussions with the consultees. Given the current status of the BusTracker project, no specific consultation was held with Lothian Buses. Because of the major involvement of Stagecoach and First, separate face to face meetings were held.

5.4.1 City of Edinburgh Council

CEC support the wider implantation of RTPI throughout the SEStran area and accept that there will be integration between the existing BusTracker system and any future SEStran product. CEC raised a number of issues regarding the integration of the two systems. The key points to note are:

5.4.1.1 General

The integration of BusTracker and a SEStran system must not undermine or degrade any aspect of the existing BusTracker system.

5.4.1.2 Data Management

CEC anticipate a 2-way exchange of RTPI data between the BusTracker and SEStran systems via back office server – server links

Care will be needed to ensure that any “common” information disseminated by both systems is consistent and timely. Failure to do this could undermine public confidence.

5.4.1.3 On-Street Signs

Within the BusTracker area of operation, BusTracker signs and associated radio infrastructure can be used to deliver RTPI information for buses being tracked and monitored by a SEStran AVL / RTPI system.

Similarly, where appropriate, CEC would expect SEStran on-street signs and associated communications architecture to deliver RTPI information for buses being tracked and monitored by BusTracker

BusTracker signs do not currently identify the operator because, when procured, an agreement existed to avoid duplication of service numbers. Introducing operators from the wider SEStran area may, however, result in duplicate service numbers. Displaying this on the sign could be confusing for customers. However, BusTracker signs display a combination of Service Number and Destination rather than just Service Number which does provide some clarification. It is also worth noting that Lothian Buses can have several destination variants within the same Service Number. It could therefore be argued that customers already have to consider more than just Service Number when viewing the signs. Notwithstanding the above, this is an area which will require careful consideration during the development of a specification. Modification of the BusTracker signing strategy is not inconceivable but would require the agreement of City of Edinburgh Council. It would potentially impact on the database, radio communications, sign configuration and number of characters available for the "Destination" text.

Sign capacity will also be an issue, particularly at busy stops. The existing BusTracker signs can report 23 services across 3 pages, considerably more than "traditional" UK RTPI systems. Nevertheless, the density of Lothian Bus services in Edinburgh means that some signs are already at capacity without the addition of "SEStran" operators. Alternative solutions or system enhancements will be necessary and need careful consideration during the specification stage. It is important to remember that physical sign capacity cannot be considered in isolation. It is in inextricably linked to radio capacity and performance which further complicates the issue.

5.4.1.4 Web / Wap Sites

Within the BusTracker area of operation, the BusTracker web and wap sites can be used to deliver RTPI information for buses being tracked and monitored by a SEStran AVL / RTPI system.

Similarly, where appropriate, CEC would expect any SEStran web, wap or SMS services to be used to deliver RTPI information for buses being tracked and monitored by BusTracker.

5.4.1.5 BusTracker Radio System

If BusTracker and SEStran RTPI systems are linked via the back office, the only impact on the BusTracker system will be capacity related, e.g. in terms of the numbers of data channels required or, conceivably, in relation to the control system database and management functions. Adding more services to existing signs increases the data burden on the existing radio channels. Mitigating measures may be necessary.

5.4.1.6 Bus Priority

In principle, CEC has no objection to "SEStran" buses requesting priority at traffic signals within Edinburgh. However, within BusTracker the priority requests are made at street-level between the bus and the traffic signal controller. They could not easily be made via back office links because of the time delay associated in processing and transmitting the data via the back office and UTC system. (Assuming, of course, the junction is connected to the Urban Traffic Control centre. Not all are.) The ongoing CEC UTMC project may provide opportunities in this area. Integration between the SEStran system and BusTracker at street level is feasible but will raise issues relating to short-range radio communications and Ineo bus priority protocols. This area requires further investigation at the specification stage.

5.4.1.7 Branding Issues

CEC accept that the BusTracker and SEStran RTPI "brands" will co-exist. In areas such as Fife and the Borders there is unlikely to be any significant issue. However, within Edinburgh and parts of East and West Lothian there is the potential for some confusion as there are already signs on-street bearing the BusTracker logo. In addition, Lothian Buses have been promoting the BusTracker brand.

At the present time, the BusTracker "area" is effectively defined by the operational area of Lothian Buses. CEC would therefore expect to see the current practice continue.

With regard to on-street signs this would mean that the BusTracker logo is used within Edinburgh and the agreed composite BusTracker / SEStran / Neighbouring Authority logo is used in BusTracker operational areas beyond the City boundary, primarily parts of East and Midlothian. Beyond the BusTracker area, CEC would expect on-street signs to be exclusively branded as a SEStran product. CEC acknowledge that bus operator boundaries

can change over time. There is no expectation to continually monitor and redefine boundaries. The existing Lothian bus operational boundary could effectively be used.

Regarding web sites, CEC believe that BusTracker and SEStran products can be marketed independently. In "overlapping areas", a choice of products will exist and the user will no doubt develop a personal preference for one over the other. The important thing is to deliver consistent information. In terms of coverage, CEC expect that the BusTracker web site coverage may not exactly match the operational area of Lothian Buses. It may be extended to provide a sensible boundary for other operators' services within an Edinburgh context. The views of the operators and database management issues are likely to shape any decision. BusTracker will certainly not offer RTPI information for services in St Andrews or the Borders, although automated links to the SEStran web-site may be better than saying "no information available" and an appropriate way of ensuring customer satisfaction.

5.4.2 East Lothian

East Lothian have procured a JMW RTPI system for a trial route between North Berwick and Dunbar. Although this has not been fully commissioned, officers ideally want to see integration with both BusTracker and any future SEStran system.

One-way integration between BusTracker and the JMW signs has already been investigated but not implemented. The current option would utilise the JMW signs but would fall short of full system integration. The JMW signs would effectively be an alternative sign type being managed by the BusTracker system.

With regard to on-street signs, East Lothian are already part of the BusTracker sign roll-out delivering RTPI information for Lothian Bus services (32 signs ordered). They would wish to see other operators' services information appear on these signs as and when vehicles are equipped with either BusTracker or SEStran systems.

Regarding further sign roll-out, officers believe the requirement will be clearer once the post-election political upheaval has settled down.

The possibility of adding signs within schools is, however, an area of interest. Many children within East Lothian travel to schools by bus with significant numbers using public service buses rather than exclusive school contracts. The pick-up points are often ¼ - ½ mile from the school so reliable RTPI updates in school would be useful, particularly during the winter

months. (There have been previous examples of commercial service breakdowns resulting in confusion on-street and subsequent complaints from parents.) Similarly, reliable web / wap / sms RTPI updates would be useful for pupils who have to wait in remote locations for the bus when going to school.

With exclusive schools contracts, the holder agrees pick up points and times. Extending RTPI to these services would be ideal but officers noted that they will generally be less likely to suffer disruption than commercial services. A reduced, lo-cost option may be appropriate, if available.

Improved tourist information is another area of interest to East Lothian. Providing marketing RTPI services in relation to tourist sites would be beneficial, particularly if RTPI information was available at rail – bus interchanges.

5.4.3 Midlothian

Karl Vanters for Midlothian Council represented them at the workshop sessions. A later telephone enquiry sought information relating to the current situation in Midlothian. This authority is engaged with CoEC in the Bustracker project and is currently awaiting the fitment of 42 Bustracker signs within Midlothian. At the time of completing this report, the sites have been identified and signs fitted but are (still) awaiting power.

In the foreseeable future two new Park & Ride sites are to be opened. These are to be at Sheriffhall and Strainton. The plan is for the site at Sheriffhall to be served by an extension of Lothian service X48. The site at Strainton is being funded by the City of Edinburgh but will not be served by a dedicated service; rather (like Ferrytoll) will rely on passing services calling. Large TFT information screens are likely to be installed at both sites but clearly these would be of more value at Strainton.

Expansion of BusTracker signs in Midlothian will meet the Council's needs providing they can display information for other operators when required.

5.4.4 West Lothian

The active participation of First Edinburgh is key to successful RTPI delivery in West Lothian although there is a desire to include smaller operators, particularly those such as Horsburgh who have been pro-active during the feasibility study.

In terms of rolling-out RTPI signs, West Lothian's core deliverable would be integration with the existing Nexus Alpha scheduled information system. This would add value to previous projects and provide RTPI at important locations. Equipping of bus operator depots and services should be prioritised to maximise the impact at these locations.

Early delivery of a web and mobile facility would also be useful to maximise the benefit for passengers.

5.4.5 Borders

Ian Forbes represented Borders Council at the workshop sessions, and was subsequently approached for views regarding the desirability of extending AVL/RTPI to the Borders area.

Currently there is no AVL/RTPI information available within the Borders. Any system subsequently introduced would aspire to cover a mix of on-street signs/SMS text messaging and web application.

Suggested locations for signs at the outset, would be at the main bus departure points in Galashiels; Hawick; Jedburgh; Kelso; Peebles and Duns.

In the future, a transport interchange is likely to be developed at Galashiels. This will become especially important if the Waverley rail line is reopened as planned in 2011. The bus station at Galashiels is owned and managed by First.

Additionally at both Earlston and St. Boswells there's currently a meeting of routes providing connectional interchange facilities. These would be enhanced by provision of AVL/RTPI.

Recognising the geographic nature of the county, Borders would prefer introduction on a corridor approach. In the first instance, there are 3 main corridors reflecting the traffic on bus services all terminate in Edinburgh and are:

- Jedburgh – Dalkeith – Edinburgh.
- Hawick – Galashiels – Edinburgh.
- Galashiels – Peebles – Edinburgh.

Currently Borders does not have a county-wide radio network and does not aspire to introduce one. Given the topography of the county coupled with financial constraints; the County Council accepts the limitations of any proposed network.

5.4.6 Clackmannanshire

Dorothy Walker represented Clackmannanshire at the workshop sessions, and was consulted by telephone regarding the aspirations of the County. Clackmannanshire are currently sponsoring the introduction of an SMS text message information service.

Any AVL/RTPI project is likely to require a minimum of on-street signs in Alloa (at Shillinghill) and in Tillicoultry (at Murray Place).

For the general introduction of AVL/RTPI Clackmannanshire would prefer a corridor approach. This would maximise the benefit to public transport users and give all operators the chance to participate. The Clackmannanshire area is generally dominated by First and service network is inter-worked between local depots which complicate the introduction of AVL/RTPI.

An existing PTI information kiosk in Shillinghill has a Journeyplan scheduled information feed and this would ideally be suited to be converted to an RTPI feed.

5.4.7 Falkirk

Stephen Bloomfield represented Falkirk Council at the workshop session and was also consulted by telephone to obtain his views about the local introduction of AVL/RTPI.

From a personal perspective, he sees on-street signs as being important in Falkirk and estimates that about 100 would be required to give ideal coverage to existing bus stations; bus interchange locations and significant other stops. As in Clackmannanshire, Falkirk favour the corridor approach to the introduction of AVL/RTPI thus maximising benefits to users.

Currently, there isn't any existing RTPI equipment installed in Falkirk.

5.4.8 Fife Council

Stagecoach are the dominant operator in Fife. Their participation is key to the successful delivery of RTPI in Fife.

In terms of the roll-out of RTPI signs, Fife would focus on the existing and proposed Tandata bus station installations. This again offers a high impact RTPI opportunity, adding value to previous projects and expenditure. Equipping of bus operator depots and services should be prioritised to maximise the impact at these locations.

Early delivery of a web and mobile facility would also be useful to maximise the benefit for passengers, providing an effective way of building on any equipped vehicles serving the RTPI enabled Tandata bus stations.

Away from the bus stations, Fife Council recognises the importance of the Stagecoach's flag-ship service 19. This route is likely to be an early candidate for any on-street RTPI signs.

Fife Council would support server-server links between the SEStran and Dundee City Council RTPI system to cater for cross boundary services.

5.4.9 First Edinburgh

First has supplied us with a list of services and depots together with the vehicle requirements which was especially helpful in compiling this report.

First has an older radio system capable of voice only transmissions which was purchased second hand. Some components are believed to be at least 20 years old. Nevertheless, the purchase and implementation of this radio system is an upgrade from the First Edinburgh system which existed at the time of the BusTracker procurement. Coverage has increased in terms of both geographical area fleet numbers. First are also trialling a new system capable of transmitting voice and data and services 38/43 operating from Linlithgow have been equipped. The equipping of Livingstone depot is now under consideration and is a serious possibility. There's no immediate aspiration to equip the remaining fleet, although further upgrades will be introduced as and when finances permit.

Bearing in mind their continued commitment to voice radio, First would prefer to retain direct control of their own voice and data radio network within the context of a SEStran AVL / RTPI project. This mirrors the stance taken by Lothian Buses in the early stages of the BusTracker project. Lothian also chose to have an independent AVL system. First did not express a firm view on this issue. Both of the previous points should be kept under review during the development of the SEStran project. It is important to note that First Edinburgh is no longer seeking to join the BusTracker system which would only offer partial coverage of

their operational network. The proposed SEStran AVL / RTPI system has distinct advantages as it covers their entire operational area.

First would welcome the opportunity to have AVL/RTPI information relayed to depot control staff and, subject to cost, may be prepared to contribute.

First also want the opportunity to have historical data from the AVL/RTPI system for use in service monitoring and to assist in the identification of congestion hot-spots.

As with most other bus operators in Scotland, with funding from the Scottish Executive, First are updating ticket machines, and have new Almex machines on order. These are expected to be introduced experimentally in May; with complete conversion achieved by November 2007. The new ticket machines will be GPS-fitted and will feature automatic fare-stage entry for fares look-up. Wi-Fi will download details of ticket sales and update data on the vehicle.

5.4.10 Stagecoach in Fife/Perth

Stagecoach also supplied a list of service numbers and their peak vehicle requirement.

Stagecoach has voice radio on vehicles fitted for the ACIS AVL/RTPI project in Dundee, but has no immediate aspiration to equip the remaining fleet. Drivers are issued with mobile phones and despite the limitations of this technology and given the nature of the operating terrain; Stagecoach finds this acceptable.

Stagecoach would welcome the opportunity to have AVL/RTPI information relayed to depot control staff and, subject to cost and the business case, may be prepared to contribute.

Stagecoach would want the opportunity to have historical data from the AVL/RTPI system for use in service monitoring and to assist in the identification of congestion hot-spots.

Stagecoach is also currently investing in updated ticket machines, and has new ERG machines on order. These will be GPS/GPRS-fitted and will feature automatic fare-stage entry for fares look-up. Wi-Fi will download details of ticket sales and update data on the vehicle. The expected conversion programme is for all of Scotland East (except Perth) to be fitted by October 2007 with Perth and Strathtay completed by March 2008.

5.4.11 Other bus operators

All bus operators running commercial or tendered registered local bus services were invited to attend the introductory workshop sessions, generally with little response.

However, some contacts were developed and subsequently used to gather background information to assist in the scoping process. The operators missing from the Workshop session represent only a small percentage of the "SEStran fleet".

5.4.12 Lothian Buses

Lothian Buses' views are similar to those of City of Edinburgh Council. Their main interest is in seeing that integration wit the SEStran project does not undermine the operation of the BusTracker system in terms of either fleet management or real-time information. Lothian highlighted existing concerns regarding the capacity of signs at busy locations.

Lothian are interested in the further expansion of real-time information in their East Lothian and Midlothian operational areas and any additional features or functionality arising from the SEStran project e.g. enhanced on-bus security systems.

5.4.13 Dundee City Council

Dundee City Council would like to establish server – server links with any future SEStran system to address cross boundary issues.

5.4.14 Traveline Scotland

Traveline Scotland is supportive of the SEStran RTPI project but does not consider integration with existing call centre and SMS services to be an early priority. Call centre staff are likely to use a SEStran web facility when available to add value to enquiries when appropriate. A decision on system integration can then be made once the benefits of RTPI have been monitored and assessed within the context of the TravelineScotland call centre and web based journey-planning services.

5.5 Summary of Key Issues Arising from Consultation

- Agreement has been reached in principle regarding the integration of the proposed SEStran RTPI system and the existing BusTracker system

- First Edinburgh are now committed, in principle, to the SEStran RTPI project
- Fife Council is the only potential partner regarding the procurement of a major communications network to meet the varied needs of both stakeholders
- Bus operators are prepared to consider financial contributions to an appropriate AVL system
- Fife, West Lothian and City of Edinburgh have scheduled information systems with numerous screens which could disseminate real-time information.

6 Strategic Model & Implementation Strategy Development

6.1 Background

The previous chapters:

- Summarized the key features and facilities of AVL / RTPI systems
- Collated background information specific to SEStran
- Summarised consultations with potential stakeholders

The remainder of this chapter highlights and prioritises systems and practices that must be accommodated by within any future SEStran project.

6.2 Technical Issues

6.2.1 Interfaces

6.2.1.1 Essential Interfaces

City of Edinburgh BusTracker – server to server links essential to deliver real-time information on BusTracker signs and the emerging BusTracker web and wap services.

Fife and Edinburgh Tandata Bus Station Systems – server to server links are essential to maximize the impact of the SEStran project. Integration will enable early delivery of RTPI across approximately 100 bus station signs

West Lothian Nexus Alpha Scheduled Information System - the case for this integration is not as overwhelming as the Tandata position due to the lower number of signs in place and the fact that the system is not expanding. Nevertheless, White Young Green believes that there is sufficient infrastructure in place to justify integration. Replacing the existing infrastructure would be expensive and would undoubtedly raise difficult questions about wasted funds.

SEStran Routewise - the SEStran AVL / RTPI system must be capable of taking electronic timetable data feeds from the Routewise system, even if robust data feeds are directly

available for the bus operator scheduling systems. This is to ensure that schedule information from the numerous small operators across the SEStran area can be handled efficiently.

6.2.1.2 Desirable Interfaces

Stagecoach - Trapeze Scheduling Software – this is a very desirable feature for 2 reasons. The BusTracker project has demonstrated the significant benefits to be gained from interfacing to well managed and maintained scheduling system. It virtually guarantees reliable data and removes the factor which is, arguably, the primary reason for poor performing RTPI systems. However, the phrase "well managed and maintained" is crucial. The second reason for pursuing a Trapeze interface is that, if the existing Stagecoach database is imperfect or incomplete, it provides an ideal opportunity for SEStran and Stagecoach to work together at an early stage of the project, focussing on critical database issues to ensure that Stagecoach's Trapeze data and procedures are capable of reliably delivering the all-stops data and running boards required by an effective AVL / RTPI system. On the basis that Stagecoach has purchased the software, there are inherent business benefits in seeing it used to its full potential.

First Edinburgh – Omnitimes Scheduling Software – the reasons for pursuing this interface are the same as for the Stagecoach system above.

Dundee City Council AVL / RTPI System – this is likely to be required at some point but is not considered a high priority item. This is primarily because:

- it was not raised as a major issue by Stagecoach
- the PVR for the critical Stagecoach Fife services into Dundee is only 8 vehicles
- Stagecoach's StrathTay commitment to the Dundee system is effectively an autonomous operation within the company.

TravelineScotland – from a public perspective, this is desirable. It should not, however, be a high priority within the SEStran project. The reasons are:

- it should add value to the TravelineScotland information
- it is not essential to the success of the SEStran project because there are other means to disseminate the information under a SEStran brand

- TravelineScotland themselves do not see it as a high priority item, to the extent that they are unlikely to contribute funds to any development costs.

6.2.1.3 Other Possible Interfaces

East Lothian JMW RTPI System – although East Lothian officers would like to see this interface delivered, the potential benefits seem low for the following reasons:

- the RTPI trial of the system has not been commissioned and requires additional funding to complete it
- the extent of the proposed trial is extremely limited with only 1 route and 1 bus
- the trial does not include either Lothian Buses or First Edinburgh, the major East Lothian operators
- From a public perspective, the most significant RTPI element of the JMW system trial is likely to be the 8 signs which may be adapted to display Lothian Bus RTPI data from the BusTracker system. However, this is really a demonstration of the BusTracker system managing alternative sign types.
- 32 BusTracker signs are already being installed in East Lothian to display Lothian Bus data for multiple services, further reducing the significance of the JMW trial
- An interface between the SEStran AVL / RTPI system and BusTracker is a core deliverable offering 100% coverage of the East Lothian fleet

White Young Green therefore recommends that SEStran only seek to develop interfaces with the JMW system if JMW Systems Ltd are chosen as the RTPI supplier. If East Lothian choose not to proceed with the JMW trial, opportunities should be explored to re-use existing hardware (signs etc)

Glasgow BIAS RTPI – in principle, this is a desirable interface but there appear to be no operational reasons for pursuing it at this time.

Northumberland RTPI (part of the NE RTPI System) – again, in principle this is desirable but RTPI aspirations are currently restricted to the south of Northumberland and links into Newcastle and Gateshead. There appears to be no operational reasons for pursuing it at this time.

6.2.2 System Specification & Functionality

This report is not intended to provide a detailed specification. This will be the subject of a later phase and more detailed liaison with the stakeholders about their short and long-term requirements and the implications of their business practices.

However, the core of any specification will undoubtedly revolve around the features outlined in section 2. At this stage White Young Green would recommend that the following key points be accepted:

- the system must be "running board" based system to offer cross service predictions, particularly on web, wap and sms applications
- The system must include an early implementation of web, wap and, possibly, SMS to ensure wide area penetration of RTPI. (NB: SMS could conflict with the Traveline Scotland service and may be undesirable). Bearing in mind the rural nature of much of the SEStran area, prioritising signs implementation in advance of web services would severely restrict the impact of the scheme.
- the system must address the essential interfaces identified above and be capable of accommodating the desirable interfaces over time
- The communications platform cannot be confirmed at the tender stage. Even if a preference is stated in the tender document, suppliers should be given the opportunity to offer alternative solutions to ensure that the tender assessment properly reflects the state of the communications market at that time. The communications position can change relatively quickly, particularly in the 3G / GPRS market and, in addition, some PMR suppliers are rapidly enhancing the capacity and features of their products.
- The system specification should be developed in accordance with published Real-Time Passenger Information Group Guidance documents.
- DDA implications should be given careful consideration when developing the information strategy and technology options

6.2.3 Additional Functionality - Enhanced Security Systems

Interest in enhanced on-bus security systems has been increasing, particularly over the past 12 months. There is an opportunity to examine this area more closely within the SEStran project.

Many bus operators already have multiple camera on-bus CCTV systems monitoring both internally and externally. The external monitors are particularly useful when dealing with accident scenarios and any subsequent claims or legal cases. These systems generally store the data on the vehicle until is recovered manually or over wireless networks within the depot.

Until recently it was not feasible or financially viable to stream live video images from the moving vehicle. This is now a possibility and commercial solutions are appearing in the market place. Of course, communicating live video is only of any value if there are administrative and support systems in place to use it effectively. However, options now exist to stream the information directly to:

- Existing bus operator control rooms, particularly if they are manned 24 / 7 or for significant periods of the day
- Established local authority security camera operations
- Police control rooms

The ongoing SEStran AVL / RTPI commission could justifiably consider and review:

- Existing bus operator on-bus CCTV and associated administration systems within the SEStran area
- Existing local authority CCTV security systems and associated administration systems within the SEStran area
- Existing Police CCTV security systems and associated administration systems within the SEStran area
- Existing administrative links between the above parties regarding the use of CCTV images

- Legal issues relating to the collection and use of video evidence in the courts
- Stakeholder aspirations relating to on-bus CCTV (police, local authorities, bus operators)
- Live video streaming technology options and associated capital / maintenance costs
- Associated "soft measures" to maximise the deterrent value of live on-bus CCTV systems
- Current practice elsewhere in the UK and elsewhere
- Costs and benefits

The SEStran AVL / RTPI project could incorporate and deliver a "live" on-bus video trial, if appropriate. There is synergy with core project as it is already considering "real-time" communications between the bus and control centre systems.

6.3 Strategic Model and Administration

6.3.1 Overview

A number of strategic AVL / RTPI options were considered and explored during the consultation process associated with this commission. This included:

a) Development and expansion of the existing BusTracker system – disregarded because:

(i) the previous City of Edinburgh Council OJEU procurement process defined a BusTracker boundary which falls well short of the SEStran requirements

(ii) such an expansion would involve major modifications and introduce significant risk within an existing AVL /RTPI platform which is performing to a very high standard

(iii) City of Edinburgh Council want to retain and maintain this successful project

b) Creation of an over-arching SEStran RTPI information system and brand, collating and disseminating information from various sources, including BusTracker – disregarded because:

(iv) the BusTracker system and brand have been extremely well received within the Edinburgh area

(v) the imminent web / wap launch will provide RTPI information across the whole of the Lothian Bus operational area (100% coverage of stops covered / 90% of the Lothian Bus fleet fitted or on order)

(vi) restructuring would introduce again introduce unnecessary risk when the existing product is operating to a high standard

Having taken account of the above points, the following model is considered to be the optimum solution for SEStran and the stakeholder group.

6.3.2 System Integration

Appendix J illustrates how the SEStran AVL / RTPI system should integrate with existing systems. The diagram reflects the essential and desirable interfaces outlined in section 6.2.

6.3.3 Operational Issues

The key point to note is that the proposed architecture maintains the operational integrity of existing systems. Failure of any one system will not undermine the basic operation of the others. This satisfies the robustness and resilience requirements of some of the consultees. A failure will, of course, mean that RTPI information is temporarily lost from neighbouring systems but the core operation of the system will be unaffected.

The data disseminated via the various routes must be timely and consistent. Integration of the systems must therefore be reliable and robust.

Agreement will also be required on display strategies. For example, some systems display information for all services on street signs even if only a proportion are RTPI equipped. Others only display real-time routes with scheduled information for occasional faulty or unequipped buses.

6.3.4 Data Management

Responsibility for data lies with the administrators of the various systems. A high standard is required across all systems. There is the potential for poor quality data from one system to

undermine the public perception of another. It is important to remember that poor quality core data is one of the most common reasons for the underperformance of AVL / RTPI

6.3.5 Long-term Administrative structure

With so many data and systems interfaces, there will be a need for close cooperation to ensure that high standards are established and maintained.

White Young Green recommend:

6.3.5.1 AVL / RTPI Project Board

A high level "Client" Group with overall responsibility for the long-term delivery of RTPI. This will include the administration of any financial or stakeholder agreements. The Board should agree and define a series of performance indicators and receive reports from a technical group. The group should include representatives from the bus operator stakeholders as well as public sector bodies, particularly if they are making significant financial contributions to the system. To reduce the size of the board, bus operators may choose a single candidate to represent their interests. Some local authority partners may do the same.

To reduce the burden, established "boards" or panels may be able to assume the AVL / RTPI responsibility. The existing SEStran Board is itself a suitable candidate as it includes representation form all the relevant groups including the bus operators.

6.3.5.2 AVL / RTPI Technical Group

This will include key representatives from the authorities responsible for the various systems and significant data sources. This should include the major bus operators. Likely candidates include system administrators and, when applicable, those managing significant expansion and / or change. Suppliers should be invited to address particular issues when appropriate. (NB: this body is primarily managing the operation of established systems.) It may be necessary to establish smaller sub-groups to address particular problems affecting the system. This group will collate data and prepare the KPI reports for the Project Board.

6.3.5.3 System Manager

The SEStran AVL / RTPI system will require a long-term manager with responsibility for day-to-day operations, management of maintenance contracts, system amendments or

upgrades. The Manager will be the primary interface with the system supplier once the system has been commissioned and out of warranty. The Manager is also likely to represent SEStran and the stakeholders at supplier user groups. Bearing in mind the nature of the organisation, SEStran may, ultimately, obtain this support from within the Stakeholder Group rather than directly employ maintenance / operations staff.

6.3.5.4 System Administrator

The SEStran AVL / RTPI system may require a system administrator to co-ordinate data supply, manage the configuration of signs etc and to administer fault reports / clearances. Bearing in mind the nature of the organisation, SEStran may, ultimately, obtain this support from within the Stakeholder Group rather than directly employ maintenance / operations staff.

It is possible that the System Manager and Administrator roles could, perhaps be combined but it may be difficult to find a suitable candidate with the required skills set. This area can be explored further during the specification and procurement process, drawing on the experiences of other established systems.

6.3.6 Marketing / branding

The SEStran AVL / RTPI system will not be an expansion of the BusTracker brand which is already in place. Following consultation, the optimum solution is to:

6.3.6.1 For On-street Signs

Maintain the BusTracker brand within the Lothian Bus operational area using the combined BusTracker / SEStran / Local Authority logo in areas outside the City of Edinburgh. This is the current branding strategy.

6.3.6.2 Web / Wap

Both BusTracker web sites and wap services should be marketed independently retaining a unique identity. In boundary areas such as East Lothian and Midlothian, users will establish a personal preference. In the majority of the SEStran area there will be no overlap between BusTracker and the SEStran coverage.

6.3.6.3 SMS

The SEStran RTPI system should, in principle, avoid the use of SMS and focus on mobile web and wap services. The benefits of this are:

- A clear distinction between SEStran and TravelineScotland's national SMS product
- A cheaper solution for the end user

The only potential problem with this approach is that users may be unfamiliar with wap and reluctant to use it. Any issues will, of course, diminish over time as younger users are often frequent users of such services. SEStran can also monitor the uptake of BusTracker wap and mobile web services which will be launched in the near future.

6.3.7 Financial Model

This is a difficult area and will be the subject of negotiation during the specification and tender stage. However, it is worth noting that the most successful AVL / RTPI systems include a significant financial commitment from the bus operator stakeholders, particularly in areas of deregulated, commercial bus operations. SEStran should seek such a commitment. The model may vary in different parts of the SEStran area to take account of local conditions. For example, it will be more difficult to justify a significant operator contribution if the local services are tendered and heavily supported by the local authority.

A number of models exist around the country but, increasingly, bus operators are being asked to meet the bulk revenue costs in exchange for public sector capital funding of the core system. The exact cost models do vary, particularly regarding local authority contributions to on-bus capital costs and bus operator contributions to sign revenue costs, but projects no longer seem to progress on the assumption that the public sector will fund 100% of capital and revenue. Many of the early schemes that were implemented on this basis have failed, partly because the operators were never been fully engaged.

Past experience has shown that financial discussions will continue throughout the specification and tendering process and will be resolved immediately prior to appointment. A number of principles should, however, be adopted:

- the discussions should be open and frank

- the cost model must be fair and equitable to all parties
- all parties must work pro-actively together to ensure that the system specification meets the individual operator requirements, maximising the added value and minimising any perceived operational burden

6.3.8 Administration Documents

The management of the system and the stakeholder group will be documented within and governed by the following three documents:

- Stakeholder Agreement – an over-arching document covering the roles and responsibilities of the various stakeholders, system operation, management and expansion
- Data Sharing Agreement – governing access to and use of data by members of the Stakeholder Group and, where appropriate, 3rd parties. This area needs careful consideration bearing in mind the commercial sensitivity of the data held by the AVL / RTPI system
- Financial Agreement: clearly defining allocation of capital and revenue costs associated with the system.
- Schedule of KPI's

7 Implementation Strategy

7.1 Role of the SEStran Board

The potential long-term role of the SEStran Board was outlined in Chapter 6. In terms of the project procurement process, the board will fulfil the normal management obligations (allocation of budgets, award of tenders, financial management etc) but it will also consider / approve:

- The scope of the Phase 1 Project – AVL / RTPI projects are high profile and often attract significant member interest. Phase 1 may therefore be influenced by political as well as technical issues.
- Marketing and branding strategies – ultimately we expect Board members to select the "brand", probably form a range of options.
- Agreeing and ratifying the system administration documents outlined in Section 6.

7.2 Strategic Project Team

The concept of a Strategic Project Team is proposed because the Phase 1 implementation may not involve all Stakeholder Groups or include all the core features, functionality and system integration requirements of the ultimate SEStran system.

The Strategic Project Team will ensure that:

- There is an ongoing engagement with other Stakeholders outside the scope of Phase 1. The long-term success of these projects is built on effective participation
- future requirements and functionality are not overlooked or degraded as a result of decisions made during Phase 1 implementation
- the Phase 1 Project considers and reacts appropriately to changing circumstances or requirements within the SEStran or national arenas

In reality, the Strategic Project Team is likely to be an enlarged version of the Phase 1 Project Team with "Strategic" members attending on an infrequent basis or when specific issues arise.

7.3 General Procurement Strategy

Procurement will be subject to OJEU procedures. Requests for expressions of interest to be considered for a short list should be issued as soon as possible. Open tender is not a practical proposition for three reasons:

- Interest levels will be high
- The capabilities and experience of the tenderers will be vast, ranging from established AVL / RTPI providers who have fitted 1000's of public transport vehicles to small software houses seeking to develop new products in this area.
- Each tender will take a considerable amount of time to assess in detail

A target short-list of, approximately, six is recommended with the option to increase up to a maximum of 10, if deemed necessary. This gives suppliers a clear indication of the likely scale of tender competition whilst retaining some flexibility for the Project Team should the need arise. The OJEU should make it clear that, following an initial tender assessment, the Client reserves the right to make site visits to one or more tenderers.

The OJEU should outline the likely scale of the SEStran commission in terms of geographic coverage but include the option of expanding the system into "neighbouring authority areas". This approach was taken by Cambridgeshire County Council when procuring their RTPI system. A "neighbouring authority" was defined as an authority sharing a boundary with an existing system stakeholder rather than sharing a boundary with Cambridgeshire. It has allowed a consortium approach to develop, expanding the core system (with the same supplier) without the need for further procurement exercises. The Cambridgeshire system now includes Peterborough, Bedfordshire and Luton with other potential partners considering their options.

SEStran's should independently confirm the legality of this approach prior to OJEU but it has been considered and accepted by local authorities in Luton and Bedfordshire.

The initial procurement contract should also include:

- index linked costs for system expansion
- maintenance specifications and index linked costs for maintenance
- Index linked costs for software support and system upgrades.

AVL / RTPI systems cannot easily be maintained by 3rd party maintenance contractors. There may be scope for cost savings within 3rd party hardware maintenance but, bearing in mind the complex nature of the systems, White Young Green suggest this should only be considered once the core system is well established and the maintenance implications are more clearly understood. A period of 3-5 years is likely to be appropriate.

Some AVL / RTPI suppliers now refuse to leave Clients on old versions of system software and build in automatic upgrades within the core software maintenance contract. This may increase costs but it has distinct advantages for the user. Apart from more efficient management of patches and fixes, the opportunity exists for User Groups to identify, prioritise and share the cost of future system development. This is more difficult if the supplier is supporting a multitude of bespoke software platforms and versions. White Young Green recommends that upgrades are included in the software maintenance specification.

7.4 Phase 1 Implementation

7.4.1 Scope of Phase 1

A significant first phase implementation is proposed in terms of the number of buses, depots and operational partners. This is considered appropriate to properly utilise the proposed links with existing systems and have a meaningful impact on the public.

Programming of Phase 1 will also require careful consideration. It is important that the public face of the system (RTPI signs / web / wap) is only commissioned once there is a robust and well tested data and vehicle platform. Public confidence in some UK systems has been undermined by commissioning signs too early, often to meet political or end of year financial deadlines. This should be avoided, if possible. The Edinburgh BusTracker project benefited from a flexible, 3 year budget profile rather than fixed annual targets. This meant that, to when necessary, technical issues dictated the programme rather than budget allocations. The benefits of this approach should not be underestimated, particularly in complex projects of this type.

White Young Green's recommendations are included below. These represent a maximum Phase 1 implementation including some "optional" items.

West Lothian & South Queensferry to Edinburgh. A logical, westward extension of the Edinburgh real-time area to include the linear corridor radiating from Edinburgh. This scheme would involve First operations from Livingston and Linlithgow depots and would include 2 important services: the 38 between Stirling and Edinburgh and the 43 between South Queensferry and Edinburgh. The 43 would have been First's primary focus had they joined the BusTracker project. Including the Livingstone depot means that West Lothian Council's scheduled information system can be converted to display real-time information. Our recommendation is to fully equip these depots (102 buses) to maximise the fleet management benefits and minimise any vehicle allocation issues.

Borders. A small and relatively self-contained area to include Monro's services from Edinburgh to Jedburgh; and First services from Edinburgh to Hawick (via Galashiels) and Galashiels (via Peebles). This would include an area with more difficult topography which may require a different communications solution e.g. GPRS instead of trunked radio. RTPI signs should be included at the main bus departure points (Galashiels; Hawick; Jedburgh; Kelso; Peebles and Duns) and at Earlston and St. Boswells, which are important for service connections. These would be enhanced by provision of AVL/RTPI. Our recommendation is to fully equip the Galashiels (First – 53 buses) and Jedburgh (Munros – 43 buses) depots to maximise the fleet management benefits and minimise any vehicle allocation issues.

Fife Within Fife there are three separate opportunities for real-time schemes. All are worthy of further consideration. In our view, it makes practical sense to include one of these within Option 1. This is a logical northward extension of real-time over the Forth Bridge with routes fanning out to cover the commuter belt of Dunfermline; Rosyth and Inverkeithing; plus an eastward extension to Dalgety Bay. The flagship Stagecoach route within Fife is the Service 19 (Rosyth / Dunfermline / Cowdenbeath / Lochgelly / Ballingry). Stagecoach has a depot in Dunfermline. Fife Council also has a Tandata bus station installation in this location. This should therefore form the basis of a Fife element to the project. Glenrothes could provide an additional Fife element as it also has a Stagecoach bus depot and a Tandata installation.

East and Midlothian. To increase SEStran impact in this area and build on previous RTPI investment in both BusTracker and the SEStran funded BusTracker signs, it may be beneficial to include the First depot at Eskbank. (62 buses) This also sits at the head of the

route between Edinburgh and Galashiels, providing continuity with the Borders proposal outlined above.

Additional buses - White Young Green recognise that key services may operate from multiple bus depots. For operational reasons, our preference is to fit complete depots but to allow full fleet coverage of key routes it may be necessary to fit some "isolated" vehicles in Phase 1 and rely on rigorous vehicle allocation by the operator. An allowance has been made in our Phase 1 budgets (approx 92 buses) to cover this. Any partly fitted depots should be given a high priority in subsequent phases.

Phase 1 Integration Requirements – the following are recommended:

(i) BusTracker

(ii) Tandata Bus Station Software

(iii) Nexus Alpha

(iv) Routewise

(v) Trapeze Scheduling Software

(vi) Omnitimes Scheduling Software

Web and wap facilities – essential to maximise the dissemination of data

Allowance for RTPI Signs – Phase 1 should include an allowance to implement additional RTPI signs throughout the SEStran region. The exact location and sign types can be agreed during the specification phase in conjunction with the stakeholders.

7.4.2 Phase 1 Project Team

The Project Team must give adequate representation to the various Stakeholders. It should directly cover, or have easy access to, appropriate individuals with responsibility for key integration areas. Phase 1 Project Team members are outlined below:

SEStran Project Manager & appropriate support staff

SEStran Consultancy Support (including specialist communications and IT skills) to develop the system specification, tender documents and various stakeholder agreements

Fife Council Representative(s)

- data management - Fife will be an early adopter of the SEStran Routewise platform and may be best placed to test small operator data interface issues which can then be applied to small operators in other areas e.g. Borders (Munro's)
- Tandata System Manager – possibly given responsibility for any other SEStran RTPI signs in Fife
- Tandata Supplier Representative

City of Edinburgh Council Representatives:

- BusTracker Project Manager
- BusTracker System Administrator
- BusTracker Supplier Representative

The BusTracker interface is, arguably, the most difficult and sensitive as it deals with 2 –way real-time information interfaces associated with a live RTPI project.

West Lothian Council

- Nexus Alpha Project Manager
- Nexus Alpha System Administrator
- Nexus Alpha Supplier Representative

First Edinburgh

It is essential that the SEStran engages with bus operators at all levels of their business from the outset. This ensures "buy-in" at all levels before, during and after commissioning. Key staff include:

- Commercial Manager
- National AVL / RTPI (where appropriate)
- Operations Manager

- Scheduling Manager
- Maintenance Manager
- Omnitimes Supplier Representative
- Bridge Systems (Radio Supplier) Representative
- Ticket Machine Supplier Representative

It will not be necessary for all of the above to attend each meeting but it is important that they feel part of the project and have a commitment to it. Ideally, the bus operator will identify a primary contact who is a "system champion" with the ability to interact with and influence others within the business.

Stagecoach Fife

- as First Edinburgh.

Munro's (Provisional)

Munro's were highlighted as a possible means of covering bus operations in the more difficult Borders area. However, from a Phase 1 project management perspective, it is easier to work with fewer suppliers. If First Edinburgh are willing partners in the Galashiels area, it may be preferable to focus on First who are already recommended members of the Project Team. This issue can be considered in more detail at during the specification phase.

If Munro's join, the requirement s will be similar to First and Stagecoach although key individuals may fulfil multiple roles:

Borders Council / East Lothian Council / Midlothian Council

Contacts will be required in each of these areas to feedback to Members, agree sign types and locations and progress on-street infrastructure works. This is similar to the current relationship between the East and Midlothian authorities, SEStran and City of Edinburgh BusTracker staff regarding the current BusTracker sign roll-out. Representatives from these areas would not require the same level of technical input as the other Project Team members highlighted because there are no significant interface issues in those areas.

SEStran Procurement / Legal Representation

Essential to ensure that procurement rules and SEStran standing orders are adhered to. Legal advice will also be required to consider the initial contract as well as the various stakeholder agreements

SEStran Marketing Representative

Advice will be required when developing branding concepts and strategies for the SEStran AVL / RTPI system.

Existing Supplier Representation

Existing suppliers are included as members of the proposed Project Team. This is seen as a pro-active measure to encourage positive and effective interaction between the appointed AVL / RTPI supplier and the suppliers of existing systems.

In many tender documents, an obligation is placed on the AVL / RTPI system supplier to interface with existing 3rd party systems providing fixed costs at the tender stage. This is often unrealistic. The relationship between the suppliers then becomes strained due to budgetary pressures and the inability to fully scope the works in advance. As a result, delays arise and, in the worst case scenario, a less than perfect solution is delivered which has the potential to undermine performance over the longer term.

This is not a minor issue within the project. Effective system integration is the key to success across large parts of the SEStran area. White Young Green therefore recommend that the existing suppliers are an established part of the Project Team and that a more transparent and structured approach is sought to deliver effective system integration. Effective scoping meetings can be held once an AVL / RTPI supplier has been appointed to establish the scale and cost of the integration works.

7.4.3 Phase 1 Project Team Management

The team members highlighted above are relevant but the project clearly cannot function with Project Team meetings of that size. Although occasional “full project” meetings will be necessary to discuss progress and maintain continuity, much of the work will be achieved by a core project team working with focussed sub-groups e.g.

- Data management sub-group
- Bus operator sub-group
- RTPI Information sub-group
- System Integration sub-group
- Communications sub-group

The above are included as an example. A clearer structure will emerge during the specification and tendering stage but it is important to recognise that effective management of such a large and complex project will, in itself, be a challenge.

7.4.4 Phase 1 Capital Costs

Phase 1 costs are summarised below.

Phase 1 - Capital Cost Summary				
	No.	Unit		Costs
Central System, Workstations and Software		Item	£	235,585.00
On-Bus	500		£	2,399,225.00
RTPI Signs	100		£	691,840.00
Bus Priority	50		£	87,500.00
Communications		item	£	1,074,520.00
System Integration		item	£	925,000.00
Project Management		item	£	580,000.00
		TOTAL	£	5,993,670.00

Figure 9 - Phase 1 Cost Summary

7.5 Ultimate SEStran System Capital Costs

The likely scale and cost of the full SEStran system is outlined below. The ultimate system adds more buses, signs depots etc. The primary platform will be established during phase 1.

Ultimate System - Capital Cost Summary				
	No.	Unit	Costs	
Central System, Workstations and Software		Item	£	235,585.00
On-Bus	1000		£	4,892,500.00
RTPI Signs	600		£	4,008,900.00
Bus Priority	150		£	262,500.00
Communications		item	£	1,222,200.00
System Integration		item	£	650,000.00
Project Management		item	£	730,000.00
		TOTAL	£	12,001,685.00

Figure 10 - Ultimate System Cost Summary

Note: the ultimate cost is heavily influenced by the number and type of RTPI signs installed. Actual numbers could be less if SEStran pursue a web and wap dominated information strategy.

7.5.1 Future Project Teams

The core of the Phase 1 Project Team should ideally remain intact to maintain continuity and fully utilise the experience gained. Members from the local authority partners will, of course, vary to reflect the areas of implementation.

7.5.2 Future Expansion and Procurement

Additional orders will be placed on the Phase 1 supplier using index linked prices for supply, installation and maintenance. There is very little scope to procure equipment from alternative suppliers because there is no standard AVL / RTPI platform with common protocols at the present time. There is some flexibility in relation to RTPI signs. New sign types can certainly be procured through the existing supplier. Options may exist to purchase signs independently

and pay a fee for the supplier to integrate them into the existing platform and communications network. There is, of course, greater flexibility where signs are being driven over internet connections as these are using standard web protocols and are not reliant on the core AVL / RTPI communications infrastructure. Wi-max and Mesh opportunities can, of course, be considered should they appear within the SEStran area.

7.6 Revenue Costs

Revenue costs have not been included in this feasibility report because they are heavily influenced by the scale of the implementation, the number of optional items that are included and the nature of the communications system. White Young Green appreciate that the system cannot be procured without a clear understanding of the maintenance costs and unambiguous stakeholder agreements about how they will be distributed. Revenue cost estimates should therefore be developed during the specification stage when the system requirements will be more clearly understood. Any subsequent tender documents should also include sections on maintenance and software support.

7.7 Summary of Key Documents

Below is a summary of the key documents to be developed in the next phase of this project.

- System Specification
- Maintenance Specification
- Training Specification
- Tender Documents
- Stakeholder and Partnership Agreement
- Financial Agreement
- Data Sharing Agreement
- Marketing Strategy

8 Summary

8.1 General

This commission assessed the areas relevant to the proposed SEStran AVL / RTPI project. The key comments, findings and recommendations from each chapter are summarised briefly below.

8.2 RTPI System Review (Chapter 2)

This section gave examples of AVL / RTPI projects and the suppliers active in the UK marketplace. It included a detailed explanation of the component parts of AVL / RTPI systems which are:

- Data supply – timetables and operator "running boards"
- Core system – including fleet management and RTPI sign management tools
- Depot wireless systems – to efficiently transfer data onto buses
- On-bus computers, driver displays, next stop signs
- Communications – voice and data between the bus and the control-centre
- Security systems – e.g. panic alarms for drivers
- Real-time information signs – to disseminate information to the public
- Web, wap and SMS services – to increase access to information
- Historic databases – to analyse service delivery and prepare reports
- Effective maintenance and administration systems

It also highlighted the different approaches that are taken to deliver effective AVL and RTPI. Historically, the most significant distinction has been that "European" systems focus on providing comprehensive fleet management tools to satisfy the demands of public transport operators. RTPI is then a deliverable by-product of the fleet management system. The original "UK" systems, on the other hand, sought to deliver RTPI with minimal fleet

management functionality and interaction with bus operators. UK systems have increased their fleet management functionality in recent years.

8.3 Data Collection & Review (Chapter 3)

This section identified the potential system stakeholders and investigated established systems which are relevant to the SEStran project.

8.3.1 SEStran Stakeholders

Local Authority Partners

- City of Edinburgh Council
- Fife Council
- East Lothian Council
- Midlothian Council
- West Lothian Council
- Falkirk Council
- Clackmannanshire Council
- Borders Council

Bus Operator Partners

- First Edinburgh
- Stagecoach Fife
- Other smaller operators

Others

- Traveline Scotland

- Lothian Bus (possibly if SEStran added value through enhanced public transport security systems)

Appendix C illustrates the operational areas of the main operators.

8.3.2 Established Systems

The established systems which are potentially relevant to SEStran are:

RTPI / AVL Systems

- Edinburgh BusTracker - the dominant RTPI project in the area
- East Lothian RTPI Trial – a 1-route trial which is not yet commissioned
- Glasgow Bias – neighbouring RTPI system
- Dundee City Council RTPI - neighbouring RTPI system with routes to / from Fife
- NE England RTPI – neighbouring RTPI system reaching the south of Northumberland

Scheduled Information Systems

- Fife – 8 bus / rail stations with approximately 75 information signs
- City of Edinburgh - St Andrews Square Bus Station, Edinburgh – approx 20 displays
- West Lothian Bus Station Systems – 7 installations commissioned / pending with 20 displays
- TravelineScotland – a call centre, SMS and web based service offering scheduled information across the whole of Scotland
- Midlothian Info-poles – 3 sites giving scheduled information.

Appendix B illustrates the location and extent of the existing scheduled and RTPI systems.

Radio Systems

In addition to any radio systems associated with above real-time projects, the following are worthy of note:

- ***Fife Council Radio Network*** – replacement of this major trunked radio system with over 1000 radio partners is required and undergoing review. Replacement timescales are likely to be in advance of the SEStran RTPI project but there may be scope to share or utilise existing transmitter locations and / or upgraded microwave links. Some elements of the Fife system will almost certainly transfer to GPRS / 3G technology to satisfy the need for reliable mobile communications inside buildings.

- ***Other Local Authorities*** - a number of other authorities have radio systems in place or being commissioned. There is no obvious potential for integration with the SEStran project with the exception of the Edinburgh Bus Tracker radio system which can be used to carry SEStran RTPI information to the BusTracker signs.

- ***First Edinburgh*** – currently investing and expanding their existing MPT1327 voice radio. This may be utilised within the SEStran to carry First Edinburgh data. To be discussed further at the specification stage.

- ***Lothian Bus Radio network*** – a comprehensive MPT 1327 voice and data network which fulfils Lothian Bus requirements within the BusTracker project. It cannot be used for SEStran purposes.

8.4 Data Management Systems and Practices

Efficient data management is an essential element of large AVL / RTPI systems. Well managed bus operator scheduling systems are the ideal source as they will provide an up to date and accurate representation of their operational network, including the “running-board” details which allow the RTPI system to make cross-service predictions. However, for small operators (or where scheduling systems are incomplete) the RTPI system will rely on service registration data held by the local authorities.

The key data management systems within the SEStran area are:

- ***SEStran Routewise*** database – a new, networked local authority service registration system provided by SEStran for their partners to use. This offers a single service registration data source for the SEStran area.
- ***Trapeze*** – the scheduling system used by Stagecoach
- ***Omnitimes*** - the scheduling system used by First Edinburgh
- ***Hastus*** - the scheduling system used by Lothian Buses, included for completeness as this is already integrated with the BusTracker project.

8.5 Communications System Review (Chapter 4)

This provided a comprehensive review of the available communications technologies, highlighting the advantages and disadvantages of each in the context of the SEStran AVL / RTPI project. The available options are:

8.5.1 Private Mobile Radio

This licenced radio system can carry voice and data. It is the most common communications platform for AVL / RTPI systems. For the Sestran area, an MPT 1327 trunked system linking multiple base stations would be necessary. The system offers excellent voice functionality allowing group calls to multiple vehicles whilst maintaining security between competing operators i.e. they can't hear each others calls. Higher capital costs are offset by lower revenue. OFCOM licencing changes are affecting this type of service in the south of England but are not expected to be an issue in the SEStran area. The situation must, however, be monitored closely during the procurement process.

8.5.2 GPRS / 3G

As data costs fall, this is becoming a more common option within AVL / RTPI projects. One advantage is that the set up costs are relatively low because the AVL / RTPI system taps into existing commercial networks with wide area coverage. However, the revenue costs are generally higher than a trunked radio solution. The cost model is, of course, influenced by the topography, the geographic area to be covered and the number of vehicles or signs within it. A hybrid solution may prove to be the best solution for SEStran.

GPRS / 3G solutions do not provide the same level of voice functionality as MPT 1327 radio systems which may be an issue for some bus operators as multiple vehicle group calls are not viable. Finally, GPRS / 3g cells can become overloaded at times of peak demand or during unusual events. Some AVL / RTPI clients prefer the independence and security of service offered by the private radio solutions.

8.5.3 Mesh

This private, high bandwidth option is based on military battlefield technology. In theory, it offers a good solution but bandwidth provided is far in excess of that required by traditional AVL / RTPI systems. It may be an attractive option in urban areas where other stakeholders can utilise the bandwidth effectively. Covering the SEStran area with Mesh is not a viable proposition because 1000's of nodes would be required. It is also worth noting that the recent trial of mesh within Portsmouth's AVL / RTPI system has been abandoned. It I therefore a relatively high risk option at the present time.

8.5.4 WI-max

AVL / RTPI could utilise these services where they exist, particularly for the management of fixed infrastructure such as RTPI signs. The SEStran project alone could not, however, justify a Wi-max implementation.

8.6 Stakeholder Consultation (Chapter 5)

Numerous stakeholders were consulted to establish:

- Support for the project, in principle
- AVL / RTPI aspirations, priorities and any particular concerns

A very brief summary is provided below.

8.6.1 Bus Operators

Bus Fleet Sizes within SEStran	
Operator	**Vehicles**
First Edinburgh	421
Stagecoach	392
Munro	43
E & M Horsburgh	80
Mackie	?
Perryman	?
Moffat and Williamson	?
TOTAL	936
Allowance for Missing / Small Operators	164
SEStran TOTAL	1000

Figure 11 - Summary of Main Operator Fleet Sizes

Both of the major operators support the project in principle and will consider financial contributions subject to demonstrating a business case.

First Edinburgh are particularly interested in their services approaching Edinburgh from the west and were previously considering joining the BusTracker project with Service 43 (Sth Queensferry – Edinburgh). They have also invested in a radio network and have upgraded their Linlithgow depot. (Livingstone upgrade under consideration)

Stagecoach are involved in the Dundee real-time project through StrathTay buses but this does not impact on their Fife operation. Stagecoach's flagship service is the 19 in the Dunfermline area. Stagecoach do not have a radio network at present.

8.6.2 Local Authority Stakeholders

The local authority stakeholders were all supportive of the project. The key points raised were:

City of Edinburgh Council

Supports integration between SEStran project and BusTracker but the operation of BusTracker must not be undermined.

Fife Council

Need Stagecoach involvement to be meaningful in Fife. Want to focus RTPI on existing Tandata bus station installations.

West Lothian

Need First Edinburgh participation to be meaningful. Want to focus RTPI on existing Nexus Alpha bus station installations initially.

East Lothian

Currently rolling out BusTracker signs with SEStran funding. Want to add First services and other minor operators. Would like to complete the JMW RTPI trial and integrate with any SEStran system. RTPI within schools would be beneficial to provide updates on commercial services used for school transport.

Midlothian

Currently rolling out BusTracker signs with SEStran funding. Want to add First services and other minor operators to maximise benefits.

Borders

Suggested locations for signs at the outset, would be at the main bus departure points in Galashiels; Hawick; Jedburgh; Kelso; Peebles and Duns and service connection points a Earlston and St. Boswells. A corridor approach to RTPI is preferred, initially focusing on the routes:

- Jedburgh – Dalkeith – Edinburgh.

- Hawick – Galashiels – Edinburgh.
- Galashiels – Peebles – Edinburgh.

Clackmannanshire Council

Clackmannanshire are currently sponsoring the introduction of an SMS text message information service. Any AVL/RTPI project is likely to require a minimum of on-street signs in Alloa (at Shillinghill) and in Tillicoultry (at Murray Place). First are the dominant operator interworking roués from several depots. A corridor approach to RTPI is preferred

Falkirk

On-street signs are considered important in Falkirk. Approximately 100 would be required to give ideal coverage to existing bus stations; bus interchange locations and significant other stops. Falkirk favour a corridor approach to the introduction of AVL/RTPI thus maximising benefits to users.

8.7 Strategic Model & Implementation Strategy Development (Chapter 6)

Based on the review of existing systems and Stakeholder consultation, White Young Green recommends the following implementation strategy:

8.7.1 Essential Interfaces.

- City of Edinburgh BusTracker –
- Fife and Edinburgh Tandata Bus Station Systems –
- West Lothian Nexus Alpha Scheduled Information System –
- SEStran Routewise -

8.7.2 Desirable Interfaces

- Stagecoach - Trapeze Scheduling Software –
- First Edinburgh – Omnitimes Scheduling Software

(A number of other of desirable interfaces exist but are not considered a high priority.)

8.7.3 System Specification & Functionality

The core of any specification will undoubtedly revolve around the features outlined in section 2. At this stage White Young Green recommend that the following key points be accepted:

- the system must be "running board" based system to offer cross service predictions, particularly on web, wap and sms applications
- The system must include an early implantation of web, wap and, possibly, SMS to ensure wide area penetration of RTPI.
- the system must address the essential interfaces identified above and be capable of accommodating the desirable interfaces over time

8.7.4 System Integration

Having considered a number of options, Appendix J illustrates how the SEStran AVL / RTPI system should integrate with existing systems. The diagram reflects the essential and desirable interfaces outlined above and addresses the concerns raised by potential stakeholders during the consultation process.

8.7.5 Operational Issues

Key points to note are:

- The proposed architecture maintains the operational integrity of existing systems.
- Data disseminated via the various routes must be timely and consistent.

8.7.6 Data Management Issues

Responsibility for data lies with the administrators of the various systems. A high standard is required across all systems. Poor quality core data is one of the most common reasons for the underperformance of AVL / RTPI

8.7.7 Long-term Administrative structure

With so many data and systems interfaces, there will be a need for close cooperation to ensure that high standards are established and maintained. White Young Green recommends the following structure:

- AVL / RTPI Project Board – a high level "Client" Group with overall responsibility for the long-term delivery of RTPI.
- AVL / RTPI Technical Group – including key representatives from the authorities and operators responsible for the various systems and significant data sources.
- System Manager –with responsibility for day-to-day operations, management of maintenance contracts, system amendments or upgrades.
- System Administrator –to co-ordinate data supply, manage the configuration of signs etc and to administer fault reports / clearances.

(System Manager and Administrator roles could, perhaps be combined)

8.7.8 Marketing / branding

The SEStran AVL / RTPI system will not be an expansion of the BusTracker brand which is already in place. Following consultation, the optimum solutions is to:

For On-street Signs - maintain the BusTracker brand within the Lothian Bus operational area using the combined BusTracker / SEStran / Local Authority logo in areas outside the City of Edinburgh. This is the current branding strategy.

For Web / Wap – both BusTracker web sites and wap services will be marketed independently retaining a unique identity. In boundary areas such as East Lothian and Midlothian, users will establish a personal preference. In the majority of the SEStran area there will be no overlap between BusTracker and the SEStran coverage.

8.7.9 Financial Model

The most successful AVL / RTPI systems include a significant financial commitment from the bus operator stakeholders. SEStran should seek such a commitment. A number of models exist but, increasingly, bus operators are being asked to meet the bulk of revenue costs in

exchange for public sector capital funding of the core system. A number of principles should, however, be adopted:

- the discussions should be open and frank
- the cost model must be fair and equitable to all parties
- all parties must work pro-actively together to ensure that the system specification meets the individual operator requirements, maximising the added value and minimising any perceived operational burden

8.7.10 Administration Documents

The management of the system and the stakeholder group will be documented within and governed by the following documents:

- Stakeholder Agreement – an over-arching document covering the roles and responsibilities of the various stakeholders, system operation, management and expansion
- Data Sharing Agreement – governing access to and use of data by members of the Stakeholder Group and, where appropriate, 3rd parties.
- Financial Agreement: clearly defining allocation of capital and revenue costs associated with the system.
- Schedule of KPI's

8.8 Role of the SEStran Board

The board will fulfil the normal management obligations but will also consider / approve:

- The scope of the Phase 1 Project
- Marketing and branding strategies
- Agreeing and ratifying the system administration documents.

8.9 Strategic Project Team

The Strategic Project Team will ensure that:

- There is an ongoing engagement with other Stakeholders outside the scope of Phase 1.
- future requirements and functionality are not overlooked or degraded during Phase 1 implementation
- the Phase 1 Project considers and reacts appropriately to changing circumstances or requirements within the SEStran or national arenas

8.10 General Procurement Strategy

The key points to note are:

- Procurement will be subject to OJEU procedures.
- A target short-list of, approximately, six is recommended with the option to increase up to a maximum of 10, if deemed necessary.
- The Client reserves the right to make site visits to one or more tenderers.
- The OJEU should include the option of expanding the system into "neighbouring authority areas".

The initial procurement contract should also include:

- index linked costs for system expansion
- maintenance specifications and index linked costs for maintenance
- Index linked costs for software support and system upgrades.

8.11 Phase 1 Implementation

8.11.1 Scope of Phase 1

White Young Green recommends:

- **West Lothian & South Queensferry.** Completely fit First's Livingston and Linlithgow depots (102 buses). Add selected vehicles to provide full RTPI coverage on 2 important services: the 38 between Stirling and Edinburgh and the 43 between South Queensferry and Edinburgh. Convert West Lothian scheduled system to RTPI and add First buses to BusTracker signs

- **Borders**. White Young Green recommends RTPI signs in Galashiels; Hawick; Jedburgh; Kelso; Peebles, Duns, Earlston and St. Boswells. . Fully fit First's Galashiels depot (53) and (provisionally) Munro's Jedburgh depot (43).

- **Fife** The flagship Stagecoach route within Fife is the Service 19 (Rosyth / Dunfermline / Cowdenbeath / Lochgelly / Ballingry). Stagecoach has a depot in Dunfermline (75 buses). Fife Council also has a Tandata bus station installation in this location. This should therefore form the basis of a Fife element to the project. Glenrothes (71 buses) could provide an additional Fife element as it also has a Stagecoach bus depot and a Tandata installation. (146 Stagecoach in total)

- **East and Midlothian.** To increase SEStran impact in this area and build on previous RTPI investment in both BusTracker and the SEStran funded BusTracker signs, fit the First depot at Eskbank / Dalkeith (62 buses).

- **Additional buses –** to fully cover important services inter-worked from multiple depots (approx 92 buses)

- **Total buses = 500**

- **Area wide communications platform as base for future expansion**

- **Integration Requirements** – the following are recommended in Phase 1

    - BusTracker

    - Tandata Bus Station Software

    - Nexus Alpha

    - Routewise

    - Trapeze Scheduling Software

- Omnitimes Scheduling Software

- **Web and wap facilities –** essential to maximise the dissemination of data

- **Allowance for RTPI Signs –** Phase 1 should include an allowance to implement additional RTPI signs throughout the SEStran region. The exact location and sign types can be agreed during the specification phase in conjunction with the stakeholders.

8.11.2 Phase 1 Project Team

The Project Team needs to be a manageable size whilst giving adequate representation of the various Stakeholders.

White Young Green's preliminary recommendation is:

- SEStran Project Manager & appropriate support staff
- SEStran Consultancy Support
- Fife Council & Existing Supplier Representative(s)
- City of Edinburgh Council & Existing Supplier Representatives:
- West Lothian Council & Existing Supplier Representatives
- First Edinburgh & Existing Supplier Representatives
- Stagecoach Fife & Existing Supplier Representatives
- Munro's (Provisional) & Existing Supplier Representatives
- Borders Council / East Lothian Council / Midlothian Council – key contacts required from each authority to manage the implementation of RTPI signs. White Young Green do not foresee any significant Phase 1 integration issues specific to these areas. Within Lothian Buses' operational areas in East and Midlothian, SEStran funded RTPI signs will continue to be managed by the BusTracker system
- SEStran Procurement / Legal Representation

- SEStran Marketing Representative
- Lothian Buses Representative – although covered by BusTracker, Lothian Buses should be represented to consider the benefits of any enhanced security systems & to comment on BusTracker integration issues.

The team members highlighted above are relevant but the project clearly cannot function with Project Team meetings of that size. Although occasional "full project" meetings will be necessary to discuss progress and maintain continuity, much of the work will be achieved by a core project team working with focussed sub-groups e.g.

- Data management sub-group
- Bus operator sub-group
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- System Integration sub-group
- Communications sub-group

The above are included as an example. A clearer structure will emerge during the specification and tendering stage but it is important to recognise that effective management of such a large and complex project will, in itself, be a challenge.

8.11.3 Phase 1 Capital Costs

Phase 1 costs are summarised below.

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System Integration		item	£	925,000.00
Project Management		item	£	580,000.00
		TOTAL	£	5,993,670.00

Figure 12 - Phase 1 Capital Costs

8.12 Summary of Key Documents

Below is a summary of the key documents to be developed in the next phase of this project.

- System Specification
- Maintenance Specification
- Training Specification
- Tender Documents
- Stakeholder and Partnership Agreement
- Financial Agreement
- Data Sharing Agreement
- Marketing Strategy

8.13 Outline Programme

Indicative deadlines are:

- OJEU process - Dec 07
- Tender - January 08
- Appointment - March 08
- Phase 1 – Joint Design Exercise - September 2008
- Rolling Installation Programme October 2008 – March 2011
- Phased Commissioning March 2009 / 10 / 11

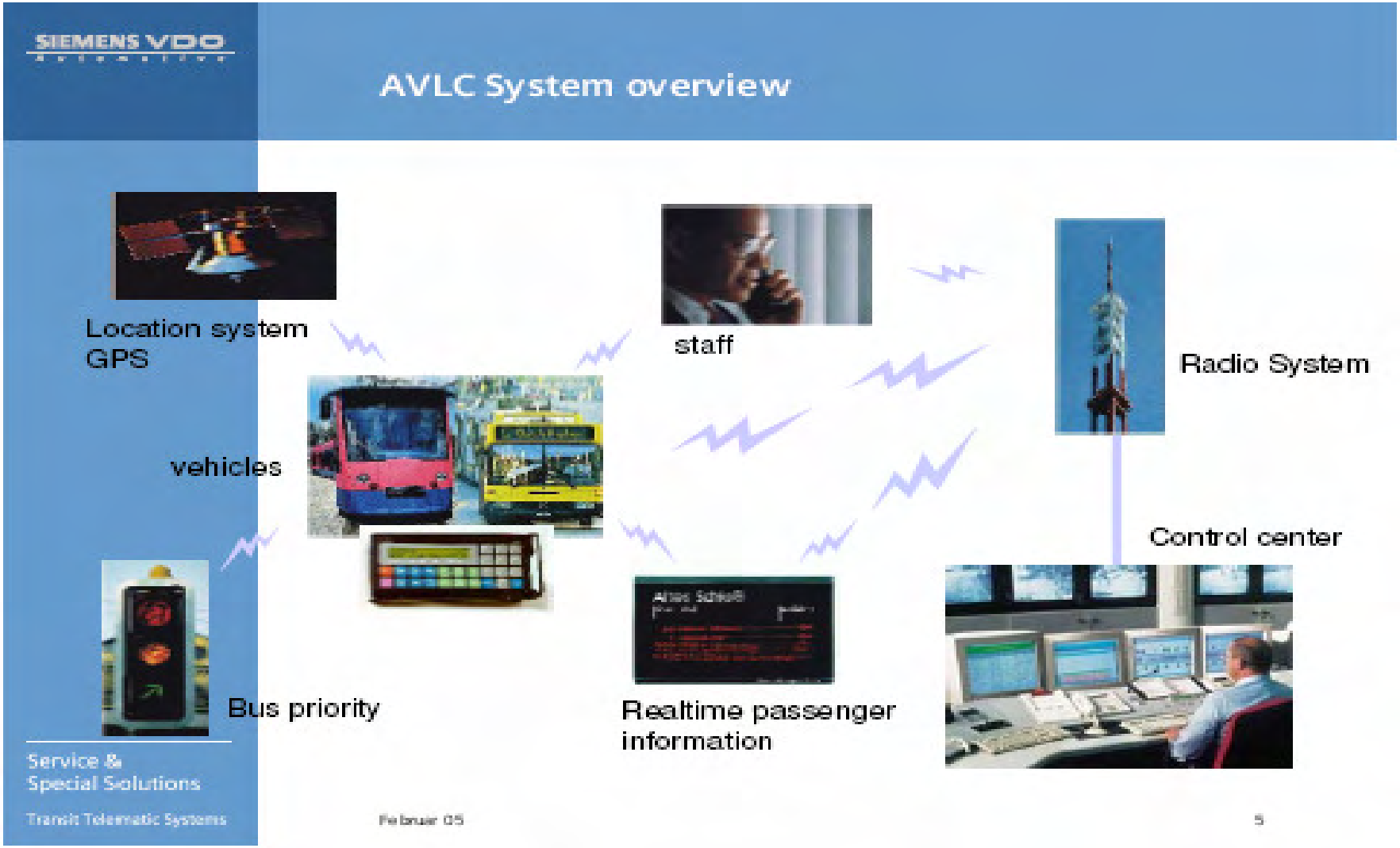
8.14 Conclusion

This feasibility report demonstrates that there is sufficient support throughout the potential local authority and bus operator partners to deliver a successful AVL / RTPI project across the SEStran area.

The report provides the basis for a subsequent specification and procurement phase having outlined the key administrative, technical and financial issues that must be considered and addressed.

The report is submitted for consideration and comment.

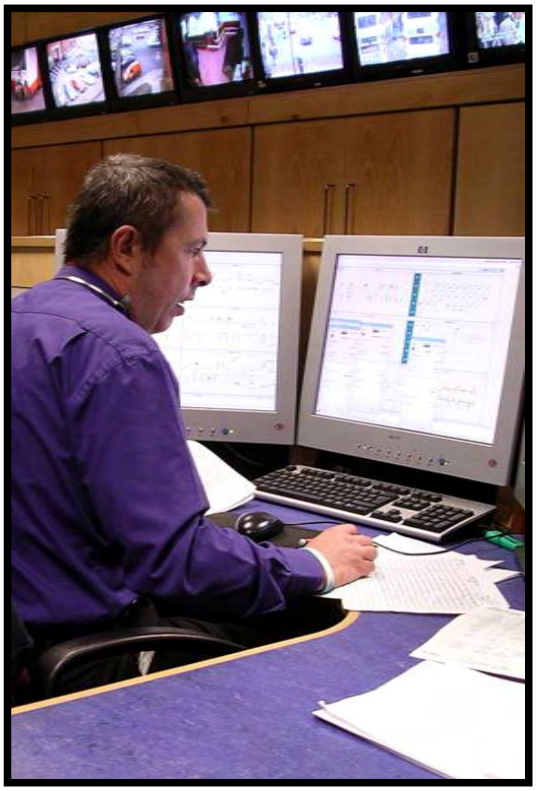
APPENDIX A -
RTPI Supplier Examples



Typical AVL / RTPI System Architecture.

Examples of Hardware from the

City of Edinburgh Council BusTracker System



Clockwise from top left:

- **Control centre workstation**
- **RTPI sign**
- **Bus driver console display**
- **On-bus integration of and Wayfarer ticket machine and AVL driver console**

IMPROVING PUBLIC TRANSPORT THROUGH TECHNOLOGY

BusNet | Overview

ACIS are dedicated to the 'improvement of public transport through technology' through the provision of:

- Real Time Information
- Real Time Fleet Management Information and Historical Performance Data
- Intelligent Variable Traffic Signal Priority

Our clients include Local Authorities and public transport operators and of course the travelling public.

The ACIS BusNet product provides fully automated travel information at bus stops, intermodal switchpoints, in the home, at work, and in places such as cinemas, shopping complexes and leisure centres via:

- On and off street displays
- World Wide Web
- Corporate intranets
- WAP
- SMS
- Telephone

ACIS award winning Variable Intelligent Bus Priority may be implemented at signal-controlled junctions, either locally or integrating with centralised systems like SCOOT. Effect on traffic flows is minimised by giving priority to late buses only. The system integrates with traffic control systems, using buses as traffic congestion 'probes' then linking to VMS signs.

For national operators BusNet provides both live monitoring and historic reports - avoiding the requirement for inspectors, highlighting operational shortcomings and enabling schedulers to redraw timetables that accurately reflect real journey times.

BusNet provides a cost effective data and voice

New services

Look at new possibilities with

- WAP
- SMS

IMPROVING PUBLIC TRANSPORT THROUGH TECHNOLOGY

BusNet | Features and Benefits

Features

- Leading edge technology
- Dynamic, flexible solutions
- Scaleable
- Modular
- Proven technology
- Cost effective
- Rapid implementation
- Constant feature updates
- Ticket Machine Interface

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GPS based Automatic Vehicle Location

- 2 metre accuracy
- No civil works
- Easily expandable
- Low cost
- Flexible

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Open Communications

- Either GPRS or Trunked PMR
- Solely or mutually
- Data and voice
- Cost effective

Topics on this page:

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Dissemination

- at the bus stop
- in the home
- at work
- intermodal switchpoints
- in places:
    - cinemas
    - shopping complexes
    - sports centres
    - hospitals
    - schools
    - colleges

Via

- on and off street displays
- web
- company intranets
- WAP
- SMS
- phone server

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Operator Reports

- Dynamic Live Monitoring
- Historic Management Reports
- Information for timetabling and scheduling
- Accurate information to review customer complaints
- Performance monitoring to respond to regulatory complaints

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Bus Priority

- Intelligent
- Variable
- Award winning

- No civil works
- Either locally or integrating with SCOOT

Return to Top

Interface with UTMC

- Congestion monitoring
- Interface to Variable Message Signs

Return to Top

Open standards

- Compliant with RTIG draft
- server level feed to link neighbouring systems
- Interface with Demand Responsive Transport

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Full in house project management

- Control
- Experience
- Single contact
- Improved project planning and training

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Many UK users

- Shared experience
- Regular user group meetings
- Initial and ongoing training support at customer premises

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Maintenance support

- Experienced team
- Locations around the country

communications system employing either trunked PMR or GPRS. Working towards open standards, BusNet permits a feed at server level to link neighbouring systems.

> RTPI

REAL TIME PASSENGER INFORMATION SYSTEM

Real time information constitutes a service that public transport users have come to expect.

INFORMING PASSENGERS

Reliable information provided to passengers in real time

The passenger information system designed by INEO Systrans is used to produce and transmit information on network traffic status: waiting time, next bus, advertising messages, etc.

Wide range of dynamic information displays at bus stops and in vehicles

There is nothing like real time passenger information terminals to give a city a hi-tech image and to help passengers manage their journeys more effectively without having to wait impatiently at bus stops.

Depending on your requirements, INEO Systrans can offer different types of displays.

Accessibility for all!

- Dynamic displays tailored to meet recommendations for the partially sighted.
- Audio information for the visually impaired.

INEO SYSTRANS
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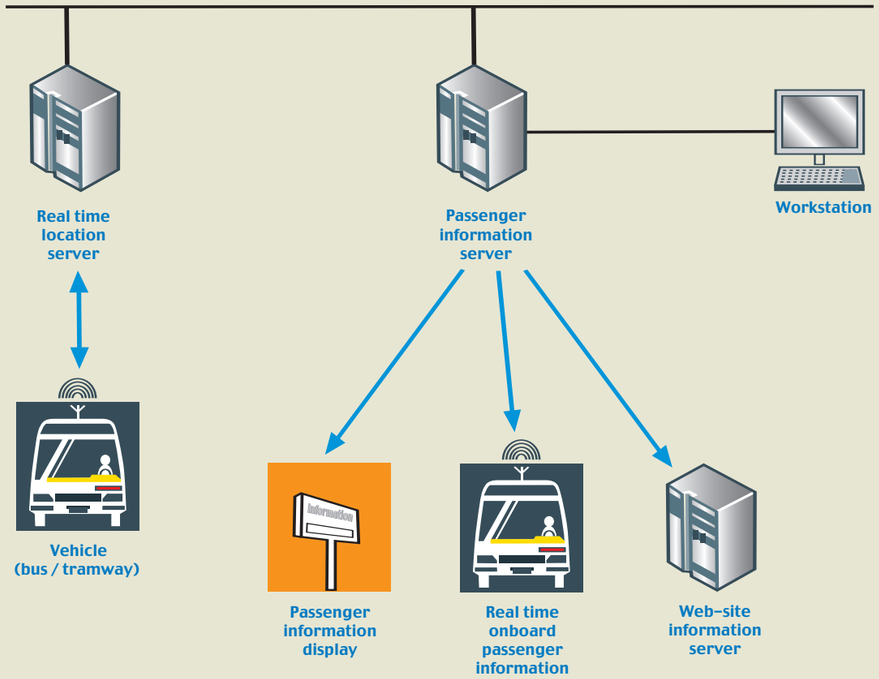
INEO SUEZ
INEO SYSTRANS

> RTPI

REAL TIME PASSENGER INFORMATION SYSTEM



RELIABLE INFORMATION

- Passenger information based on two processes: **vehicles localisation in real time** (GPS, odometers, etc.) and **calculation of vehicle schedule adherence and estimated journey time**.
- This information is then provided in real time to passengers via **an information transmission network supplied and installed by INEO Systrans**.
- Site studies are used to set up **the most appropriate means to transmit the information** to the media available to passengers: the radio network used to locate vehicles, land lines, GPRS, Edge or 3G.
- This enables information media to convey **reliable information** on the next bus, waiting time etc. at the bus stops or onboard.

FREQUENTLY UPDATED INFORMATION

- **Information is updated cyclically** by the central unit every 10 to 30 seconds and based on the calculated rate of progress made by a bus along its route.
- **A real time update** is carried out to delete information on a specific bus immediately after it has left the bus stop.

Passenger information at bus stops

FLEXIBLE DISPLAYS

- **Waiting time**, **destinations** and the **"via"** for the next vehicles
- **Current time**
- Messages concerning one of the network's routes: **"route" messages**
- General information messages: **"commercial" messages**

TWO TYPES OF ELECTRICAL POWER SUPPLY

- Permanent supply connected to the power distribution system
- Street lighting supply, often less expensive and easier to connect

A COMPREHENSIVE RANGE OF DISPLAYS

INEO Systrans can offer a wide range of technologies for bus stop information displays, **all equipped with vandal-proof glass panels**.

- **LED**
- **LCD**
- **TFT**
- **Large panels** at major interchange points

LED display

LCD tramway display

LCD bus display

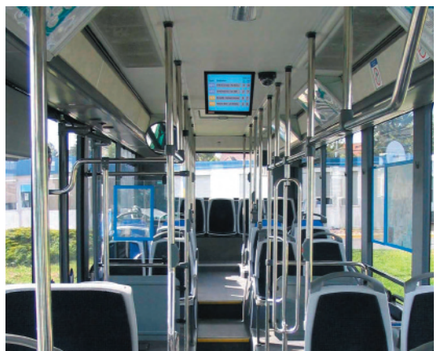
TFT panel

Large panel

Onboard passenger information

For messages appropriate to onboard displays such as next stop, current stop, destination, etc., the information is provided by the vehicle's onboard computer supplied and installed by INEO Systrans. Typical display media:

- **LED strip** with scrolling text
- **TFT screen** for improved message content and the screening of videos. Ideal for a hi-tech image!



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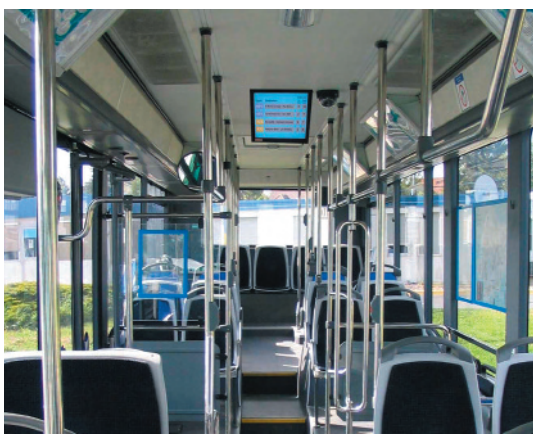

Fuel Management

Real Time Passenger Infomation

InfoStop

Bus Priority

Emergency Vehicle Priority

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Bridging the Gap: Policy to Technology

Real Time Passenger Information (more...)

JMW design, manufacture and install the software and hardware for GPS, GPRS and PMR based Real Time Passenger Information. JMW are unique in offering customers the flexibility of tailor made products or off the shelf products, both at affordable prices.

JMW's InfoRoute software provides on vehicle AVL tracking / logging, report facilities whilst also interfaces with ticket machines and permits SMS messaging and web access.

The technology is versatile and thus has provided the foundations for other products, for example InfoFare (RTPI integrated with ticket machines), InfoStop (the rural or urban interactive bus information point), InfoColumn (the information point with LCD screen and or web access) and indeed the JMW LED displays which are DDA complaint but also available in a flag design or can be adapted for disabled users or indeed as information displays at recycling depots. The use of products is versatile in that the tracking and logging facility has been adapted from buses to taxi's to tracking plant and trailers. The InfoColumn can be used at train and bus stations, in areas to assist tourist whilst the InfoStop assists the visually impaired and socially excluded. JMW pride themselves with having up to date knowledge on government policies, Local Transport Plans and in turn how customers can utilise government funding to implement RTPI and or it's by products.

InfoStop (more...)

The concept of deliverying Real Time Passenger Information in rural areas and also to users who often find themselves socially excluded or unable to use hi-technology bus information points, was a concern to JMW. To readdress this concern, JMW designed and implemented the InfoStop which is a product that delivers information on bus services such as waiting times, low floor availability, all at the touch of a button. To assist all users the product can incorporate Braille and audio thus ensuring the information Stop is interactive for ALL passengers.

Benefits

1. Easy to Install
2. Affordable
3. Can be powered by battery, solar, orlamp column
4. Can use government funding such as the Transport Innovation Fund, Rural Transport Fund, or Community Funds

The InfoStop operates using an Orange GPRS link to the central server at JMW headquarters, this server holds timetable data for all the customers bus routes which can either be updated by JMW or the customer via an interface over the internet. Should the customer prefer a PMR connection to GPRS then PMR coverage from a local base station is required.

The unit can be designed to fit your requirements but the standard InfoStop has 12 LED's to display the information relating to waiting times, low floor access and if the time shown is from timetable information or a RTI unit on a bus. The user simply selects the required service by pressing either the next bus button or one of the bus service buttons on the panel and is informed by audio or visually on the panel the information requested.

The unit is very robust to help deter vandalism as is common with glass screens. However, some customers prefer a touch screen which is a further option.

Traffic Priority (more...)

Congestions has and will always be an issue for the island of the UK. Government policy and ideology is focused firmly on tackling congestion and using sustainable transport which offers best value. Since 1992 JMW have offered a means to reducing congestion whilst also promoting the environment and helping reduce accidents on the roads. Bus Priority, 'blue light' priority (emergency vehichles), and vehicle priority are important products with a desired policy outcome.

The Bus Priority products have won the government clear zone award and were pioneered in the early 1990s. This product increases the frequency and the speed a bus travels on a route with the assistance of a tag or GPS. The blue light equivalent operates on the same principle but permits emergency vehichles priority at juntions or traffic lights which in turn ensures the movement of traffic is uninterrupted which reduces accidents.

The vehicle priority is a product based on technology encompassed into a number plate. This offers even greater flexibility to its application and ensures a lower cost whilst also being vandal resistant.

The advantage of traffic priority using a number plate over technology such as Tags is there is no need to dig up roads. JMW offer tags, GPS and number plates as a means to priorities traffic whilst assisting with the reality of congested roads and a passive public sceptical about public transport. These products increase the public trust in traffic technology

click for Flight Information Systems

Bus Information Systems

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Bus /Rail Interchange wins bus industry awards more >>

Kilmarnock journey enquiry system more >>

Edinburgh Bus Station more >>

Bus Station Software

Our successful product BIDS is installed in over fifty bus stations and interchanges.

Open Systems, modular & scaleable

BIDS systems are built on resilient, industry leading computing platforms with Client-Server architecture and Open SQL DBMS. The modular and scaleable design of BIDS systems means they can be readily tailored to meet the exact needs for each project whilst assuring a path to future enhancement. With extensive interface and communications capabilities and support for every type and format of display technology BIDS systems deliver outstanding flexibility and performance in every department.

Timetable management

BIDS has comprehensive timetable management facilities based on a relational database which holds details of Operators, Services, Journey Routes and Destinations. The user friendly BIDS Operator application allows Master Timetables to be built from scratch, assisted by BIDS productivity features whilst the unique BIDS Conditions and Exceptions logic eases the task of defining journey exceptions for school and bank holidays and special occasions. The BIDS Scheduler automatically generates Operational Schedules which are derived from the master timetables and are used by the BIDS Display functions.

Data Import & Export

Although BIDS can operate in a totally standalone mode it is often a requirement to import timetable data from one or more external sources. This may be from a Registrations or Journey Planner Database, from one or more individual Bus or Coach operators or from real time information systems. BIDS anticipates this need with support for a range of data exchange standards including ATCO CIF, Trident and TransXchange. Imports can be scheduled to occur automatically every day or week as required and there are a variety of communications options including over the Internet using the BIDS FTP module.

Operator Workstations

The Operator Workstation provides access to all of the BIDS facilities. The BIDS GUI is sophisticated yet simple to use, combining friendly menu-driven operation with carefully selected use of colours, icons and controls and requiring only basic office IT skills.

In many systems there will be one or more BIDS Operator workstations provided within the Bus Station for the Station Manager and or for staff in a travel information office. BIDS Operator can also be provided at one or more remote locations either as well as or instead of users within the Bus Station. The Remote BIDS Operator may have extended permissions and can be provided with an on-demand dial-in access over ISDN or over an existing private network or can be implemented with an 'Always On' facility over the Internet.

Security

The BIDS Permissions System allows flexible assignment of view and edit rights to users. Controlled by PIN and Password, user permissions may be organized in groups and for individuals. It provides complete security so that users from different organisations can each manage their own timetables.

Operator facilities

Updates can be applied to services including those currently on display using the BIDS Progress Departure/Arrival function where simple radio button selections for Delay, Cancel, and Change Stand etc allow very rapid status changes which are reflected immediately on display.

RTPI Interface

BIDS is equipped to interface with RTPI systems so that estimated arrival times can be included with scheduled times on passenger displays. BIDS is compliant with UK RTIG standards.

Display Technologies

BIDS has on-board support for all display technologies including TFT and Plasma screens, LED and LCD boards.

Tel: +44 (0)1635 552011 | Fax +44 (0)1635 580864
Email: info@tandata.co.uk

Overview

Nexus Alpha is now engaged in the final phase of a complete redesign of its systems, a redesign that is taking our traditional approach several stages further: taking advantage of new technologies and creating new technologies of our own.

The intention is to provide a complete range of fully featured systems ranging from ultra low power devices suitable for solar/wind power up to the largest LCD and LED panels currently available. What's more, we have designed our systems so that custom solutions are relatively simple to create, not just in terms of the construction but also in terms of the displays and how the data is presented.

All systems share internal components, in particular computers and software, and hence can offer the customer an integrated package of systems serving a wide variety of needs.

All systems run the same highly specified software suite (Prometheus) which has been built from the ground up to cater for all potential requirements.
Nexus Alpha's new range of Information systems features:

• Common internal hardware (Hermes) thus providing an integrated and seamless system architecture
• Nexus Alpha's industry leading communications capability employing TCP/IP or GPRS as appropriate
• DDA compliance including natural audio with REACT triggers
• Exacting standards of strength (vandal resistance) and longevity
• Highly automated and integrated diagnostics and reporting
• Modular construction for simplified field maintenance

MORE...

HELIOS

HELIOS

Helios is a new range of highly specified high bright LCD panels. Please contact us for details and availability.

HELIOS LITE

Helios Lite is a widescreen LCD panel designed for internal use in areas where resilience is demanded and is the first of the range to reach production. Helios Lite may be built with a conventional X86 series SBC or with a Hermes unit according to requirements and use – the former is often a customer requirement where MS Windows is the preferred OS.

Helios Lite may also be modified easily to customer requirements and branded as required.

Helios Lite is currently being deployed as Drivers' Displays where its role is to show the safety information sent to them from the Tyrell systems in TOC Rail Control Centres. This application demands high reliability and exceptional confidence that the message is getting through - confidence that is delivered with Tyrell and Helios Lite.

However Helios Lite is equally at home wherever its understated design, versatility and robust construction is valued - earlier products of this type are in use in bus stations, hospitals and even embedded in bus shelters.

MORE...

MAIA

In its base configuration MAIA A is an audio only unit designed for minimal power consumption whilst retaining full information delivery. In common with all systems, MAIA features audio output based on natural speech. In the context of the transport industry, Nexus Alpha audio systems can handle an exceptionally wide range of disruption information as well as the more usual service running data.

MAIA AV (shown here) is fitted with a small low power LCD display (6.5” diagonal) which is powered on demand.

MAIA may be Solar/Wind powered or powered from night switched circuits. When communications are carried over GPRS, MAIA systems may be installed where no power is available and hence requires virtually no cabling.

MAIA may also be fitted with other items such as:

- Piezo keypad for interactive selection of information
- Help point with dial through to help desk

- Panic button with auto dial using GPRS modem
- Video camera for surveillance of immediate area (note: frame/data rates depend upon connectivity)

MAIA is an exceptionally flexible and elegant unit that is as comfortable in a modern station complex as it is competent to survive the rigours of remote locations.

FERROGRAPH

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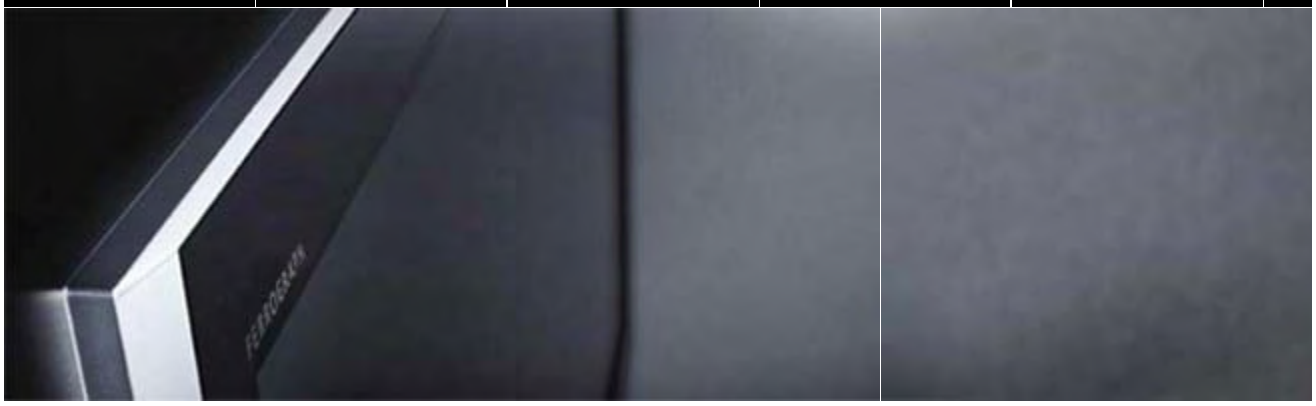

Products
Rail & Underground
Buses & Coaches
- Interchange Displays
- Shelter Displays
- On Vehicle Displays
- Digital Voice Announcer
- Freestanding TFT
- Low Power Displays
- Flag Displays
- Bus Stop Poles
Airports
Media & Advertising
Call Centre, Office & Banking
Installed solutions

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Latest News

Bus Stop Poles

Ferrograph is able to provide mounting poles for Bus applications, either in conjunction with, or separate to the provision of a Real Time Display.

The aluminium extruded pole offers a robust, modern pole, for mounting the Flag display, and when supplied complete with the display, offers a turnkey solution.

The gallows pole offers an alternative method of mounting the Bus Shelter display, allowing the option to provide a full size 3 line 30 character display in a location where a shelter is not installed. The optional sunhood offers further protection against the elements, and increases visibility.

Ferrograph is able to offer a bespoke design and build service for all display types and locations. This includes design calculations and the necessary approvals with architects and planners.

Contact Us for more technical information on this product.

FERROGRAPH

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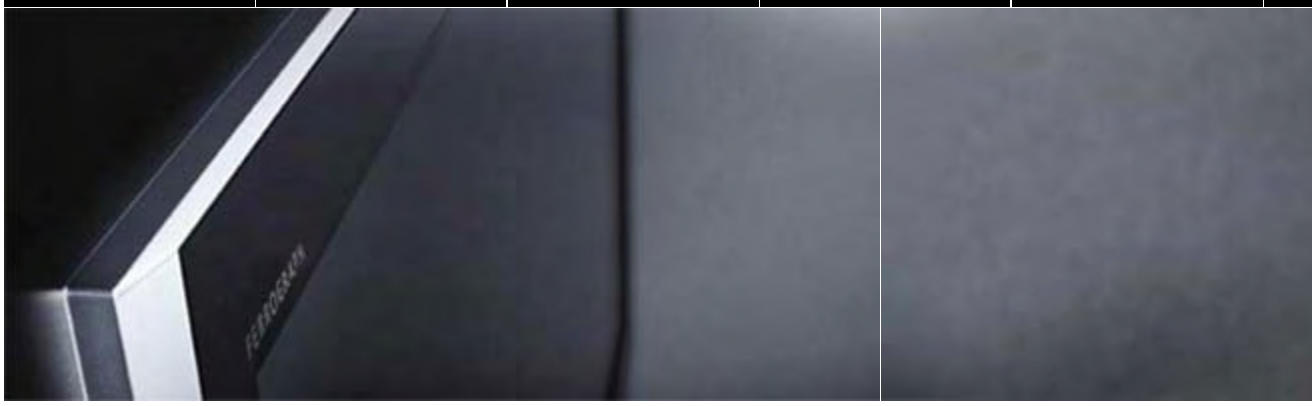

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Latest News

Interchange Displays

Ferrograph's LED Bus Interchange Displays are a family of products designed to offer clear passenger information to the travelling public, and to ensure efficient flow of passengers through the waiting areas of bus stations.

There are three products within the family:

Index Board is available with 18, 24 or 30 lines of 30mm high characters, with 60 characters per line.

Departure Board is available with 6, 9 or 18 lines of 30mm high characters, with 45 characters per line.

Head of Stand is available with 3 lines of 30mm high characters and with either 30 or 45 characters per line.

Each display incorporates ultra bright amber LEDs, with 9 pixel high characters, allowing full Disability Discrimination Act (DDA) compliance.

The extruded aluminium enlosures are sealed to IP65 which offers full protection against weather and vandalism.

A bespoke service is available for the design, manufacture and installation of supporting structures, giving a turnkey solution to the passenger transport authority or bus station owner / operator.

Contact Us for more technical information on this product.

APPENDIX B –
Scheduled Information Systems

- Tandata displays at Fife bus stations
- Tandata displays at Fife rail stations
- Nexus-Alpha displays (West Lothian, existing)
- Nexus-Alpha displays (West Lothian, due for implementation)
- Tandata display, Edinburgh Bus Station
- JMW displays, Dalkeith

Existing & Proposed Systems within SEStran

Eve route 120:
JMW Systems trial

Lothian Buses network:
theoretical ultimate extent of Bustracker RTPI system

Existing and Proposed Scheduled and Real-Time Passenger Information within SEStran Area