

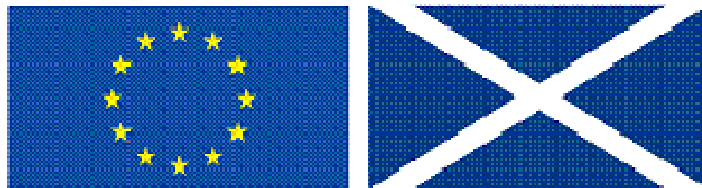


**Invitation to Tender for Supply, Delivery, Installation And  
Commissioning**

**of an**

**Automatic Vehicle Location  
and  
Real Time Passenger Information System**

**Phase 1**



**EUROPE & SCOTLAND**

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**SEStran**

**AVL/RTPI procurement**

**Specification**

**Date 08 June 2009**

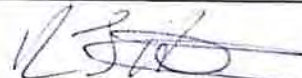
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**Document Control**

Project: AVL/RTPI procurement  
Client: SEStran  
Job Number: E06916-63  
File Origin: Projects\E06913-13\Specification\Specification.doc

Document Checking:

Prepared by: Richard Holland Signed: 

Checked by: Stuart Maxwell Signed: 

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Issue	Date	Status
1	08/06/09	Final
2		
3		
4		

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# Part One – Introduction

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# 1 Project overview

## 1.1 SESTRAN - A REGIONAL TRANSPORT PARTNERSHIP

1.1.1 SEStran (South East Scotland Transport Partnership) is one of seven Regional Transport Partnerships (RTP) in Scotland, set up by the Transport (Scotland) Act 2005, with an initial remit to develop a Regional Transport Strategy (RTS). The main purpose of the RTS is to provide a framework which will guide the future management of, and investment in, transport for the SEStran area over the next 10-15 years. SEStran contains eight constituent council areas – City of Edinburgh, Clackmannanshire, East Lothian, Falkirk, Fife, Midlothian, Scottish Borders and West Lothian. The partnership covers an area of 3,180sq miles and is home to 28% of Scotland's population. Further information about SEStran can be found on its web site at <http://www.sestran.gov.uk/>.

1.1.2 The regional and local authority partners in the system are therefore:

- South East Scotland Transport Partnership (Lead partner);
- City of Edinburgh Council
- Fife Council
- East Lothian Council
- Midlothian Council
- West Lothian Council
- Falkirk Council
- Clackmannanshire Council
- Borders Council

1.1.3 The European Union are also a significant project partner. Matched funding for Phase 1 has been secured from the European Regional Development Fund (ERDF) Priority 4 Rural Programme. Funding is specifically targeted at East Lothian and Scottish Borders, the focus of Phase 1 activity. There is, however, recognition that the funding is contributing to a regional platform which will ultimately deliver fleet management and real-time passenger information across the SEStran area. There may be opportunities to secure further EU grants to support the subsequent system roll-out. Such opportunities will be enhanced by successful delivery of Phase 1.



## 1.2 POLICY CONTEXT FOR PROVIDING REAL-TIME PASSENGER INFORMATION

1.2.1 The SEStran area covers a diverse range of geographical locations from the highly urban, in Edinburgh city centre, to the rural Borders. The SEStran area is growing rapidly, both in economic and population terms. A principal aim therefore of the RTS is to promote a programme of transport policies and measures which will accommodate this growth, by providing a transport system which allows the economy to function efficiently, without adversely affecting the environment. The means to do this will primarily be through improvements to public transport, which will enhance the range, quality and reliability of public transport available in the area.

1.2.2 Providing real time information (RTI) at rail stations, and at interchanges and major bus stops in SEStran area, including rural areas is included in the RTS as Topic 27. The RTS notes that although RTI does not directly meet many of the RTS objectives, it does contribute significantly to the quality of public transport.

## 1.3 EXISTING SITUATION REGARDING PUBLIC TRANSPORT INFORMATION

### Real-time passenger information schemes

1.3.1 The City of Edinburgh Council BusTracker system is the dominant real-time and AVL system within the SEStran area. The system is used only by Lothian Buses and is approaching full-fleet coverage across their whole operational area. There are no other bus operator partners in the system.

1.3.2 BusTracker sign installation is ongoing throughout the Edinburgh area and in East Lothian and Midlothian, where Lothian Buses are a major operator. The City of Edinburgh Council radio network coverage reaches these areas and is therefore capable of driving the required signs. TFT screens are also being installed at key locations in Edinburgh. The system includes bus priority facilities.

1.3.3 There are other real-time passenger information schemes in Glasgow, Dundee and the North East of England.

### Bus station systems

1.3.4 **Fife Council** has a bus station information system which was supplied by Tandata (BIDS). Signs are located at Glenrothes, Leven, St Andrews Kirkcaldy and other locations described in Appendix E.



1.3.5 There is also a BIDS system in place at St **Andrews Square Bus Station**, Edinburgh. Display screens 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.

1.3.6 **West Lothian Council** has a scheduled bus station departure system supplied by Nexus Alpha. 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 and MacArthur Glen Shopping Complex, St Johns Hospital and Livingstone North Railway Station. Other locations are included at Appendix E. The system provides scheduled information for the next 6 departures from individual stances showing service number, destination and scheduled departure time.

## 1.4 OVERVIEW OF STAKEHOLDER ASPIRATIONS

### SEStran and Local Authority Stakeholders

1.4.1 SEStran and the local authority partners are seeking to promote public transport through the successful delivery of a robust and reliable RTPI system and effective fleet management tools.

## 1.5 BUS OPERATORS

1.5.1 The system is open to all regional bus operators. The biggest operators in the area covered by scheme include:

- First in Edinburgh
- Stagecoach East Scotland
- Munro’s of Jedburgh
- E&M Horsburgh (provisional)
- Lothian Buses

1.5.2 The various bus operator partners have significantly different aspirations for the AVL/RTPI system which could affect the choice of on-bus equipment and workstation functionality.

### Lothian Buses

1.5.3 Lothian Buses Plc is the largest municipal bus company in the United Kingdom and the largest provider of bus services in Edinburgh, Scotland. It also serves parts of East Lothian and Midlothian. Lothian Buses plc operates the majority of daytime bus services in Edinburgh,



extending to outlying suburbs, towns and villages. The central depot is located on Annandale Street, Edinburgh. Lothian Buses is the only municipally owned bus company in Scotland, being 91% owned by the City of Edinburgh council and the remainder by the councils in East Lothian, Midlothian and West Lothian.

- 1.5.4 Services operated by Lothian Buses are covered by the existing BusTracker AVL/ RTPI system. Lothian Buses may however choose to adopt or utilise some systems or functionality delivered under this (SEStran) scheme. In addition they have an interest in the exchange of data and information between the SEStran and BusTracker schemes.

#### First in Edinburgh

- 1.5.5 First Edinburgh Ltd operates in south east and central Scotland and is part of First Group plc. The company operates across the central, eastern and borders regions of Scotland and into northern England. The regional company is titled First in South East & Central Scotland and has its headquarters at Tarbert, Falkirk. The regional company has a fleet of over 420 buses. The main depots for buses operating around Edinburgh are at Livingston and Linlithgow. The company also operates services in Scottish Borders with a depot at Galashiels and out-stations at Eskbank/Dalkeith and North Berwick.
- 1.5.6 First use 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. First require that any interface with an AVL/RTPI system must be automated, and stressed that they would assist wherever possible in promoting this aspiration.
- 1.5.7 First in Edinburgh has in place a modern MPT1327 trunked voice radio system covering operations in from the Livingstone and Linlithgow depots. It also voice communications covering other depots. It is not however possible to patch calls from one system through to the other. First aspires to have a single communications system through any vehicle can be contacted. First is upgrading its life expired radio system.
- 1.5.8 First is keen to implement the vehicle location and control elements of the AVL/RTPI system.





### Stagecoach East Scotland

- 1.5.9 Stagecoach East Scotland is an operating region of Stagecoach UK Bus, with its regional base in Cowdenbeath, Fife. Stagecoach in Fife is used for services throughout the kingdom of Fife and beyond to Dundee and Edinburgh. The depots for Stagecoach in Fife are at Glenrothes, Dunfermline, and Cowdenbeath.
- 1.5.10 Stagecoach is implementing a Trapeze scheduling and rostering system which will be all-stops compliant. This will give Stagecoach the opportunity to exchange data using the TransXchange data protocol.
- 1.5.11 Stagecoach East Scotland does not presently have voice communications with its vehicles. It is also less convinced about the benefits that a highly functional vehicle location and control system will add to their more rural, inter-urban operation. Stagecoach values historic location data for use in off-line analysis of schedule adherence and timetable planning.
- 1.5.12 Stagecoach are fitting their entire fleet in Scotland with ERG ticket machines which could be used to collect location information although the necessary GPS functionality has not been implemented. Nationally, Stagecoach is also concerned about the burden imposed by in-vehicle RTPI hardware when cascading vehicles throughout the country. The ideal scenario for Stagecoach is to minimise on-vehicle systems and the hardware transfer implications. Details of the ERG ticket machines are included in Appendix G.
- 1.5.13 Although Stagecoach aspires to a lower level of functionality than other bus operators in the scheme, they have not excluded adding a “traditional” on-bus unit and voice radio capability to their East Scotland fleet. The final decision will be based on an assessment of:
- The relative costs of alternative options and fleet management tools being offered
  - The burden imposed when transferring vehicles
  - The extent to which a “ticket machine based” system undermines the quality and reliability of RTPI information.

### Munro’s of Jedburgh

- 1.5.14 Munro’s operates from its garage in Jedburgh and provides services in and around the town. The fleet includes approximately 40 vehicles, not all of which are involved in stage carriage operation.



## E&M Horsburgh

- 1.5.15 E&M Horsburgh is a coach hire company that operates a small number of services, of which the most significant in terms of vehicle numbers is the Edinburgh airport shuttle. The fleet numbers approximately 90 vehicles, not all of which are involved in stage carriage operation.



## 2 System overview

### 2.1 KEY OBJECTIVES OF THE AVL/RPTI SYSTEM

2.1.1 The key objectives of the system and auxiliary components are to:

- Provide reliable real-time information to passengers through a variety of systems and communications media e.g. signs, web and mobile applications, and interactive voice response;
- Provide a voice and data communications platform;
- Enable real-time management of bus service delivery;
- Enable bus priority at traffic signals;
- Promote SEStran as regional transport authority;
- Provide a comprehensive fleet management system to improve operational efficiency and provide a historical database for statistical analysis;
- Provide a comprehensive public transport database for future studies and research;
- Provide public transport information;
- Provide an expandable vehicle location and real-time information system that is integrated with:
  - the existing “Bus Tracker” system in Edinburgh;
  - bus station departure information systems in Fife, West Lothian and Edinburgh; and
  - the SEStran RouteWise database;
- Enable statistical analysis of bus running times and schedules; and
- Provide information to drivers to aid timekeeping.

### 2.2 SYSTEM ARCHITECTURE

2.2.1 The system will be modular. Interfaces between components will use open standards in accordance with emerging national and European standards.

2.2.2 The potentially differing requirements of the system partners must be accommodated e.g. in terms of fleet management functionality.



2.2.3 The system must accommodate the commercial confidentiality of bus operating companies. The system will secure access for a number of different users, firewalls where necessary and must accommodate the need for some data to be treated as commercially confidential.

2.2.4 The key system components are expected to be:

- Real-time information to passengers through on street displays and personal media;
- On-bus unit to detect and report vehicle location and display driver information;
- Cost effective and efficient voice and data communications;
- A core system with remote workplace terminal(s) and other servers as necessary to manage vehicle control and data transfer;
- Traffic signal priority system(s);
- Efficient and reliable upload of relevant data;
- A comprehensive statistical analysis package and maintenance analysis.

2.2.5 The required functionality of the key components are described in more detail below.

#### Passenger information

2.2.6 The system will deliver real-time passenger information via a number of channels including . new and existing roadside and interchange electronic displays, through the internet, and mobile devices such as mobile telephones and smartphones.

2.2.7 A variety of display types and technologies will be utilised including:

- New displays at bus stops (with and without passenger shelters);
- New displays at interchanges;
- New displays at other key locations (to be confirmed);
- Existing City of Edinburgh BusTracker displays; and
- Existing displays at interchanges.

2.2.8 In addition to the range of sign types specified in Part Three, the Purchaser requires the flexibility to add further signs from other suppliers with minimal integration costs. The specification therefore explores a range of communications carriers and protocols.



- 2.2.9 The rural nature of some parts of the area to be covered by the system may require innovative solutions for the provision of information on-street. Solar power and other low power sign options are therefore desired within the sign portfolio.
- 2.2.10 The system will have its own dedicated web site from which real-time passenger information may be obtained. Suppliers should include prices for both a generic web-site and one customised to meet SEStran’s specific requirements. The web site will be capable of disseminating real-time passenger information to hand held mobile devices including mobile telephones and emerging devices such as smartphones. Proposals should include options for an interactive voice response service.
- 2.2.11 Tenderers should clearly state the channels through which real-time passenger information will be delivered and the associated costs of sending and receiving such information.
- 2.2.12 Tenderers may include further information dissemination methodologies that are not mentioned above if such methodologies will assist in delivering the objectives of the system as described above.

#### On-bus equipment

- 2.2.13 Buses will be fitted with a vehicle location determination capability. The various bus operators have differing aspirations regarding the functionality required of on-bus systems and a number of options are therefore included in this tender with regard to on-bus equipment.
- 2.2.14 It is important to stress, however, that the stakeholders are not committed to a particular solution at this stage. Tenderers must therefore comment on the features and facilities they are prepared to offer and any perceived advantages or disadvantages, particularly in relation to the reliability and robustness of fleet management data and RTPI predictions.
- 2.2.15 Note that accurate and timely traffic signal bus priority requests are required in all on-bus scenarios.
- 2.2.16 As a variety of on-bus unit configurations may be selected by the bus operator stakeholders, tenderers must clearly state:
  - Their preferred on-bus architecture in relation to the differing stakeholder aspirations;
  - Which architectures they can provide and support within a single system;



- The accuracy and robustness of the option or options they are willing to supply under this tender; and
- The advantages and disadvantages of the various options they are willing to supply under this tender including stated performance levels.

2.2.17 It is also essential that the Tenderer identify and assess any risks regarding the quality, reliability and robustness of real-time passenger information outputs before committing to a system specification.

2.2.18 This issue is critical to SEStran and their stakeholders as they want to achieve high levels of customer satisfaction. In addition, to ensure public perception of the existing BusTracker system is not undermined, City of Edinburgh Council and Lothian Buses will only accept real-time passenger information outputs from the SEStran system for onward transmission under the BusTracker brand if they are shown to be reliable and robust.

2.2.19 Depending on stakeholder requirements, the on-bus equipment may display information in the vehicle cab to inform drivers when they are running ahead or behind schedule. This may be provided through the on-bus unit, the ticket machine or by other means.

#### Voice and data communications

2.2.20 A cost effective and efficient area wide voice and data communications platform is required. An analysis of the communications requirements for this system carried out by WYG recommended the use of a trunked MPT 1327 Private Business Radio network, augmented by GPRS in rural areas such as the Scottish Borders. Tenderers are permitted to suggest alternative arrangements. However any such alternatives must be accompanied by a full financial analysis and statements on levels of reliability and availability that would be achievable.

2.2.21 First in Edinburgh has offered its new MPT 1327 radio mobiles and base stations for use in this project. Section 6.1 describes the options that should be explored in terms of the trunked radio system. Tenderers must therefore include a costed option which utilises re-usable elements of the First system which may be transferred to SEStran ownership for multi-operator use as part of wider bus operator agreements. If it is not possible technically to re-use elements of the First system this should be stated.



- 2.2.22 The communications system should be capable of routing voice and data traffic in the most economically effective way. Any GPRS contracts proposed within the tender must be at rates equal to or more advantageous than the national contract rates negotiated by RTIG.
- 2.2.23 As the voice and data communications network will potentially be used by multiple operators, it extremely important to ensure the confidentiality. The system must ensure data is suitably secured and that communications cannot be listened in to without authorisation. The requirement for confidentiality extends to the schedule data input to the system.
- 2.2.24 It is essential that a failure of hardware, data management or administration procedures within one stakeholder’s operational area must not disrupt other stakeholders’ systems or procedures. The potentially differing requirements of the system partners must still however be accommodated e.g. in terms of service management functionality.
- 2.2.25 Tenderers must ensure that all necessary licences are obtained and provide operational cost models for the initial system and future expansion.
- 2.2.26 Bearing in mind the dispersed nature of the stakeholder sites and the requirement to use a server farm to host the system, it is essential that the system architecture minimises the revenue cost of the entire communications network (including any leased lines, virtual private networks (VPNs), microwave links, GPRS and 3G services, site share agreements, maintenance costs).
- 2.2.27 Tenderers should highlight any high capacity network links which could be utilised by other stakeholders outwith the RTPI project. Tenderers must clearly identify the communications capacity requirements of each system option.
- 2.2.28 The Tenderer is responsible for communications costs until satisfactory completion of an agreed Site Acceptance Test schedule and issue of an Interim Take-over Certificate. Satisfactory completion of an agreed Site Acceptance Test schedule and issue of an Interim Take-over Certificate will trigger the third milestone payment described in the Conditions of Contract.

#### Core system

- 2.2.29 It is expected that the core system will be located on a server farm. Bus operators will have remote workplace terminals that deliver service monitoring and control functionality. Suppliers must clearly identify any core system software or hardware or communications system thresholds which will arise during the expansion process.



- 2.2.30 The system will require efficient and reliable upload of bus network data from third party scheduling and bus service registration systems. It is expected that data will be furnished directly from the major bus operators' scheduling systems, which are Trapeze and Omnitimes. It is expected that data for small operators' services will be imported from the SEStran RouteWise database.
- 2.2.31 Vehicle location data will be transmitted to the core system as required. A cost effective and efficient means of data upload and download between the control centre and any on-bus computer is required. It is expected that this will be achieved through wireless local area networks in the bus garages.
- 2.2.32 A link is required to the City of Edinburgh Council BusTracker RTPI system which covers Edinburgh and the operational area of Lothian Buses. Real-time passenger information will be exchanged and displayed on existing BusTracker signs, and the arrival times for buses on the BusTracker system will be the displayed on relevant SEStran road-side displays. It is essential that the operational integrity of the existing BusTracker system is not undermined, technically or in terms of the quality of real-time information displayed.
- 2.2.33 Note also that real-time data feeds are also required to the bus station systems in West Lothian, Fife and St Andrews Square, Edinburgh.

#### Bus priority

- 2.2.34 The system will enable priority to be given to buses at traffic signals.

#### Reporting, statistical analysis and maintenance analysis

- 2.2.35 The system must have sufficient reporting functions to fulfil the requirements of the Traffic Commissioners, and to enable analysis of schedules. A variety of statistical reports is required to enable operators to comply with the requirements of the Traffic Commissioners, and to enable more the development efficient and effective schedules. The system should let users define their own reports, and permit the analysis of historical data without affecting the operational performance of the system. The system must permit the analysis of particular times and services without the need to retrieve archived data.
- 2.2.36 A computerised monitoring system must be included in the system which can alert the system manager when maintenance and fault rectification is required.





## 2.3 SCOPE OF ULTIMATE SYSTEM

2.3.1 The ultimate system will cover the whole of South East Scotland and all operators. The main characteristics of the potential ultimate system are shown in Table 1. Suppliers should explicitly detail any thresholds for their system where additional servers or licences would be required in moving from the Phase 1 implementation to the ultimate system. Note however that the system will be delivered in phases. Phase 1 aims to deliver a significant real-time passenger information system across South East Scotland whilst building the platform for future expansion. This will be achieved by:

- Delivering a communications platform to cater for Phase 1 and future expansion;
- Installing a core AVL system to cater for Phase 1 and the ultimate system;
- Fitting complete bus operator depots with AVL equipment and fleet management tools – maximising the local impact and minimising vehicle allocation difficulties for the bus operator;
- Integrating existing scheduled information with real-time information signing systems;
- Early delivery of a WWW and mobile web service; and
- Selective implementation of RTPI signs at busy stops.



**Table 1: Ultimate system requirements**

Facility		Ultimate Requirements under this Contract
RTIS system	Core System Hardware / Software (on server farm)	1
	Workstations (varying functionality)	33
	Information server	1
	Web site	1
	WAP interface	1
	IVR interface	1
	Buses equipped with AVL	1000
	Bus priority facility at traffic signals	150
	Real-time onformation signs	600
	Service Interface for Real Time Information (SIRI)	8
Database Capacity	Bus stops	10,000
	Buses	1,100
	Bus operators	4 ops + SEStran hosting facility for numerous "small ops"
	Bus Services (with up to 10 schedules per service)	1000
	Chainages / Stops per chainage	Tenderer to confirm limits / thresholds
Additional Analysis Software		Tenderer to detail their capabilities

2.3.2 In principle, partially equipping depots is considered undesirable. However, where an important route is served from multiple depots, sufficient vehicles will be equipped in the secondary depot to meet the PVR (with an appropriate allowance for spare vehicles). Table 2 shows the fleet numbers in relevant depots. Note that as the system will be delivered in a number of phases, not all depots will be included in Phase 1.

**Table 2: Depots and vehicles**

Candidate Operator / Depot	Buses to be equipped	Phase 1	Later Phases
<b>FIRST</b>			
Eskbank/Dalkeith	62	50	12
Musselburgh (incl N Berwick)	51 (incl 10 at N Berwick)		51
Livingston	68		68
Galashiels	53	52	
Balfron / Bannockburn	77		77
Larbert	76		76
Linlithgow	34		34
<b>Stagecoach</b>			
Aberhill	76		76
Glenrothes	71		71
Cowdenbeath	62		62
Dunfermline	75		75
St Andrews	29		29
Perth	79		79
<b>Others</b>			
Munro's Jedburgh	43	38	5
E & M Horsburgh (provisional)	80		80
Minor operators	164		164
<b>TOTAL</b>		<b>140</b>	<b>1000</b>

## 2.4 EXPANSION AND MODULARITY

2.4.1 The system must be modular allowing easy expansion of both capacity and functionality with interfaces between components using open standards where these are available and in accordance with emerging national and European standards. Suppliers must supply a schedule summarising the standards and data formats applicable to the various components of their system.

2.4.2 The system shall be scalable accommodating expansion through its modular design. Suppliers must clearly identify any "system expansion" thresholds requiring significant modification to the design philosophy, architecture, communications network, core system servers, software licences etc.



- 2.4.3 The system should include provision for addressing components and interfacing with other systems using Internet Protocol (IP).
- 2.4.4 Common industry standards (e.g. the use of standard connectors etc) must also be employed wherever possible.
- 2.4.5 All equipment supplied shall comply with the latest edition of the relevant British Standard and "Electricity at work" Regulations. The design and method of installation and maintenance must meet the above regulations.
- 2.4.6 References to UTMC shall mean the DfT initiated Urban Traffic Management and Control (UTMC) programme. UTMC Specifications shall be those specifications issued by DfT (and predecessors) through the UTMC programme. The primary specifications applicable shall be TS003:2005 (The UTMC Framework Technical Specification).
- 2.4.7 Suppliers must indicate whether or not they are active members of the 'Suppliers Forum' promoted by the RTIG with the aim of agreeing data exchange protocols. Suppliers must explain how migration to common protocols will be managed, the implications on the system hardware and software being offered and the costs, which will be incurred. A commitment to free or low cost migration is obviously advantageous.
- 2.4.8 The RTI system must be designed with due regard to emerging national standards which are described in the following documents issued by the Real Time Information Group (RTIG) and others:
- National RTPI Strategy;
  - Outline Requirements Specification for Real Time Public Transport Information Systems (issued by RTIG Technical Sub-Group);
  - Communications Requirements (issued by RTIG Technical Sub Group);
- 2.4.9 Tenderers should note the proposed use of other relevant standards including:
- SIRI;
  - TransXchange; and
  - Electronic bus service registration (EBSR).



## 2.5 PERFORMANCE

- 2.5.1 The system and its components shall be capable of normally running unattended and be capable of supporting the delivery of an operational service 24 hours per day, 365/366 days per year.
- 2.5.2 The Tenderer shall clearly state within the Tender response the expected Mean Time Between Failure (MTBF) of the system and its component hardware and software applications. The statement shall include a description of those maintenance/management tasks that will result in a total or partial loss of service; their expected frequency, duration and the resultant expected overall system availability.
- 2.5.3 The Tenderer shall state any reduction in performance or other adverse effects that may occur as a consequence of expanding the system.
- 2.5.4 It is the Tenderer's responsibility to make the Purchaser aware of any enhancements that become available in RTPI during the contract period. This will be in the form of a written document, supplied to the Purchaser at, a minimum of, yearly intervals.

### 3 Phase 1 implementation

3.1.1 Phase 1 will see the installation and commissioning of the core system, on-bus equipment, depot equipment, some communications equipment and AVL workstations. Phase 1 will be focussed in geographic terms on East Lothian and Scottish Borders and the its scope of Phase 1 is detailed in Table 3. The exact number, location and types of electronic displays will be agreed during a Joint Design Exercise in conjunction with the stakeholders.

**Table 3: Phase 1 requirements**

Facility		Phase 1 Requirements under this Contract
RTIS system	Core System Hardware / Software (on server farm)	1
	Workstations (varying functionality)	15
	Information server	1
	Web site	1
	WAP interface	1
	IVR interface	0
	Buses equipped with RTIS On-bus Unit (including GPS receiver)	140
	Bus Priority Facility at Traffic Signals	1
	Real-Time Information Signs	68
	Service Interface for Real Time Information (SIRI)	4
Database Capacity	Bus Stops	10,000
	Buses	1,100
	Bus Operators	3 ops + SEStran hosting facility for numerous "small ops"
	Bus Services (with up to 10 schedules per service)	1000
	Chainages / Stops per chainage	Tenderer to confirm limits / thresholds
Additional Analysis Software		Tenderer to detail their capabilities



3.1.2 The principle public transport operators partners in Phase 1 of the system are expected to be:

- First in Edinburgh
- Munro’s of Jedburgh

3.1.3 Note that participation Munro’s of Jedburgh remains provisional. Vehicles from these fleets will be equipped with equipment from the float. The exact distribution of depots and buses to be equipped will be confirmed in the Joint Design Exercise (see Section 9).

## 3.2 OBJECTIVES OF PHASE 1

3.2.1 Phase 1 aims to a deliver a significant real-time passenger information system across the SEStran area whilst building the platform for future expansion. This will be achieved by:

- Delivering a communications platform to cater for Phase 1 and future expansion;
- Installing a central system platform to cater for Phase 1 and the ultimate system;
- Fitting complete bus operator depots with AVL equipment and fleet management tools in order to maximise local impact and minimise vehicle allocation difficulties for the bus operator;
- Integrating with existing scheduled and real-time information signing systems throughout the SEStran area in order to maximise RTPI visibility at key network locations and add value to previous public sector investment;
- Early delivery of a web and mobile services to make real-time information accessible at all stops in both rural and urban areas; and
- Selective implementation of RTPI signs at busy stops.

## 3.3 PHASE 1 BUS DEPOTS AND FLEET NUMBERS

3.3.1 Vehicles will be fitted out on a depot by depot basis to ensure important routes are fully RTPI equipped. Table 2 (above) shows candidate depots for Phase 1.

3.3.2 In principle, partially equipping depots is considered undesirable. However, where an important route is served from multiple depots, sufficient vehicles will be equipped in the secondary depot to meet the peak vehicle requirement (PVR) with an appropriate allowance for spare vehicles.



### 3.4 PHASE 1 INFORMATION STRATEGY

3.4.1 The priority for phase 1 of the system is to maximise the re-use of existing display hardware and to promote access through the web and mobile devices.

#### Integration with existing signing systems

3.4.2 It is required in Phase 1 to provide real-time passenger information to the following systems which include over 300 real-time signs:

- The City of Edinburgh Council & Lothian Buses' "BusTracker" RTPI system
- 

#### Web & mobile services

3.4.3 Phase 1 also includes the delivery of web and mobile services to maximise the impact of the bus fitting investment making real-time information accessible at stops throughout both rural and urban areas. Integration with the BusTracker system and associated web site also ensures delivery of information about "SEStran" bus operators' services to established BusTracker users in and around Edinburgh.

#### New SEStran RTPI signs

3.4.4 Phase 1 includes a number of new "SEStran" RTPI signs to provide a visible SEStran RTPI presence on-street, particularly in areas which are not covered by the existing systems listed above. The exact sign numbers and locations are to be agreed with Local Authority Partners and confirmed prior to Contract award.





## 4 Management and maintenance of the system

- 4.1.1 The System Partners intend to enter into a partnering agreement. This will define the Roles and Responsibilities of the various stakeholders and their obligations to co-operate with the successful Supplier to enable them to fulfil their contractual obligations.
  
- 4.1.2 The potential scope of the system is detailed above. The system supplied must support modular expansion to the prescribed limits. Suppliers must clearly identify any core system software or hardware or communications system thresholds which will arise during the expansion process. Examples of such thresholds include points at which additional workstations or servers may be required. Expansion costs associated with such thresholds must be identified.
  
- 4.1.3 The Supplier should provide quotations for the maintenance of all system components and define the level of maintenance cover being offered. This must include software support and a telephone help-desk facility accessible to all local authority and operator stakeholders. Also included should be detail of any initial warranties provided with the proposed equipment. The Supplier must describe how their system will cater for 24hr, 7 days per week operational requirements in respect of critical components and software.

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## Part Two - Instructions and general information

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# 1 Instructions for tendering

1.1.1 Tenders must be submitted in accordance with the following instructions. Tenders not complying with these instructions in any particular may be rejected.

## 1.2 TENDER INSTRUCTIONS

1.2.1 Prospective tenderers shall ensure that they are fully familiar with the nature and extent of the obligations to be accepted by them if their tenders are accepted.

1.2.2 Should any prospective tenderers be in doubt as to the interpretation of any part of the contract documents, they should contact the individuals nominated below. Any queries arising from the tender documents, which may have a bearing on the offer to be made, should be raised as soon as possible, in writing, to the following address. E-mail queries are acceptable. Queries will not be accepted after 31st August 2009.

For Tender Procedural Enquiries	For Technical Enquiries
Mr Ian Mathie	Richard Holland
First Floor, Hopetoun Gate, 8b MacDonald Road, Edinburgh EH7 4LZ E mail <a href="mailto:ian.mathie@sestran.gov.uk">ian.mathie@sestran.gov.uk</a>	WYG TRANSPORT PLANNING 2 St James Gate, Newcastle Upon Tyne, NE1 4AD E mail <a href="mailto:richard.holland@wyg.com">richard.holland@wyg.com</a>

1.2.3 Your tender submission should include all relevant certificates and schedules attached to this document, all completed and duly signed where necessary.

1.2.4 It is the responsibility of prospective tenderers to obtain for themselves at their own expense any additional information necessary for the preparation of their tenders.

1.2.5 All information supplied by the Partnership in connection with this invitation to tender and the tender documents must be treated as private and confidential. Tenderers must not disclose the fact that they have been invited to tender or release details of the tender document, other than on an "In Confidence" basis to those who have a legitimate need to know or whom they need to consult for the purpose of preparing the tender.

1.2.6 The attached documents are and shall remain the property of the Partnership and shall be returned with the tender and, if no tender is submitted, upon demand.

1.2.7 Tender prices are to be in pounds sterling and exclusive of VAT. Although Value Added Tax will be paid at the current rate, prices quoted should exclude tax.

1.2.8 All corrections made using correction fluid must be initialled and signed.



- 1.2.9 Tenderers will be required to demonstrate their ability to provide the service. In particular, tenderers will be required to submit an outline programme giving details of their proposed operational structure and details of the way they will organise their workforce to carry out the Service. Such information will be provided as part of the submission but may also be subject to changes following discussions and agreement with the Purchaser prior to and/or after the award of tender.
- 1.2.10 Unless otherwise stated, all documents requiring a signature must be signed by a Director and/or the Secretary of the company, or such person being duly authorised for that purpose.
- 1.2.11 The Partnership is not bound to accept the lowest or any tender submitted. In evaluating the tender, the Partnership will evaluate it with an overall emphasis to Best Value for the Partnership.
- 1.2.12 Tenders must remain open for acceptance for a period of 6 months from the return date.
- 1.2.13 The tender document should be written in English.
- 1.2.14 For the convenience of tenderers, an electronic version of this Invitation to Tender document will be provided.



## 2 Format of the tender documents

2.1.1 The tender shall be submitted in two parts, a Financial Proposal and a Quality Proposal.

### 2.2 FINANCIAL PROPOSAL

2.2.1 The **Financial Proposal** must be made on the Bill of Quantities incorporated in the tender documents. The tender document must be signed on the appropriate page (at front of document) by the Tenderer and submitted with the Bill of Quantities, which must be fully priced and totalled in ink.

2.2.2 Unit rates and prices and extensions must be quoted in Pounds and whole pence to two decimal places. The terms "nil" and /or "-" are not to be used, but should be indicated as £0.00.

2.2.3 Figures **MUST** be inserted against each item to be carried forward in the Bill of Quantities. The tender documentation describes a number of options. Where the Bill of Quantities includes an optional item this has been clearly identified as not to be included in the overall price. Before a contract is awarded, the Purchaser will write to any tenderer whose tender has required arithmetical adjustment.

2.2.4 The Purchaser does not bind itself to accept the lowest or any tender and reserves the right to accept any tender in whole or in part. Tenders **MUST** remain open for acceptance for a minimum of 6 months from the tender return date. Tenders are accepted on behalf of the Purchaser by the issue of a Letter of Acceptance.

2.2.5 The Financial Proposal must be submitted in a separate sealed envelope (or equivalent) within the tender package.

### 2.3 QUALITY PROPOSAL

2.3.1 Tenderers must submit with their tender a **Quality Proposal** which describes the system being offered and how the project will be managed. The Quality Proposal must:

- a. Provide a technical method statement addressing the key specification, installation and project management issues detailed in the following sections of the tender document. This must include:
  - i) the proposed / preferred system architecture together with appropriate notes outlining why this is considered to be the optimum solution
  - ii) relevant comments on alternative system architecture options either specified in the tender document or considered and rejected by the tenderer



- iii) details of all hardware and software (including sign types)
- iv) the proposed communications system(s) including details of additional base stations and radio-communications licences etc and necessary modifications to existing systems
- v) any other relevant information
- vi) a completed tender checklist (Appendix J)
- b. provide software and hardware licensing details (Appendix A)
- c. provide 3 years audited accounts
- d. provide project management proposals (in accordance with section 17)
- e. Provide the following information of “Reference Sites”:
  - i) Provide brief details of 10 operational RTPI / fleet management systems supplied by the tenderer including relevant contact details within public transport operators and local authorities / Passenger Transport Executives. The reference sites should be similar to the proposed SEStran system as far as possible. Tenderers with fewer than 10 operational systems should list all of their existing RTPI systems with relevant contact details.
  - ii) Provide a single nominated “reference” site, which may be visited, if required, during the tender assessment process. Appropriate contact details must be provided.

2.3.2 The Quality Proposal, which shall make no reference to costs or prices, shall also be signed in ink and submitted in a separate sealed envelope (or equivalent) within the tender package.

2.3.3 Variants to the tender are acceptable but only as an alternative submitted together with a tender submitted strictly as per applicable conditions of contract and specifications. Tenderers wishing to submit a tender based on an alternative design must ensure that it is accompanied by sufficient information to enable a full assessment of its acceptability. To assist tender preparation and assessment, a checklist has been provided. This highlights the various specification clauses. Tenderers must state whether their system is fully compliant, partially compliant or non-compliant. A checklist is provided as Appendix H (in MS Excel format).

2.3.4 Tenderers should note that tenders and supporting documents must be written in English

2.3.5 To assist the Purchaser in the tender evaluation it is preferred that the Tenderer structures the Quality Proposals using headings similar to those in Part Four of this specification.





### 3 Tender return

3.1.1 Your tender should be submitted by post or by hand. The tender return label included in the tender documentation should be included in the package.

3.1.2 Tenders must be returned to:

SEStran

First Floor, Hopetoun Gate

8b MacDonald Road,

Edinburgh, EH7 4LZ.

3.1.3 Your tender should consist of at least the following hard copy:

- Covering letter;
- SEStran tender return label;
- Quality proposal;
- Financial Proposal;
- Bill of Quantities (to be signed on every page);
- Certificate of Insurance (to be signed as required);
- Tender Certificate (to be signed as required);
- Tender Declaration (to be signed as required);

3.1.4 Note that electronic versions of the Certificate of Insurance, the Tender Certificate and the Tender Declaration are included with this specification at Appendix I. They should be printed out, completed and signed.

3.1.5 Each set of hard copy tender documents should include a copy of the following electronic files on read-only media identified with the Tenderer's company name and the project name (SEStran RTPI Phase 1).

- Quality proposal as Adobe portable document format file;
- Bill of Quantities in Excel format as supplied with tender documentation as Adobe portable document format file;



- Compliance checklist in Excel format as supplied with tender documentation and as Adobe portable document format file;

3.1.6 Tenderers must supply five sets of hard copy material and one copy of the relevant files on read-only electronic media.

3.1.7 Tenderers should parcel or package the tender in a secure manner and attach the tender envelope to the front of it. It is not acceptable to send the data in an unsecured box, case, bag or separately in unsecured ring binders or lever arch files. Technically, in such cases, a tender is non-compliant and may well be rejected on those grounds.

3.1.8 No marking or means of identification shall be on the outside of the parcel.

3.1.9 Tenders received after the closing date and time shall not under any circumstance be opened or considered.

### 3.2 TENDER RETURN DATE

3.2.1 Tenders to be returned by 12h00, 14 September 2009.

### 3.3 DECLINING TO TENDER

3.3.1 Those declining to tender should return all documentation to:

Mr Ian Mathie

First Floor, Hopetoun Gate,

8b MacDonald Road,

Edinburgh, EH7 4LZ.



## 4 Tender evaluation

### 4.1 GENERAL

4.1.1 The contract will be awarded to the most economically advantageous tender on the basis of a Quality Assessment of the tenderer's Quality Proposal and a Financial Assessment of the tenderer's Financial Proposal using the criteria detailed below. The Quality Assessment may be reviewed and amended as necessary following a site visit to the tenderer's nominated Reference Site. The Purchaser reserves the right not to visit a Reference Site where it is clear, following the evaluation of the tenderer's Quality Proposal, that a site visit would not significantly affect the outcome of the Quality Assessment.

4.1.2 The criteria which Sustran will use to determine that a tender or option represents the most economically advantageous are detailed below.

### 4.2 ASSESSMENT OF QUALITY PROPOSAL

4.2.1 Quality will be assessed as follows.

4.2.2 The tender evaluation model will utilise the following Qualitative Performance Assessment Schedule.

**Table 4: Qualitative performance assessment schedule**

Performance	Score
Exceeds requirements	5
Meets requirement in full	4
Substantially meets requirements	3
Partially meets requirements	2
Substantially fails to meet requirements	1
Totally fails to meet requirements	0

4.2.3 Tenderers should note that:

- Each Section of Part Four - Specification will be scored with the exception of Section 1 (Overview);
- Each Section will be scored by sub-heading in accordance with the Qualitative Performance Assessment Schedule and given a score between 0 and 5;
- The sub-headings are numbered at "level 2" and are listed in the table of contents e.g. 10.1, 10.2, ..... 13.2 etc.;



- Any Section without sub-headings will be scored as a single sub-heading in accordance with the Qualitative Performance Assessment Schedule and given a score between 0 and 5;
- Summing the sub-heading scores will give a Total Qualitative Performance Assessment Score for each Chapter.

4.2.4 The Total Qualitative Performance Assessment Score (Total QPAS) for each Section will inevitably be influenced by the number of sub-headings. To overcome this, QPAS values will be converted to a “Weighted Section Score” (WSS) as follows:

$$WSS = (QPAS / \text{Max QPAS}) \times SW$$

where CW is the weighted maximum score for the relevant Chapter.

4.2.5 WSS scores for each chapter will be summed to give a **Total WSS** value for each tender.

4.2.6 SW values for each Chapter are defined below:

**Table 9: Qualitative performance assessment schedule**

	Section Title	Section Weighting (SW)
1	In-Station And Workplace Computer Systems	20
2	On Bus Equipment	10
3	Depot Computer Systems	5
4	Information Display And Dissemination	20
5	Bus Priority	10
6	Communications	20
7	Installation	10
8	Acceptance Testing	5
9	Project Team And Joint Design Exercise	10
10	Training And Documentation	10
11	Project Management	10
12	Maintenance	10
13	Software Support & System Upgrades	10

4.2.7 The tenderer with the highest **Total WCS** value will then be awarded a **Quality Score (QS)** of 100 points.

4.2.8 Quality scores for the remaining tenders will be allocated proportionally:

$$\text{Tender A QS} = (\text{Tender A Total WSS} / \text{Highest Total WCS}) \times 100$$



### 4.3 FINANCIAL APPRAISAL.

4.3.1 Tenders will be assessed on the basis of the Bill of Quantities.

4.3.2 The **lowest tender value (LTV)** satisfying the minimum quality criteria will be awarded a **Financial Score (FS)** of 100 points.

4.3.3 Financial scores for the remaining tenderers will be allocated proportionally:

$$\text{Tender A FS} = (\text{LTV} / \text{Tender A Value}) \times 100$$

### 4.4 OVERALL TENDER ASSESSMENT SCORE

4.4.1 The Overall Tender Score (OTS) for each tender will be calculated as:

$$\text{OTS} = (\text{QS} \times 0.7) + (\text{FS} \times 0.3)$$



## 5 Freedom of Information

- 5.1.1 The Freedom of Information (Scotland) Act 2002, which came into force on 1 January 2005, designates SEStran as a Scottish public Partnership and therefore subject to the provisions and obligations in that Act. This means that from 1 January 2005, any person who makes a valid request for recorded information held by SEStran will be entitled to receive it, unless all or part of that information can be withheld as a result of the exemptions in that Act.
- 5.1.2 As part of our responsibility under the Act, SEStran may be required to disclose any information held relating to your response to anyone who makes a request under that Act. Such information may only be withheld if it meets one or more of the exemptions or conditions in that Act. Information held cannot simply be classified as "confidential" or "commercial in confidence" to enable it to be protected from disclosure.
- 5.1.3 Information may also be requested under the Data Protection Act 1998 and The Environmental Information (Scotland) Regulations 2004 which came into effect on 1st January 2005.



## 6 Programme

6.1.1 Tenderers must submit an Outline Programme showing key milestones for the supply and installation of the system. The Outline Programme should show the sequence and timing of the design, development, acceptance testing, delivery and installation of the system requirements and indicate where interim payments are expected in relation to the payment schedule.

6.1.2 The Outline Programme should take into account the target dates shown in Table 5 below.

**Table 5: Outline project plan**

Tender Period		08/06/09 – 14/09/09
Tender Assessment / Appointment		15/09/09 – 23/10/09
Contract Period		26/10/09 - 31/03/14
	including:	
	Phase 1 period of (3½ yrs tying up with financial year end)	26/10/09 - 31/03/13
	Phase 1 Warranty	31/03/13 – 31/03/14
	Subsequent Optional expansion under maintenance terms established within this contract	01/04/14 onwards

6.1.3 Any concerns regarding programming should be clearly stated in the tender.

6.1.4 It is intended that the Outline Programme will form the basis of a finalised Programme to be agreed between the Tenderer and the Purchaser within 21 days of the contract award date. The finalised programme shall include a Fitting Schedule and the make reference to the outcome of the Joint Design Exercise described in Part Four.

### 6.2 CONTRACT PERIOD

6.2.1 The contract shall commence on 1st October 2009 and shall endure for a period of 5 years.



## 7 Pricing

### 7.1 PRICE

7.1.1 The Tenderer should submit prices by completing a Financial Proposal. This should be based on the Bill of Quantities included at Appendix A. Note that each page of the hard copy of the Bill of Quantities should be signed on behalf of the Tenderer.

7.1.2 The rates included in the Bill of Quantities will be index linked to the Retail Prices Index and used to determine the cost of future system expansion. Tenderers may set various threshold values for the size of future orders and set appropriate price adjustment factors to be applied to the rates in the Bill of Quantities.

### 7.2 PAYMENT MILESTONES AND MECHANISMS

7.2.1 Payment shall be made as follows:

- 10% on completion of the Joint Design Exercise and stakeholder sign-off of specification;
- 25% of the relevant item upon satisfactory completion of a Factory Acceptance Test;
- 10 % of the relevant item upon satisfactory completion of an agreed Site Acceptance Test schedule and issue of an Interim Take-over Certificate for a system consisting of 1 operator depot, 10 operational vehicles and 1 office mounted sign;
- 10% of the relevant item upon satisfactory completion of an agreed Site Acceptance Test schedule and issue of an Interim Take-over Certificate for 3 operator depots (including a minimum of 2 operators), 100 operational vehicles, 10 signs at various Stakeholder office locations and a prototype web application;
- 30% of the relevant item upon satisfactory completion of an agreed Site Acceptance Test schedule and issue of a "Take-over Certificate" for the full system; and
- 15% of the relevant item cost at the end of a 12 month defects liability period.

7.2.2 The maintenance and 12 months defects liability periods shall commence following issue of the full take-over certificate. The Tenderer is responsible for the maintenance of items covered by interim certificates during the intervening period, except for any defects which are specifically excluded from the maintenance contract.





7.2.3 Maintenance payments shall be paid 3 months in arrears throughout the 5 year maintenance period. A total of 60 maintenance payments shall therefore be made. The maintenance period shall run concurrently with the 12 month defects liability period.

### 7.3 PAYMENT OF ACCOUNTS

7.3.1 Payments shall be made in accordance with the Conditions of Contract.

7.3.2 Payment will normally be made within 30 days of receipt of an invoice, if there is no dispute over the invoice. Contractors shall raise invoice(s) to SEStran after the end of each activity as outlined in the pricing schedule unless otherwise agreed with the Client.

7.3.3 Where there is a dispute regarding any invoice, SEStran may return the invoice to the Contractor for amendment and resubmission.

### 7.4 FRAMEWORK ARRANGEMENT

7.4.1 The Public Transport Operators may wish to purchase or lease system components supplied under this tender directly from the Tenderer. The Tenderer is therefore required to supply system components to Operators choosing to purchase at the same rates and terms and conditions. If the facility is available, Tenderers may submit proposals for leasing arrangements. Any proposal should itemise costs for individual elements of the system to allow public transport operator commitments to be identified. If taken up, leasing agreements shall be between the Tenderer and the public transport operator(s). The responsibility for payment for any system components purchased or leased by the Operators shall rest solely with the Operators and SEStran shall have no financial liability.

7.4.2 The system components to be supplied under this contract comprise phase one of a potential major system roll out across the south east of Scotland. If required by the Purchaser or its system partners within the Contract Period, the Tenderer undertakes to supply additional system components including installation, commissioning and maintenance services where appropriate, at the tendered rates included in the Bill of Quantities subject to an annual price fluctuation based upon agreed price indices.

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## Part Three - Conditions of contract

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The conditions of Contract shall be the General Conditions of Contract, Model Form MF1, (rev 4) 2000 Edition recommended by the Institution of Electrical Engineers and the Association of Consulting Engineers, amended and added to as shown below.

The Conditions of Contract as amended and added to shall be deemed to form and shall be read and construed as part of the Contract.

The General Conditions of Contract, Model Form MF1, (rev 4) 2000 Edition can be purchased from:

The Institution of Electrical Engineers,  
Publication Sales Department,  
PO Box 96,  
Stevenage,  
Herts.  
SG1 2SD

Or

The Institution of Mechanical Engineers,  
Publication Sales Department,  
Northgate Avenue  
Bury St Edmonds  
Suffolk  
IP32 6BW

Or

The Association of Consulting Engineers  
Alliance House  
12 Caxton Street  
London  
SW1H 0QL



# 1 General conditions

Prime Cost Items	SUB-CLAUSE 5.5	Percentage to be added	N/A%
Delay in Completion	SUB-CLAUSE 34.1	Percentage of Contract Value to be paid or deducted for each week of delay	0.50%
		Maximum percentage of Contract Value which payments or deductions shall not exceed	10%
	(Insert the percentage of the Contract Value for each week of delay and the maximum percentage of Contract Value to be paid or deducted for each Section of the Works where more than one Section has been defined for the purpose of taking-over.)		
Prolonged Delay	SUB-CLAUSE 34.2 Maximum loss recoverable by the Purchaser		£ Contract Price
Allowance for Profit on Claims	SUB-CLAUSE 41.2	Percentage to be added	Nil%
Limitation of Contractor's liability	SUB-CLAUSE 44.3	Limit of liability	£Contract Price
Person to Appoint Arbitrator	SUB-CLAUSE 52.1	The President of the Institution of Electrical Engineers	



## 2 Special conditions (A) (FOR GENERAL REQUIREMENTS)

Definitions 1. DEFINITIONS AND INTERPRETATIONS  
Clause 1.1.a

Delete "the person .....Conditions" and substitute "SEStran"

Clause 1.1.d

The Engineer is Mr Mathie or other Engineer appointed from time to time by the Purchaser and notified in writing to the Contractor to act as Engineer for the purposes of the contract in place of the said Mr Mathie.

Clause 1.1.g

Line 24 - Insert "the Programme" after "referred to therein"

Clause 1.1.r

Line18 - Insert "finalized" after "means the"

Clause 1.1aa

Delete "to the General conditions" and insert "to the Form of Tender".

### ENGINEER AND ENGINEER'S REPRESENTATIVE

Engineer's  
Duties

Clause 2.1

The Engineer is required to obtain the Purchaser's prior specific approval before exercising the following duty: instructing the Contractor to make any variation to the Works which is estimated to involve an addition to the Contract Price of more than £5,000 or 10% of the Contract Price, whichever is the less.

Clause 2.8

Delete in its entirety

New Sub-Clause 2.9

The following sub-clause is added:

In order that the Engineer may satisfy himself that the Works are being properly carried out, the Contractor shall make available to the Engineer without further



charge the full use of such Contractor's equipment and labour as may be required by the Engineer to enable supervisory inspection to be made whilst work is in progress or immediately after completion of the said work."

#### CHANGES IN COSTS

Clause 6.2

Delete in its entirety

#### AGREEMENT

Clause 7

Delete in its entirety

#### PERFORMANCE BOND or GUARANTEE

Clause 8.1

"If required by the Purchaser, should the Contractor be a subsidiary company within the meaning of Section 763 of the Companies Act 1985, the Contractor shall arrange for its holding company or companies (as defined by the said Section 763) to grant to the Purchaser a written guarantee of due performance of the contract in the form notified by the Purchaser to the Contractor."

Clause 8.2

Line 23 - Delete "the bond"

#### NOTICES

Notices to  
Purchaser and  
Engineer

Clause 10.1

Line 18 delete "or to the Engineer" and substitute "the Engineer or the Engineer's Representative."

Purchaser's address:  
Mr Ian Mathie  
SEStran  
First Floor, Hopetoun Gate  
8b MacDonald Road  
Edinburgh, EH7 4LZ.





Engineer's address:  
As above.

PURCHASER'S GENERAL OBLIGATIONS

- Import Permits, Licences and Duties      Clause 11.3  
Delete in its entirety
  
- Purchaser's Lifting Equipment      Clause 11.5  
Delete in its entirety
  
- Utilities and Power      Clause 11.6  
The purchaser shall make available electricity and water supplies within the Market Street offices and bus operator depots. The purchaser shall make available electricity supplies at proposed real-time information sign locations .
  
- Power etc. for Tests on Site      Clause 11.7  
Line 25 - Delete "Purchaser" and substitute "Contractor."  
Line 26 - Delete "provide free of charge" and substitute "include in his rates."  
Line 28/29 - Delete "requisite, and as may reasonably be requested by the Contractor" and add "required" after "may be" in line 28.

CONTRACTOR'S OBLIGATIONS

- Clause 13.1  
Line 6 - insert "all in accordance with the Programme and" after "Tests on Completion"
  
- Clause 13.3  
Insert before the first sentence "Within the time stated in clause 14.1, the Contractor and the Engineer shall undertake a Joint Design Exercise for the purpose of clarifying and resolving any anomalies and misunderstandings of the Specification but excluding any material alterations to the Specification which would require an increase in the Contract Price. Notwithstanding the foregoing, "
  
- Clause 14.1  
Line 27 - Delete "the time stated in the Contract or, if no time is stated, within 30 days" and substitute 21 days"  
Line 28 - delete "shall submit to the Engineer for his approval the Programme for the execution of the Works" and substitute "and the Engineer shall agree a finalized



Programme for the supply and installation of the Works"

Line 32 - Add "and an interim payment schedule" after "erection and testing"

Form of Programme

Clause 14.2

The Programme shall be in the form of an agreement signed by both parties and must include a clear indication of the Time for Completion of the works.

Clause 14.3

Delete in its entirety and substitute:

"The Programme shall form part of the Contract and should the Contractor fail to perform his obligations under the Programme this shall be deemed a Contractor default in terms of clause 49.1."

Clause 27.2

Line 10 - delete "of more than 15 per cent thereof"

Clause 27.6

Line 46 - delete "of more than 15per cent"

Delay in Completion

Clause 34.1

Insert "and sub-clause 34.3" after "(Prolonged delay)"

Additional Clause 34.3

If the Contractor fails to perform his obligations within the times specified in the Fitting Schedule which forms part of the Programme, there shall be deducted from the Contract Price or paid to the Purchaser by the Contractor as fixed, agreed and liquidated damages, for each bus in respect of which the Works are not completed and the bus ready to be returned to service in accordance with the Fitting Schedule, the sum of £100.

Procedures for Performance Tests

Clause 35.2

Line 33/34 - Delete "Purchaser or the Engineer on his behalf" and substitute "Contractor."

Line 34 - Delete "Contractor" and substitute "Purchaser or Engineer on his behalf."

Line 36 - Delete "Contractor" and substitute "Purchaser or the Engineer on his behalf"

Defects Liability Period

Clause 36.1

The Defects Liability Period shall be 12 months after taking over.



CERTIFICATES AND PAYMENT

Clause 39.1

Delete in its entirety and substitute:

"The Contractor may make application to the Engineer for interim certificates of payment in accordance with the interim payment schedule set out in the Programme.

Clause 39.2

Delete in its entirety and substitute;

"The Contractor shall be entitled to apply for an interim certificate of payment within 14 days of receipt of a relevant certificate of test and inspection pursuant to clause 23.4 or taking -over certificate pursuant to clause 29.2."

Issue of Payment Certificate

Clause 39.3

Line 17 - Delete "14" and substitute "28"

PAYMENT

Remedies on Failure to Certify or Make Payment

Clause 40.3

Line 29 - Delete ":-"

Line 30 - Delete "(a)"

Line 33 - Delete the comma and substitute a full stop. Delete "and/or"

Lines 34 - 37 - Delete sub-paragraph (b) in its entirety

ACCIDENTS AND DAMAGE

Care of the Works

Third Party Insurance

Clause 47.4(a)

Contractor shall effect third party insurance for a minimum amount of £5,000,000 for any one claim or series of claims arising from the same incident.

Extension of Third Party Insurance

Renumber existing Clause 47.4(a) and add the following sub-clause

"47.4(b) The Contractor shall extend the insurance under Sub-Clause 47.4 (Third Party Insurance) to cover damage or death or personal injury which occurs whilst the Contractor is making good pursuant to Clause 36 (Defects Liability) or



which occurs whilst the Contractor is on Site for the purpose of making good or carrying out the Tests on completion during the Defects Liability Period or completing any outstanding work or which arises during the Defects Liability Period from a cause occurring prior to taking over."

PURCHASER'S DEFAULT  
Clauses 51.1 - 51.3

Delete in their entirety

Clause 54.1

Delete "England" and "English" and substitute "Scotland " and "Scottish"

ADDITIONAL CONDITIONS  
Clause 55

Payments due from the Contractor

Whenever under the Contract any sum of money shall be recoverable from or payable by the Contractor such sum may be deducted from or reduced by the amount of any sum or sums then due or which at any time thereafter may become due to the Contractor under the Contract or any other contract with SEStran.

Gifts, Inducements and Rewards

Clause 56

The Purchaser shall be entitled to cancel the Contract and to recover from the Contractor the amount of any loss resulting from such cancellation, if the Contractor shall have offered or given or agreed to give to any person any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any action in relation to the obtaining or execution of the Contract or any other contract with the Purchaser or for showing or forbearing to show favour or disfavour to any person in relation to the Contract or any other contract with the Purchaser, or if the like acts shall have been done by any principal employed by him or acting on his behalf (whether with or without the knowledge of the Contractor), or if in relation to any Contract with the Purchaser the Contractor or any principal employed by him or acting on his behalf shall have committed any offence under the Prevention of Corruption Acts 1889 to 1916. Where any such gift, inducement or reward has been given or promised in relation to the obtaining or the execution of the Contract or any sub-contract hereunder the Contractor shall also be liable to pay by way of liquidated damages a sum equal to ten percent of all the sums which become payable to him under the Contract. Any dispute as to the amount recoverable by the Purchaser from the Contractor as a result of determination hereunder shall be settled in the manner provided by Clause 52 hereof.

Value Added Tax

Clause 57

57.1 In this Clause "exempt supply" "invoice" "tax", "taxable person" and "taxable supply" have the same meaning as in Part 1 of the Finance Act 1972 (hereinafter referred to as "the Act") including any amendment or re-enactment thereof and any



reference to the Value Added Tax (General) Regulations 1972 (S1 1972/1147) (hereinafter referred to as the VAT Regulations) shall be treated as a reference to any enactment corresponding to those regulations for the time being in force in consequence of any amendment or re-enactment of those regulations.

57.2 The Contractor shall be deemed not to have allowed in his tender for the tax payable by him as a taxable person to the Commissioners of Customs and Exercise being Tax chargeable on any taxable supplies to the Purchaser which are to be made under the Contract.

57.3 (a) The Contractor shall not in any statement submitted under Clause 39 include any element on account of tax in any item or claim contained in or submitted with the statement.

(b) The Contractor shall concurrently with the submission of the statement referred to in Sub-Clause 57.3 (a) of this Clause furnish the Purchaser with a written estimate showing those supplies of goods and services and the values thereof included in the said statement and on which tax will be chargeable under Regulation 21 of the VAT Regulations at a rate other than zero.

57.4 At the same time as payment (other than payment in accordance with this Sub-Clause) for goods or services which were the subject of a taxable supply provided by the Contractor as a taxable person to the Purchaser is made in accordance with the Contract there shall also be paid by the Purchaser a sum (separately identified by the Purchaser and in this Clause referred to as "the tax payment") equal to the amount of tax payable by the Contractor on that supply. Within seven days of each payment the Contractor shall:-

(a) if he agrees with that tax payment or any part thereof issue to the Purchaser an authenticated receipt of the kind referred to in Regulation 21(2) of the VAT Regulations in respect of that payment or that part; and

(b) if he disagrees with tax payment or any part thereof notify the Purchaser in writing stating the grounds of his disagreement.

57.5 (a) If any dispute, difference or question arises between the Purchaser and the Contractor in relation to any of the matters specified in Section 40(1) of the Act then:-

(i) if the Purchaser so requires the Contractor shall refer the matter to the said Commissioners for their decision on it;

(ii) if the Contractor refers the matter to the said Commissioners (whether or not in pursuance of subparagraph 57.5(a)(i) above) and the Purchaser is dissatisfied with their decision on the matter the contractor shall at the Purchaser's request refer the matter to a Value Added Tax Tribunal by way of appeal under Section 40 of the Act whether the Contractor is so dissatisfied or not;

(iii) a sum of money equal to the amount of tax which the Contractor in making a deposit with the said Commissioners under Section 40(3)(a) of the Act is required so to deposit shall be paid to the Contractor; and



(iv) if the Purchaser requires the Contractor to refer such a matter to the Tribunal in accordance with sub-paragraph 57.5(a)(ii) above then he shall reimburse the Contractor any costs and any expenses reasonably and properly incurred in making that reference, less any costs awarded to the Contractor by the Tribunal and the decision of the Tribunal shall be binding on the Purchaser to the same extent as it binds the Contractor.

(b) Clause 52 shall not apply to any dispute, difference or question arising under paragraph (a) of this Sub-Clause.

57.6

(a) The Purchaser shall without prejudice to his rights under any other Clause hereof be entitled to recover from the Contractor:-

(i) any tax payments made to the Contractor of a sum which is in excess (if any) which in all the circumstances was due in accordance with Sub-Clause 57.4 of this Clause.

(ii) in respect of any sum of money deposited by the Contractor pursuant to Sub-Clause 57.5(a)(iii) of this Clause a sum equal to the amount repaid under Section 40(4) of the Act together with any interest thereon which may have been determined thereunder.

(b) If the Contractor shall establish that the Commissioners have charged him in respect of a taxable supply for which he has received payment under this Clause tax greater in amount than the sum paid to him by the Purchaser, the Purchaser shall subject to the provisions of Sub-Clause 57.5 of this Clause pay to the Contractor a sum equal to the difference between the tax previously paid and the tax charged to the Contractor by the Commissioners.

57.7 If after the date for return of tenders the descriptions of any supplies of goods or services which at the date of tender are taxable or exempt supplies are with effect after the date for return of tenders modified or extended by or under the Act and that modification or extension shall result in the Contractor having to pay either more or less tax or greater or smaller amounts attributable to tax and that tax or those amounts as the case may be shall be a direct expense or direct saving to the Contractor in carrying out the Works and not recoverable or allowable under the Contract or otherwise then there shall be paid to or allowed by the Contractor as appropriate a sum equivalent to that tax or amounts as the case may be. Provided always that before that tax is included in any payment by the Purchaser or those amounts are included in any certificate by the Engineer as the case may be the Contractor shall supply all the information the Engineer requires to satisfy himself as to the Contractor's entitlement under this Sub-Clause.

57.8 The Contractor shall upon demand pay to the Purchaser the amount of any sum due in accordance with Sub-Clause 57.6 and 57.7 of this Clause and it shall be deemed a debt due by the Contractor to the Purchaser and shall be recoverable accordingly.

Racial  
discrimination

Clause 58

58.1 The Contractor shall not unlawfully discriminate within the meaning and scope



of the provisions of the Race Relations Act 1976 or any statutory modification or re-enactment thereof relating to discrimination in employment.

58.2 The Contractor shall take all reasonable steps to secure the observance of sub-clause 58.1 hereof by all servants, employees or agents of the Contractor and all sub-contractors employed in the execution of the Contract.

Contractor to comply with Special Requirements in relation to Statutory Bodies

Clause 59

The Contractor shall comply with the Special Requirements in relation to Statutory Bodies contained in Appendix F of the Tender.

Compliance with such Special Requirements shall not relieve the Contractor of any of his other obligations and liabilities under the Contract and fulfilment of such other obligations and liabilities shall not relieve him of his responsibility to comply with the said Special Requirements.

Fossils etc.

Clause 60

All fossils, coins, articles of value or antiquity and structures or other remains or things of geological or archaeological interest discovered on the Site shall as between the Purchaser and the Contractor be deemed to be the absolute property of the Purchaser and the Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing or damaging any such article or thing and shall immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out at the expense of the Purchaser the Engineer's orders as to the disposal of the same.

Interference with Traffic and Adjoining Properties etc

Clause 61

61.1 All operations necessary for the execution of the Works shall so far as compliance with the requirements of the contract permits be carried on so as not to interfere unnecessarily or improperly with the public convenience or the access to or use or occupation of public or private roads footpaths to or of properties whether in the possession of the Purchaser or of any other person and the Contractor shall save harmless and indemnify the Purchaser in respect of all claims whatsoever arising out of or in relation to any such matters.

61.2 All work shall be carried out without unreasonable noise and disturbance. The Contractor shall indemnify the Purchaser from and against any liability for damages on account of noise or other disturbance created while or in carrying out the work and from and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in regard or in relation to such liability.

61.3 Subject and without prejudice to any other provisions of the Contract the Contractor shall take all reasonable precautions:-

(a) In connection with any rivers, streams, waterways, drains, watercourses, lakes and the like to prevent:-

(i) silting;

(ii) erosion of their beds or banks; and





(iii) pollution of the water so as to affect adversely the quality or appearance thereof or cause injury or death to animal and plant life.

(b) In connection with underground water resources (including percolating water) to prevent:-

(i) any interference with the supply to or abstraction from any such sources; and

(ii) pollution of the water so as to affect adversely the quality thereof.

Packing

Clause 63

All goods delivered under this contract are to be securely packed before despatch and each package must be distinctly marked with the description and quantity of contents, with the name of the Contractor and with a distinctive number or mark, which is to be shown for purposes of identification. All previous irrelevant markings must be carefully obliterated. Returnable packages must be clearly marked:- "RETURNABLE" and will be returned AT THE CONTRACTOR'S EXPENSE.

Payment of Subcontractors

Clause 64

Where the Contractor enters a subcontract with a supplier or contractor for the purpose of performing the Contract, he shall cause a term to be included in such subcontract which requires payment to be made to the supplier or contractor within a specified period not exceeding 30 days from receipt of a valid invoice as defined by the subcontract requirements."

Availability information

Clause 65

The Contractor shall keep proper and separate accounts in relation to all expenditure referable to the contract. The Contractor shall afford facilities at all reasonable times for his books of accounts, vouchers and records to be inspected by the Purchases or his authorised agent for the purposes of verifying the Contractor's claims for payment under the contract. Where required by the Purchaser claims for payment shall be supported by auditors' certificates.

Statutory and other requirements

Clause 66

The Contractor shall in the performance of the Contract conform in all respects with the provisions of any law or any order, regulation or by-law of any national, local or other duly constituted authority that may in any way affect the execution or completion of the Works and the remedying of any defects therein and with the rules and regulations of all public bodies, companies and persons whose property rights are affected or in any way may be affected by the Works (herein called "the Regulations") and in particular the Contractor shall observe such of the restrictions and perform such of the obligations as may be imposed on the Purchaser in relation to the Works under the Regulations provided always that:

a) if any provision of the Contract or any instructions of the Engineer would cause the Contractor to be in breach of the





Regulations, the Engineer shall issue such instructions as may be necessary to ensure conformity with the Regulations and if in complying with any such instructions the Contractor shall incur extra Cost, the instruction shall be treated as a variation under Clause 27 (Variations) and valued accordingly;

(b) the Contractor shall be responsible for the payment of all fees required to be paid by the Regulations insofar as such fees are payable solely by reason of, and in connection with, the construction and completion of the Works;

(c) where the Contractor is not required by the Contract to undertake any permanent reinstatement or making good of the Site or any part thereof or of the means of access thereto, any obligation of the Contractor to maintain any interim restoration thereof required by the Contract or to comply with his responsibilities under Sub-Clause 18.1 (Fencing, Guarding, Lighting and Watching) in respect of the particular part of the Site or of the access thereto, shall cease when the same is handed over by the Purchaser to others for permanent reinstatement, when permanent reinstatement commences, or three months after the Contractor has given notice to the Engineer of the completion of interim restoration, whichever is the earliest.



### 3 Special conditions (C)

[FOR HARDWARE/SOFTWARE]

In conjunction with the Model Form of General Conditions of Contract MF/1 (rev 4) 2000 ; Clauses 1 to 16 of the Additional Special Conditions Involving Incidental Supply of Hardware and Software as amended below are included in the Contract.

## Part Four –Specification

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# 1 General requirements

1.1.1 The overall system requirements can be summarized as:

- Standardised automated reporting specification;
- Simple cost effective solutions;
- Communications flexibility;
- Swap-out kit;
- Expandable systems (capability and scale);
- Common protocols to facilitate fleet movement; and
- Flexible support packages.

1.1.2 The main functional areas within the system are as follows:

- Radio communications;
- Automatic Vehicle Location System;
- Real-Time Passenger Information;
- Bus Priority at Traffic Signals;
- Fleet Management;
- Reporting requirements

1.1.3 On a technical level the system needs to:

- Minimise communications needs (i.e. only transmit messages when it needs to);
- Not be over complicated;
- Allow a building block approach;
- Interface with other and legacy equipment;
- Facilitate schedule modification;
- Minimise the work required in schedule upload;
- Allow viewing of a corridor, as well as a service or take a view of the whole fleet; and
- Be able to deal with on road problems.



## 1.2 SYSTEM CAPACITY AND PERFORMANCE REQUIREMENTS

1.2.1 A primary requirement of the system is that it shall have sufficient capacity and performance to meet the needs of the project and readily accommodate significant expansion through modular addition of the system hardware and software. In this respect the system shall be capable of using a range of communications media.

1.2.2 The system shall be of an open architecture and use or adopt published protocols. (Published protocols shall be those that are available in the public domain and are free for use.) It shall be flexible and expandable so that capacity and performance enhancement can be easily and cost effectively carried out using equipment from alternative suppliers in future phases as required.

1.2.3 The tenderer shall detail within the tender the systems architecture of the proposed design and the protocols intended to be used. The tenderer shall describe how capacity of the main functional components can be expanded and performance maintained as the system develops and expands and how third party alternative suppliers' on-bus units and other system components might be incorporated. Full details of any limitations in capacity, functionality or performance shall be provided in detail by the tenderer.

## 1.3 CAPACITY

1.3.1 The internal network communications supplied for the system shall provide sufficient capacity to meet the needs of the ultimate system described in Part Two. The capacity, design and configuration of the network and the system shall be such that at full operational loading, the loading on the network shall not exceed an average of 30% over any 60 seconds period.

1.3.2 All server computers handling external communications related to the system shall have sufficient capacity to service the ultimate capacity without additional cost to the Purchaser. The capability of the server(s) in respect of its ability to service the ultimate capacity and its key functions within the system should be given and be expressed in meaningful terms.

## 1.4 PERFORMANCE

1.4.1 The System and its sub-systems shall at a minimum meet the following performance requirements.

1.4.2 The system and its components shall be capable of normally running unattended and be capable of supporting the delivery of an operational service 24 hours per day, 7 days per week.



1.4.3 The tenderer shall clearly state within the Tender the expected Mean Time Between Failure (MTBF) of the system and its component hardware and software applications. The statement shall include a description of those maintenance/ management tasks that will result in a total or partial loss of service; their expected frequency, duration and the resultant expected overall system availability.

1.4.4 The System capacity provided to operate the system in terms of communications, memory, processing capability and data storage capacity shall be adequate to ensure that the core system and each work station or other element installed as part of this Contract is operating at no greater than 75% of its operating capacity when the system is fully loaded as follows (i.e. the system should generally be provided with 25% spare operating capacity):

- Subsystems controlling or monitoring the equivalent of the ultimate system;
- All operator terminals being active with operators carrying out a range of routine tasks;
- All internal data exchanges and integration transactions are activated;
- All external communications services fully activated;
- Data exchanges occurring on all external interfaces;
- All routine scheduled system tasks activated.

1.4.5 The system shall be demonstrated by simulation or other means agreed with the Engineer to remain operationally fit for purpose and have an acceptable operating performance when populated with the ultimate level of equipment to the satisfaction of the Engineer. The Tenderer shall state and quantify any reduction in performance or other adverse effects that may occur as a consequence of expanding to the ultimate level.

1.4.6 The System shall respond to operator inputs within a time of no greater than 0.5 seconds, with an indication that the message has been received when the System is operating at a loading equivalent to the ultimate configuration.

## 1.5 HARDWARE

1.5.1 The Tenderer shall provide a complete integrated system in accordance with these Requirements.

1.5.2 The System shall be supplied with all necessary hardware and software to provide the required functions and control the required number of equipment sites and buses.



- 1.5.3 The tenderer shall provide all necessary hardware and software to accommodate transitions between the various phases of the project implementation such that operation of the systems and the services they provide remain fully available during normal working hours.
- 1.5.4 The system hardware, software and architecture shall be designed to be open, expandable and upgradeable, using published protocols and clearly defined open standard interfaces to ensure that the system remains operationally effective and cost-efficient to operate and maintain over a minimum life cycle of 10 years.
- 1.5.5 The architecture of the system’s hardware, software and communications shall be designed and implemented to ensure that the system and any other system belonging to the stakeholders is secure from external or internal risks such as infection from computer viruses, malicious attacks or infiltration from ‘hackers’. Tenderers shall provide a risk assessment that identifies potential risk areas and describes the measures provided within the design to mitigate such risks. All such measures shall be included as part of the Tender.
- 1.5.6 The system shall employ current industry standard hardware elements that must be integrated to form a complete system.
- 1.5.7 Hardware elements should as far as possible and to the satisfaction of the Engineer meet the following requirements:
- Industry standard;
  - Readily available from multiple suppliers;
  - Modular in design;
  - Flexible, allowing for addition of hardware/ functional capabilities;
  - Subject to low maintenance requirements;
  - Easily serviceable; and
  - Self-diagnostic to the greatest extent possible.
- 1.5.8 Any requirement to supply an item of equipment shall include the provision of all necessary cables, connectors, power supply units and the like to ensure correct installation and operation.
- 1.5.9 Equipment provided should, wherever possible, be capable of using common consumables.





## 1.6 COMPLIANCE WITH STANDARDS

- 1.6.1 All work, goods and materials shall comply with the standards specified in this Specification as modified by the Final System Specification (see section 9.1.10). All equipment, interconnections, software and system operation shall be to the latest version available at the time of Tender submission and shall, where appropriate, be currently approved by the Department for Transport (DfT), Home Office, Scottish Executive, and/or any other appropriate regulatory body and be installed to the satisfaction of the Engineer.
- 1.6.2 Common industry standards (e.g. the use of standard connectors etc) must also be employed wherever possible.
- 1.6.3 Where individual elements of equipment offered do not have the appropriate DfT, Home Office, Scottish Executive or Welsh Assembly approval or equivalent approval received from another European Community Member State for use in this context, then the Tenderer shall provide evidence that such approval is likely to be issued during the Contract and details for how this approval will be gained shall be reported. If the Engineer believes that proof of the requisite approval is not available, the Tenderer shall provide at his expense a replacement, with the relevant approval, for such equipment, and shall bear all consequential costs.
- 1.6.4 All equipment supplied shall comply with the latest edition of the relevant British Standard and "Electricity at work" Regulations. The design and method of installation and maintenance must meet the above regulations.
- 1.6.5 References to UTMC shall mean the DfT initiated Urban Traffic Management and Control (UTMC) programme. UTMC Specifications shall be those specifications issued by DfT (and predecessors) through the UTMC programme. The primary specifications applicable shall be TS003:2005 (The UTMC Framework Technical Specification).
- 1.6.6 The Tenderer shall provide a system that will be capable of future developments/expansion, if necessary this development being successfully performed by an alternate supplier without facing restrictions e.g. Intellectual Property Rights.
- 1.6.7 The Tenderer shall make reference to the current National Standard for Real-Time Information Systems developed by the Real Time Information Group (RTIG), with a detailed statement of compliance/non compliance of the various system components.



## 2 Core system and workstations

### 2.1 GENERAL

2.1.1 The following list is not prescriptive but it is envisaged that the system will consist of:

- Batch time server(s) – managing core system data;
- Real-time server(s) – holding the current network details and managing real-time functionality associated with fleet management;
- Voice server – managing voice communications;
- Depot servers – managing data upload / download to vehicles in depots;
- Information server(s) – collating and disseminating real-time information to signs and other third party systems;
- Web server(s) – collating information from real time and / or information servers and managing the web facility;
- Statistics server – collating historic tools and providing analysis functions;
- Maintenance server – collating data, monitoring system performance and generating fault reports & performance KPI's based on system reported faults, "exception" reports (i.e. faults which are inferred and detected because performance statistics are abnormally low / high) or faults logged by the operations staff; and
- A series of workstations offering a variety of functions to meet the needs of the individual Stakeholder;

2.1.2 A possible network configuration diagram is included at Appendix D. Tenderers must submit a costed proposal on the basis of this configuration. Alternative proposals can, however, be submitted if considered advantageous in terms of cost, functionality or reliability.

2.1.3 The main functions of the core system(s) are:

- To hold and manage the system database;
- To provide voice and data transmission capability (where required);
- To provide a user-friendly workplace interface;
- Recording, evaluating and managing the incoming vehicle messages;
- Triggering and transmitting instructions to vehicles and signs as appropriate;



- Representing the fleet operation in tables and diagrams;
- Maintaining a historical database of system and public transport fleet operations;
- Interfacing with other public transport systems for data upload and download;
- Managing / controlling workplace terminal access; and
- Managing dissemination of RTPI to various users.

2.1.4 The core system must ensure that information can be segregated or filtered so that competing bus operators do not have access to their competitors' information. The system partners recognise that this may have a significant impact upon the proposed system architecture.

## 2.2 SERVERS AND WORKPLACE TERMINALS FUNCTIONS AND LOCATIONS

2.2.1 Where practicable, the core system servers will be located and managed on a server farm proposed by the Tenderer. For information, SEStran's Trapeze RouteWise servers are currently hosted by DIGIMIS located at:

Lochside House, 3 Lochside Way

Edinburgh Park

Edinburgh, EH12 9DT.

Contact: Steve Donaghue 0131 452 2202

2.2.2 Alternative proposals for hosting the core system will be considered.

2.2.3 Tenderers must clearly identify any core system software or hardware or communications system thresholds which will arise during the expansion process.

2.2.4 The functionality associated with workplace terminals or, or workstations, can vary considerably and can be tailored to suit individual business requirements. The following key functions have been identified:

- Batch time server interface (managing data upload to the batch-time server);
- Interface to third party scheduling software systems;
- Voice communications (to buses, roving terminals and, possibly, audio signs);
- Bus Operator fleet management tools (\*using data communications);



- RTPI sign management tools (using data communications);
- “Window” on bus and sign operations (without voice or management tools);
- Depot data upload and download;
- Tests and auxiliary programs;
- Statistics analysis; and
- Maintenance analysis.

## 2.3 CORE SYSTEM

2.3.1 The core system will comprise the AVL and RTPI servers and communications equipment. It is expected that the core system will be housed on a remote server farm. Users will access the core system functions via remote workstations. The core system shall control all communication to and from buses, and workstations and shall drive the RTPI sub-system. It shall contain the real-time application at the heart of the AVL/RTPI processing and be responsible for all real time data.

2.3.2 Suppliers must clearly identify any core system software or hardware or communications system thresholds which will arise during the expansion process.

2.3.3 The system will require efficient and reliable upload of bus network data from third party scheduling and bus service registration systems. It is expected that data will be furnished directly from the major bus operators’ scheduling systems, which are Trapeze and Omnitimes. It is expected that data for small operators’ services will be imported from the SEStran RouteWise database. TransXchange 2.1 interfaces are required.

2.3.4 Vehicle location data will be transmitted to the core as required. A cost effective and efficient means of data upload and download between the control centre and any on-bus computer is required. It is expected that this will be achieved through wireless local area networks in the bus garages.

2.3.5 A link is required to the City of Edinburgh Council BusTracker RTPI system which covers Edinburgh and the operational area of Lothian Buses. Real-time passenger information will be exchanged and displayed on existing BusTracker signs, and the arrival times for buses on the BusTracker system will be the displayed on relevant SEStran road-side displays. It is essential that the operational integrity of the existing BusTracker system is not undermined, technically or in terms of the quality of real-time information displayed.



### Connecting remote workstations

- 2.3.6 It shall be possible to connect remote workstations to the core system. The Tenderer must state the most cost effective communications solution to support the functionality required at individual workstations.
- 2.3.7 It is important to minimise ongoing revenue costs for communications without undermining system operation.
- 2.3.8 The tenderer should state the proposed network protocol. If a protocol other than TCP/IP is to be used then the implications for stakeholders should be clearly stated.
- 2.3.9 Where leased lines or similar are required for communications between depot terminals and the core system, the costs associated with installing these lines shall be included in the Tenderer's price. The Tenderer may propose an alternate method of communications; these alternate communications must be financially detailed. Any ongoing operating costs associated with the communications system must be identified by the tenderer.

### Remote maintenance

- 2.3.10 The system must include facilities enabling service engineers to dial-in to carry out remote system maintenance. Thin client technology is acceptable for this and other purposes.

### Expansion

- 2.3.11 The core system hardware, software and architecture shall be designed to be open, expandable and upgradeable, using published protocols and clearly defined open standard interfaces to ensure that the system remains operationally effective and cost efficient to operate and maintain over a minimum life cycle of five years. The system must be capable of expansion to include the requirements of subsequent phases of implementation, including the addition of further operators as required. Tenderers must clearly identify any core system software, hardware or communications system thresholds which will arise during the expansion process. The cost of adding additional capacity must be clearly stated even if such cost is zero. Tenderers must include, as a minimum, the cost to the purchaser of adding an additional operator to the system.

## 2.4 WORKSTATIONS

- 2.4.1 Workstations shall be supplied with all necessary hardware and software to provide the required functions and control the required number of equipment sites and buses.



- 2.4.2 The workstations provided shall be fully featured and must be fit for purpose such that they give bus operators access to all the system functions and facilities necessary to monitor their fleet.
- 2.4.3 The Tenderer shall describe fully the hardware facilities provided. The Tenderer will also describe their preferred method for linking the operator terminal to the core system.
- 2.4.4 Workstations shall connect to other local computer networks within the depot. The connection shall enable the interfacing of systems and the transfer of data between the system terminal and the bus operator's other systems. The Tenderer shall provide all necessary 'firewalls' and other security facilities necessary to protect the respective systems and networks.
- 2.4.5 Workstations shall be fitted with an audible alarm.
- 2.4.6 Workstations shall be equipped with microphone/loudspeaker facilities to allow communications between the operator and portable equipment, using direct calling or by object linking from on screen displays.
- 2.4.7 Each workstation shall have direct access to suitable archive media devices.
- 2.4.8 Workstations should be capable of representing graphically the information using a modern graphical user interface.
- 2.4.9 The following details for each workstation shall be provided:
- External dimensions of equipment;
  - The most critical dimension and weight for access into the Control Centre (for checking door widths and load bearing capacities);
  - Access areas required around the equipment;
  - Total power consumption (both peak and continuous);
  - Heat output and noise levels;
  - Access arrangements required for installation.
- 2.4.10 All system cables shall be provided by the Tenderer. The Tenderer shall be responsible for the installation of socket outlets and telephone connection points with the agreement of the Engineer or his representative.



## 2.5 DATABASE MANAGEMENT

2.5.1 Database management will be the function of the batch time server. The batch time server will manage the upload of data to the system.

2.5.2 The core system database shall contain and manage all of the following:

- A core database;
- Schedule and rota data; and
- Operational dates.

### Core Database

2.5.3 This represents the data required to configure the real-time passenger information system operation including:

- System data (e.g. users, authorisations)
- On-board computer data (e.g. call criteria for bus priority, destination texts)
- Display data (e.g. masks, acoustic units)
- Control computer data (e.g. instructions, messages)
- Radio operation data (e.g. radio areas)

2.5.4 The data to be held for real-time equipped routes includes:

- Bus stop location data for all stops on route;
- Interchange locations;
- Depot entry and exit locations;
- Bus route data including:
  - The route path definition including variants;
  - Distances between individual stops and depots;
  - "Destinations" and "via" information including the ability to vary "destination" (as far as the external RTP1 outputs are concerned) as the bus progresses along the route;
- "Next stop" text displays / audio announcements;
- "Virtual loop" locations for bus priority at traffic signals;
- Priority request ID to ensure the appropriate traffic signal stage is demanded;
- Travel and stopping times;



- Traffic signal installations and relationships between signal stages and individual bus priority request bits; and
- Real-time information sign locations.

2.5.5 Note: Travel times can vary immensely. In rush hour traffic, the travel time may be several times greater than the time required for the same journey late at night. In order to reproduce these factors a “day type” facility should be provided. Each route path shall contain the travel and stopping times that are valid for all given day types and special events. This will uniquely determine the travel and stopping times for every day type and time of day. A minimum of 10 “day types” are required

#### Schedule and rota data

2.5.6 Schedule and rota data includes:

- The departure time of the first trip (and with that the trip from the depot);
- The headway times;
- The minimum and maximum layover times;
- Whether layovers are “protected” or not;
- The route network definition with travel and stopping times and other route data;
- Driver relief locations and times; and
- Connection protection details to manage interconnecting services

2.5.7 Note: the system must be able to accommodate scheduling details for a minimum of 10 schedules.

2.5.8 The database must also be able to store planned route path and schedule changes ready for introduction by a timetabled event if required.

2.5.9 The system must be able to allow for the suspension on a list or range of dates any bus working or replacement service. Tenderers should explain how this will be accomplished.

#### Operational data

2.5.10 The database shall maintain comprehensive database records relating to the operation of the RTIS control system hardware and software, public transport fleet operations, real-time information signs; etc. This shall include:





- System event logs including operator actions
- Records of vehicle movements
- Bus priority request details (e.g. date, time, bus, direction, reason)
- Fare box and passenger data (where available)
- Records of all routine system testing and diagnostic routines
- Fault records
- Vehicle diagnostic 'warning' messages (where available)
- Passenger loadings counts by stop (where available)

2.5.11 Tenderers should state any limits on the maximum size of the database and any limits bus numbers, operators, services and timetables related to any limit on the size of the database.

#### Data entry, import and export

2.5.12 It is imperative that data from the existing scheduling and rostering systems can be imported into the system by efficient electronic means. In practice this will require the use of TransXchange 2.1 (or later) format. The schedule will need to contain details of all bus stops served by the route, including their NAPTAN references and OS coordinates.

2.5.13 The system must be capable of accommodating evolution in the TransXchange format whilst remaining backwards compatibility with previous versions of the format. The tenderer is responsible for the cost of updating the system to accommodate the latest (agreed) version of TransXchange. Other mechanisms for data exchange (including direct links) will be acceptable, but tenderers should clearly note the extent to which the transfer will be fully automated and give realistic estimates of staff time and costs associated with any manual intervention.

2.5.14 Data on bus stops will be available from Local Authorities through the national NAPTAN database. Although both the Trapeze and Omnibus programs are capable of incorporating these data their accuracy remains in some doubt and the data should be checked.

2.5.15 Minor changes to schedules must be able to be accommodated without the need for a full schedule re-load to the system. This applies to changes to service timings and frequencies.

2.5.16 The system must be capable of schedule outputs based on actual timings by day and by time of day. These should be capable of export using atco.cif and TranXchange v2.1 (or later) format to form the basis of a new working schedule to be developed by scheduling staff. The timings should be based on an analysis of a large volume of observations and tenderers are to



propose the formula by which they would be derived, taking account of both average and outlying values.

2.5.17 Different data are to be available for output based on the direction of travel, day and time of day to be user configurable.

2.5.18 The system should include a post event rerun option. This function will show where every vehicle was at any time, and can thus be used as evidence to be presented in the event on a Traffic Commissioner hearing into service reliability, as evidence in connection with insurance claims, assaults etc.

#### Database structure

2.5.19 It is preferred that data should be stored in the format described by EuroBus/Transmodel in the "Reference Data Model for Public Transport" (CEN TC278/WG3). Any deviation from this standard should be noted and the implications assessed for the exchange of data with stakeholders and the operation of the real-time passenger information.

2.5.20 It must be possible to record and store data at an "all stops" level rather than timing point level.

2.5.21 Tenderers should recommend an efficient strategy for storing, archiving historic and retrieving historic data for use in analysis packages.

## 2.6 CONTROLLING VOICE COMMUNICATIONS

2.6.1 Communication using a voice radio is required as part of the RTPI system.

2.6.2 The use of an MPT 1327 trunked radio is a requirement for First in Edinburgh. Other operators may choose to add voice radio.

2.6.3 Voice connections are set up between the control centre (dispatcher) and external stations (drivers, passengers at stops or in vehicles, service personnel). The following paragraphs outline the system requirements.

#### Access to audio functions

2.6.4 The system will provide integrated audio functions giving users the facility to communicate by voice and enabling dispatchers to control those communications.



- 2.6.5 Access to the audio functions should be provided for dispatchers through an integrated audio window in the workstation user interface. The user interface shall contain an audio window integrated with the AVLS functionality.
- 2.6.6 This window will provide integrated audio functions giving users the facility to communicate by voice and enabling dispatchers to control those communications.
- 2.6.7 This window will give the operator a list of incoming calls, and the ability to establish and release different types of voice communications.
- 2.6.8 The audio function window will be principally composed of:
- A display of incoming calls coming from drivers. Normal calls should be sorted by time order. Urgent calls should be placed above normal calls. Any distress call should always be the first call of the list.
  - A display of communications in progress; and
  - A toolbar of icons to enable contact with vehicles or agents.
- 2.6.9 By clicking on the appropriate object in the audio function window of the workstation, the dispatcher should be able to:
- Answer a request to talk sent by a driver
  - Call a specific vehicle
  - Call all vehicles of on a specific route
  - Call all vehicles of the transport operator's fleet
  - Answer a request to talk sent by a field operative carrying a hand portable
  - Call a field operative carrying a hand portable
- 2.6.10 The most frequent actions, like answering a call, terminating a call or re-calling the last vehicle in communication, should be capable of being performed more quickly through dedicated functions keys.
- 2.6.11 The communication will be performed through a voice console. This equipment will provide the dispatcher with:
- An external microphone, an external loudspeaker, an external PTT;
  - A handset or headset composed of a microphone, a loudspeaker and a PTT.



2.6.12 The voice console will be automatically activated when the dispatcher establishes the communication.

Driver request-to-talk calls

2.6.13 Voice communication is to be managed from the control centre. A driver must initiate a request-to-talk whenever he wants to talk with the dispatchers.

2.6.14 The call types shown in Table 6 are to be provided:

**Table 6: Call types**

Call type	Partner	Priority	Remarks
Emergency call	Control centre	1	
Priority call	Control centre	2	Urgent request to talk call
Request to talk call	Control centre	3	
	Other vehicles	3	Shunting operation

Regular voice connection

2.6.15 The dispatcher will initialise a voice connection with one or several vehicles after a priority call, request to talk call or other relevant event has been registered in the control centre. He should also be able to set up the voice connection with vehicles on other routes. For conversations with an individual vehicle, the dispatcher must be shown within 2 seconds of initiating the connection whether or not the vehicle has actually been contacted. If the connection has not been successful, the dispatcher shall have the option to repeat the call.

2.6.16 When sending announcements (voice or text), the dispatcher shall be able to require that the driver acknowledges reception by pressing the corresponding terminal key. Missing acknowledgements or “not understood” feedback messages shall be entered in the list of failed announcements and can be repeated at a later date.

2.6.17 A conversation with a specific vehicle can be set up using keyboard inputs without having to select the vehicle with the mouse first.

2.6.18 Conversations shall be one or two-way. One-way connections are dispatcher announcements to the partners as shown in Table 7.

**Table 7: Call connections**

Partner	Direction
One vehicle	One and two way
Several vehicles (group)	One and two way (with conversation rules)
One stop	One way
Several stops	One way
One route	One and two way (with conversation rules)
Several routes	One and two way (with conversation rules)
All radio partners	One and two way (with conversation rules)

2.6.19 For announcements to all vehicles on defined routes or all radio partners it shall be possible to specify whether they are directed at the driver only, the driver and passengers in the vehicle, or to passengers waiting at stops equipped with public address facilities.

#### Call coding

2.6.20 The system shall differentiate between the following codes:

- Data telegram;
- Tone selective calling,
- Digital selective calling; and
- (Open voice radio).

2.6.21 The core system shall be able to support the simultaneous reception and transmission of different call codes. Data telegrams shall only be displayed or transmitted via the core system computer. Selective calls shall either be displayed and entered via the core system computer or directly on the radio operating console.

#### Conversations with selective calls

2.6.22 The following selective call functions are to be supported by the core system computer:

- Display of request-to-talk calls, emergency calls and priority calls;
- Conversations and announcements involving one or several radio partners;
- Announcements to groups of radio partners; and
- Announcements to routes and to the entire network.



### Special announcements features

- 2.6.23 Note: Passenger announcements may not be implemented.
- 2.6.24 It should be possible to adjust the volume of public address announcements made via external loudspeakers to be adjusted according to the time of day (e.g. day or night).
- 2.6.25 It should be possible to direct announcements at the driver, passengers or both.
- 2.6.26 In connection with the radio controller, announcements from the control centre shall be able to be introduced with a warning sound prior to the announcement being made.

### Emergency call connection

- 2.6.27 After an emergency call has been registered the driver will be able to trigger an emergency call connection using a discrete "panic" call button which may, for example, be foot operated. The location of the panic button must be agreed with each operator. An emergency call connection will over-ride any existing voice connections and set an alarm on the appropriate work-station(s). The location of the vehicle shall automatically be displayed on a geographic map to assist the dispatcher when alerting the emergency services. During an emergency call, the dispatcher will listen in to the vehicle and then, if appropriate, to talk to the driver. The dispatcher must also be able to quit the connection early, prolong it or convert it into a regular conversation.

### Shunting voice connection

- 2.6.28 Shunting describes a special voice connection between two drivers (or Inspector/driver) in two separate vehicles with the aim of carrying out a task without actively involving the dispatcher. Such tasks include:
  - Shunting
  - Towing
- 2.6.29 The request for a shunting conversation will always come from a driver. The driver will make the request to the dispatcher within the course of a regular conversation.
- 2.6.30 The dispatcher will then be able to set up the shunting conversation between the two drivers in one of two ways:
  - The dispatcher may directly connect the first driver with the second driver (on-switching function), or



- The conversation with the first driver is terminated and a new connection set up between the drivers.

2.6.31 Once the drivers are connected, the dispatcher will be able to listen in to the conversation and join in at any time. After the conversation has finished the dispatcher will terminate the connection.

2.6.32 It should be possible for calls from hand-portables to drivers or other hand-portables to be established without the need for dispatcher actions.

#### Listening in / joining in on the voice channel

2.6.33 This function will occur on the voice channel. Drivers in equipped vehicles shall have the facility to listen in to all other conversations on the voice channel and be able to join in whilst remaining reachable via data radio and continuing to send their position information and other data on the data radio channel in the assigned time slots.

2.6.34 The dispatcher shall be able to block the listen in/join in function, allow it or even force it. If the dispatcher has set the listen in/join in authorisation to "allowed", then the driver shall be able to decide for himself whether he wants to listen in or talk via an on/off switch on the on-board computer.

#### Announcements from a PC sound card (provisional)

2.6.35 This option has a variety of applications. It may provide a simplex alternative to full duplex voice communications for stakeholders who do not adopt an MPT1327 trunked radio solution. It could also replicate group call type functionality for hybrid vehicles operating in areas of GPRS coverage.

2.6.36 The dispatcher shall be able to record an announcement whilst talking into the radio microphone with a sound card fitted within the PC. The recorded announcement can then be used by the local workplace. It shall also be possible to record announcements off line, i.e. without connecting up to a radio partner.

2.6.37 It shall be possible for 'WAV' or similar files to be imported & used within the control computer and then to be played as an announcement from any workplace.

2.6.38 The user should be able to delete individual recorded announcements via the user interface when such recordings are no longer required. It should be possible to save up to 50 announcement files.



2.6.39 It should be possible to direct announcements to individual vehicles, selected vehicles, routes, the network and displays fitted with public address units. The receiving device shall send confirmation that the message has been received and played.

#### Fast function for reply and acknowledge

2.6.40 A fast reply function should be available for all events that have the voice connection or emergency connection as the default action.

2.6.41 Similarly a fast function for acknowledgement is to be available, which automatically acknowledges the uppermost event in the event queue without previously selecting it.

#### Group call

2.6.42 Conversations, announcements, running board variations and instructions etc shall be able to be aimed at individual vehicles or routes or at specific vehicle types or supply groups, e.g. "all buses".

#### Instructions

2.6.43 Instructions are pieces of information that are transmitted from the control centre to the vehicles via data radio. The transmitted instruction is to be acknowledged in two ways:

2.6.44 Technical acknowledgement - The on-board computer will automatically acknowledge the reception of an instruction telegram by sending the technical acknowledgement to the control centre as soon as the time slot cycle allows. If technical acknowledgement is missing, the system should automatically resend the message a defined number of times. If no acknowledgement is received, a failure message should be logged on the dispatcher workstation.

2.6.45 Driver acknowledgement - Although the instruction is displayed on the driver terminal, it is not possible to guarantee that the driver has actually seen or acknowledged it. For particularly important instructions, the dispatcher should be able to demand an acknowledgement from the driver. These instructions will flash in the driver display until a button such as 'OK' is pressed. A data radio telegram is then sent informing the dispatcher in the control centre that the message has been received and understood.

2.6.46 The type of acknowledgement sent should be determined by the instruction type as shown in Table 8 below. This applies to text and wav file (or similar) messages.





**Table 8: Acknowledgements**

Receiver	Instruction type	Technical ack'ment	Driver / Inspector ack'ment
Vehicles / hand portables	Normal instruction	Yes	No
	Important instruction	Yes	Yes
Signs	Normal	Yes	No

2.6.47 The table illustrates the possible variants. For every instruction text the default setting for driver acknowledgement (yes/no) shall be definable during the planning process. Before the dispatcher sends an instruction he should be able to change this default setting as required.

2.6.48 It should be possible to transmit variable instructions with up to 20 characters (1 line of 20 characters). In the control centre, a minimum of 20 most recent instructions are to be saved in a list and allowed to be called up at a later time. Tenderers should identify any limits on numbers of characters that can be transmitted.

## 2.7 DISPATCH ACTIONS

2.7.1 The system must be capable of outputting predictive information to the operator based upon the real-time information collected by the system. This predictive information must allow the operator to take pre-emptive action to address impending problems.

2.7.2 The AVL system’s user interface shall enable dispatchers to take the following actions from workstations:

- Modification of driver assignment to driver duties;
- Modification of vehicle assignment to running boards;
- Modification of driver duty assignment to running boards;
- Modification of driver reliefs;
- Modification of timetables;
- Create a “duplicate” block;
- Order buses to turn short;
- Program route diversions;
- Hold a bus;
- Configure the regulation method (timetable or headway regulation) applied to routes;
- Configure the when and how the selected regulation method is applied; and



- Travel with offset.

2.7.3 The AVL system will automatically adjust the timetable applied to bus services and will automatically recalculate prediction times when dispatch actions are taken.

#### Modification of driver assignment to driver duties

2.7.4 The driver management functions shall enable the dispatchers to monitor the performance of the scheduled driver duty and to take any necessary corrective measures.

2.7.5 Dispatchers shall have the facility to carry out the following assignment modifications:

- to assign a driver to a duty with no scheduled driver;
- to change the driver assigned to a duty; and
- to swap the assignments of two drivers.

2.7.6 The system shall generate a warning if the action cannot be achieved.

#### Modification of vehicle assignment to running boards

2.7.7 The bus management functions shall enable the dispatchers to carry out modifications in the scheduled bus assignment and to take any necessary corrective measures.

2.7.8 Dispatchers shall have the facility to carry out the following assignment modifications:

- assign a bus to an empty running board;
- change the assigned bus on a running board;
- swap the assignments of two buses;
- reserve, modify/cancel a reservation of a bus for maintenance; and
- create a "duplicate" running board to insert an additional vehicle into the service.

2.7.9 These operations shall be subject to a feasibility check taking into account the availability of buses and their assignments.

#### Modification of driver duty assignment to running boards

8.7.3.1 The driver management functions shall enable the dispatchers to carry out the following assignment modifications:

- to assign a driver to a running board not provided for; and
- to change the driver assigned to a running board



2.7.10 The feasibility of these actions shall be verified with respect of assignment coherence.

#### Modification of driver reliefs

2.7.11 The driver management functions shall enable the dispatchers to monitor the driver duty and to carry out the following assignment modifications:

- to replace a driver by another on part of a duty (by creating the necessary reliefs)

2.7.12 The feasibility of these actions shall be verified with respect of assignment coherence.

#### Modification of timetables

2.7.13 Dispatchers shall have a set of functions available to manually modify bus timetables.

2.7.14 They shall have the facility to carry out the following assignment modifications:

- Modification of departure time;
- Addition or cancellation of a journey on a running board;
- Re-spacing; and
- Departure lag.

2.7.15 Modification of timetables shall consist in modifying the time of a departure from a terminus or a timing stop point. The action of modifying a departure time should automatically modify departure times at other timing stop points of the journey.

2.7.16 The system shall verify that the modification is compatible with layover requirements upstream (if departure is advanced) or downstream (if departure is delayed).

2.7.17 The dispatcher should have the availability to associate this control action with a re-spacing of adjacent departures in order to minimize disturbance on the departure regularity.

2.7.18 Re-spacing shall consist in rebalancing headways when a modification made to the timetable by a dispatcher provokes a change in headway. This is the case when a service is cancelled or added, and when departure time modification control actions are used.

2.7.19 Re-spacing may be initiated by dispatchers when making a control action.

2.7.20 The control stop point where re-spacing is applied shall be specified when the control action is initiated by the dispatcher.



2.7.21 The departure lag function shall consist in shifting all departure times at a terminus for a time period. It is therefore the means of applying departure time modification to a consecutive set of departures.

#### Order buses to turn short

2.7.22 This function shall consist of modifying the destination of a journey and the starting point of the subsequent journey by performing turning a vehicle round short of its original destination.

2.7.23 This function can be applied to:

- a journey on a route;
- a journey on a route and all following journeys on this route, or
- a journey on a route and all following journeys on this route and of a set (or all) of bus services on the same route

2.7.24 In the cases of multiple turning short, the dispatcher shall choose between:

- An applicable departure time at stop points that will remain the same, or
- A recalculation of timetables on the basis of one layover duration at terminus.

2.7.25 The dispatcher will have the availability to request re-spacing on departures adjacent to departures that have been cancelled or added.

#### Program route diversions

2.7.26 The dispatcher must be able to divert routes when roads are unavailable.

2.7.27 The dispatcher shall be able to define characteristics of diversions in advance by defining them in the database or in real time from dispatchers' workstations.

2.7.28 Real time diversions will be defined by the dispatcher using an on-screen map display. The dispatcher will click on the bus stop where the diversion starts, the route that will be taken (a series of points reflecting the actual road network) and the end point bus stop where the vehicle rejoins the route.

2.7.29 The system shall list all possible services that may be affected by the diversion based on the stops that have been omitted. The dispatcher will select the affected services (by tick box) or nominate "all services".



- 2.7.30 The dispatcher will define the duration of the diversion (indefinitely, "x" hours; start and end times; specified dates and times).
- 2.7.31 The system will automatically adjust all RTPI information outputs (signs, web etc) to reflect the impact of the diversion.
- 2.7.32 Occasionally it will be necessary to modify a routes and schedules to reflect a temporary diversion, which will be in place for several days/weeks/months. In such circumstances, it shall be possible to:
- Define the start/end date for the diversion; and
  - Enter and store a temporary database modification for the part of the route affected
- 2.7.33 The modification shall be held and remain active (until cancelled by a system manager or timetable) even if the permanent database for that running board/route schedules are subject to change during the defined diversion period.

#### Holding a bus

- 2.7.34 This function shall be used to retain a bus at a stop point of a route and authorizes it to depart only on the order off the dispatcher.
- 2.7.35 This will be carried out in two steps:
- Holding the bus will be carried out by selecting a bus on the workstation display (this instruction shall remain displayed on the driver console and workstation screen until the bus is released) or
  - Release of the bus will be achieved by selecting a held bus on the workstation display and the resultant message displayed on the driver console will be similar to that of a departure on order at terminus.

#### Timetable and headway regulation modes

- 2.7.36 Each route shall be regulated according to one of two modes:
- Timetable regulation. In this mode buses respect scheduled departure time at stop points. This mode is generally selected on routes with average or low service frequency.
  - Headway regulation. In this mode, the system shall ensure the regularity of service at stop points. This mode is preferable where the service frequency is high.



2.7.37 When the route is regulated in timetable mode, the dispatcher screen and driver console shall display the current lead/delay of the bus and the applicable departure time at the next timing stop point.

2.7.38 When the service is regulated in headway mode, the dispatcher screen and driver console shall display the bus headway, expressed in terms of time intervals which separate the bus from adjacent services, and the applicable departure time at the next timing stop point.

#### Defining the regulation mode

2.7.39 The regulation mode applicable to each route is defined by dispatchers, either manually, or via the system timetable.

2.7.40 The system shall enable control actions provided to:

- Take into account an additional bus on a service;
- Inform a driver to turn short;
- Change the predictive departure times at a control stop point;
- Add one or several journeys to a running board;
- Withdraw one or several journeys from a running board;
- Modify the terminus of a journey.

2.7.41 When a vehicle is ordered to turn short, the service which has been turned short will be automatically cleared from the down-stream bus stop displays which are no longer served. The new destination or a "part service" message shall be automatically generated by the system and sent to signs at bus stops that are still being served by that service, warning passengers that there is a change in terminus destination. NB: the system must automatically correct all RTPI outputs.

#### Dealing with road works, diversions etc

2.7.42 The real-time passenger information system shall be able to handle diversions of bus services. The diversions shall be described either in the bus operator's rostering and scheduling software and shall be imported in the real-time passenger information system, or will be directly described by an operator at a workstation with a graphical interface showing the relevant map section.

2.7.43 The dispatcher shall be able to activate a diversion on a route, or a group of route, either several days before the operation, or in real-time further to an incident occurred on the initial



route(s). The new itinerary shall be sent to the drivers that will be informed of the bus stops diverted.

2.7.44 A message shall be automatically generated by the system and sent to signs at bus stops which go out of service to warn passengers that there is a route diversion.

2.7.45 The system shall also manage unexpected diversions initiated by the bus driver.

#### Repeating instructions

2.7.46 All control centre commands such as instructions, switching commands, stop information and dispatch actions are to be technically monitored. If the receiver, despite repeated transmission, does not acknowledge an instruction, it shall be noted in the control computer as a failed instruction. The dispatcher should be able to repeat any failed instructions at a convenient time, without having to type the instruction in again.

## 2.8 USER INTERFACE

### Windowing technology on workstations

2.8.1 The system shall be capable of displaying operational information at the workstations. Workstations shall have a modern, ergonomic user interface that is equivalent to Microsoft defined standards.

2.8.2 The user interface shall contain a system window with menu-controlled user guidance. The system window shall indicate the status of all system components. The system window and all other windows will contain a toolbar with buttons representing the most frequently used actions. The dispatcher should be able to use these buttons, denoted by appropriate symbols, to immediately activate the main control centre functions (e.g. setting up voice and emergency connections, sending instructions, acknowledging messages, processing events, displaying special texts, opening notebooks etc.).

2.8.3 The window elements are to be operated mainly with a mouse. As an alternative to the mouse, operation via function keys should also be possible. All inputs (particularly those made via the keyboard) are to be checked for plausibility.

2.8.4 Objects (vehicles, routes, stops, drivers, etc.) shall be selected via menus, table or graphic elements. Group selections should also be possible in tables and graphics using the Control key.



2.8.5 Selection lists shall be provided in the dialogue boxes for the selection and display of texts. The desired text should be selectable with a mouse click, using the arrow keys or by typing in the first letter. Multiple selections shall also be possible using the mouse and Control key.

2.8.6 All tables and graphics shall have 'multi-screen' capability; allowing information to be displayed on two or three attached monitors. Each table or graphic is to be assigned to one monitor by default. However, it should be possible to move these to any other monitor by the dispatcher at any time. In addition, each dispatcher should have the ability to design and save his own standard screen arrangement.

#### Logging on and off the workstations

2.8.7 Every user shall log on with their name and given password. Passwords are to be alterable at any time by users.

2.8.8 The core system will recognise a minimum of six authorisation levels, to ensure that system-critical parameters can be modified only by authorised personnel.

2.8.9 The user categories shall be:

- Administrative - able to view data and manipulate it;
- Dispatcher - control centre personnel for the daily operation of the control centre with all dispatcher functions;
- Database Manager - responsible for data entry;
- Operations Manager – access to commercially sensitive data;
- System Manager - specially trained employee responsible for the operational parameterisation of the system; and

2.8.10 Service Engineer (service staff responsible for technical parameterisation, configuration Every logon/logoff action is to be internally logged, allowing any irregularities in control operation to be reconstructed if required.

#### Help text

2.8.11 The system should provide context-sensitive help. Menus or special help keys are to be used to access the electronic manual, which shall contain event-related help. Help functions shall include:

- Looking for key words;





- Jumping to related topics;
- Explanation of terms; and
- Adding notes.

#### Workstation parameters

2.8.12 It should be possible for the System Manager to define the workspace parameters of any workstation with fleet management capability.

2.8.13 Configuration of tables and graphics

2.8.13.1 It should be possible to adjust the font size and style as well as the foreground and background colours in all the tables and diagrams. It should be possible to save these settings within the personal standard arrangement of each user and become effective immediately after the corresponding user has logged on.

2.8.14 Configuration of event logs

2.8.14.1 It should be possible to configure events so that are recorded only in the operations log file without being displayed in the event queue. It should also be possible to exclude events completely so that they do not even appear in the operations log. The event logging configuration shall be capable of being separately defined for workstations with fleet management capability, for other operator terminals and for information workstations.

2.8.15 The following event attributes shall be defined for every event and “workplace type”:

- Display in the event queue or simple entry in the log or the event is ignored altogether;
- Priority of the event;
- Default action for processing the event;
- Time until automatic acknowledgement;
- Confirmation before automatic acknowledgement;
- Foreground colour; and
- Background colour.

2.8.15.1 It should also be possible to establish which noise is used to alert the dispatcher when each event occurs.



#### 2.8.16 User-specific settings

2.8.16.1 The actual settings of the working environment are to be separately saved for every user. These settings shall be activated when the corresponding user logs on.

2.8.16.2 The following elements represent user-specific settings:

- Currently active applications
- Position and size of the currently open application windows
- Fonts in the tables and diagrams
- Colours in the table and diagrams

2.8.16.3 The System Manager shall specify standard settings which shall be used when there are no user-specific settings.

#### 2.8.17 Responsibilities

2.8.17.1 The system shall provide the facility to allocate particular routes to defined dispatcher terminals if required.

### 2.9 MONITORING TABLES AND GRAPHICS

2.9.1 It shall be possible for all the operational status of all vehicles to be represented on all workstations in the form of tables or graphics. The content and format of the outputs shall be able individually configurable. Coloured coding of important real-time events (e.g. exceeding threshold values in schedule deviation, priority calls) are to be adjustable universally for all tables and images. If several windows are opened at the same time to represent an operational status, the data is to be simultaneously updated in real-time.

#### Event queue table

2.9.2 A dedicated window will display an event queue. The event queue shall contain all the operational events (e.g. request-to-talk calls, driver messages) as well as the most important system messages and mechanical alarms in a text form. Events shall be entered into this table as soon as they occur and are to be placed according to their priority. Every event is to be assigned a priority by the System Manager. The content and format is also to be defined by the System Manager.

2.9.3 Typically, information in this table should include:



- Route/run number or block number;
- Event time;
- Event text;
- Action;
- Vehicle number;
- Passenger load (if available);
- Status of the position determination and radio availability;
- Position (last stop, distance from stop) as actual position;
- Terminal or destination;
- Schedule status;
- Layover balance;
- Last message; and
- Last instruction.

2.9.4 The relevant information should be saved for each event.

2.9.5 Automatic "Alarm" conditions shall include, but not be limited to:

- Late running alarm - with five user definable thresholds;
- Bus diverting from route; and
- Communications problems.

2.9.6 Alarms generated by driver intervention shall include:

- Emergency call;
- Accident call;
- Bus full and cannot pick-up any further passengers;
- Vehicle breakdown;
- Driver advice of traffic congestion.

2.9.7 It shall be possible to categorise "Alarm" conditions within the system, as a minimum to differentiate between dangerous and/or urgent conditions and other warnings.



### Timetable table

2.9.8 The timetable table shall display::

- The scheduled timetable;
- The timetable applicable subsequent to any dispatch action;
- The achieved timetable for departures which have already occurred or the estimated timetable for departures yet to occur; and
- The number of minutes the vehicle is early or late (taking account of any lay-over balance).

### Connecting services table

2.9.9 The connection table shall contain the following information:

- Connection stop;
- Feeder route/run with actual position, schedule status and scheduled departure time;
- Receiver route/run with actual position, schedule status and scheduled departure time;
- Minimum changeover time;
- Predicted departure time of the receiver; and
- Connection status.

### Network overview

2.9.10 The network overview shall be a schematic representation of the entire transport network of the bus operator in real time. It will show the current extreme values of schedule deviations for each route in the form of a bar chart; each diagram is to be composed of a number of routes grouped together according to their operational properties. Each bar chart shall indicate the extreme values of lead and delay per route, with a note providing the fleet number of the corresponding vehicles, as well as the average values for lead and delays.

2.9.11 The network overview should give a clear representation of the expected state of the network and identify missing vehicles or services. This image will be used to identify situations including but not limited to occasions such as when no driver has registered for vehicle, or when a vehicle has been replaced during the operational day.



### Route overview

2.9.12 The route overview shall be a schematic representation of the operating status of all corresponding vehicles. The combination of routes to be displayed will be selected by the user according to user rights set by the system supervisor.

2.9.13 The route overview should be generated automatically, including route variants. If necessary, an editor function can be provided to "fine-tune" the appearance of the image. This must not be an onerous task. If manual intervention is required, Tenderers must explain the process, estimate the time required and state whether the exercise has to be repeated after a network change for all routes or only for affected routes.

2.9.14 Information represented in the route overview shall include:

- Route name;
- Stop sequence per route and trip direction (always the principal route path);
- Stops per route with short name and equipment level (displays, loudspeakers);
- The progress of the vehicles is represented along the schematic routes with appropriate symbols;
- Vehicles shall be identified in the diagram by fleet number or running board number;
- Vehicles shall be displayed with expected/actual positions and schedule status identified as on-time, ahead of schedule by +X minutes or behind schedule by -X minutes, or alternatively their headway in minutes, displayed next to their representation; and
- Vehicles shall be shown in colour depending on their schedule status.

2.9.15 Vehicles parked at a terminus shall appear in a dedicated area of the image displayed next to the corresponding terminus.

### Map view or Geographic Information System (GIS)

2.9.16 It will be possible to display a map on which vehicle positions are displayed in real-time. A geographic information system, GIS, is to be used to produce representations in which vehicles are represented on a map according to their real geographic co-ordinates.

2.9.17 The map view should be able to display the complete route path of one or more services. The route path must follow the physical layout of the relevant highways. Tenderers should explain how such route paths will be produced. It is permissible to require manual edits to any route paths



that are generated from data. However such edits should be kept to minimum and should be applied to any subsequent data import. The system should be capable of storing multiple versions of the route path if necessary.

- 2.9.18 Analogous to the route overview, the vehicle symbols shall move along the routes on the map with the same colour markings corresponding to their schedule status. Alternatively, the user shall be able to choose to show the vehicles of each different route in different colour.
- 2.9.19 It should be possible for the user to move the map image to any section of the network. For example, to graphically represent the entire network, an approach area to a major interchange or a parallel route section in the centre of town. The map image should be composed of various zoom levels, allowing the user to switch from the global view to a more detailed view within the same picture.
- 2.9.20 The user shall be able to select the routes to be displayed from the list of routes set by the system supervisor. He shall have the facility to choose to display or not the route itineraries on the map, as well as stop points and stop points' short names.
- 2.9.21 The map view shall have the facility to remain centred on a vehicle selected by the user.
- 2.9.22 When a vehicle is not moving, the position of the vehicle should be shown on the GIS using its GPS co-ordinates.
- 2.9.23 If a vehicle is on route, its position may be shown on the GIS using either its location derived from GPS or its position calculated from chainage and odometer reading.
- 2.9.24 If a vehicle goes off-route, the GPS location should be used to identify and display its actual position on the GIS. The GIS should also display (using a different icon) the location the vehicle should be in (which may be calculated from chainage and the odometer reading or other methods if available).
- 2.9.25 If no location data are available, the system should request the vehicle to transmit its location derived from GPS.
- 2.9.26 The system should store vehicle location data to enable a vehicle's movements for the operational day to be reviewed. Data for previous days should be archived and made available to review and compare movements across a number of days.



### Network overview table

2.9.27 This table will provide an analytical summary of all bus services, i.e. the principal information about each bus of the entire network. The table will show for each route of the network all buses currently running that route. For each bus the table shall display:

- Bus service number;
- Driver duty number;
- Fleet number of the bus carrying out the service;
- Block or running board number;
- The value of the lead/delay in minutes. This value shall appear with the same colour code as in the Route and Map images dependant on schedule status;
  - In service;
  - On dead run;
  - Depot pull out;
  - Depot pull in;
  - At a terminus;
  - On a diversion;
  - Location not known;
  - Not in service;
- The driver relief status:
  - Relief awaited en route during the current journey;
  - Relief not carried out (relief stop point passed without relief);
  - Relief carried out.

2.9.28 The network overview table shall also display in a distinctive manner any bus currently in normal voice communication with the control centre and in any bus in distress voice communication.

2.9.29 The network overview table should give a clear indication of blocks where a vehicle should be in service and for which no vehicle is logged on for example when a vehicle has been taken out of service.

### Bus and bus stop details

2.9.30 Clicking on the representation of a bus or a bus stop in any one of the monitoring images shall activate a pop-up window providing detailed information on:

- Vehicles;



- Routes;
- Stops;
- Events; and
- Drivers

2.9.31 The detailed information shall also be displayed for individual vehicles involved in voice connections or emergency connections. The System Manager shall be able to define the format and content of the detailed information.

2.9.32 For a bus the details pop-up window shall show:

- Route number;
- Running board number;
- Schedule deviation (lead/delay in minutes);
- Headway (in minutes before/after straddling vehicles);
- Layover balance;
- Fleet number;
- Driver name and number;
- Driver duty number;
- Driver relief status; and
- Type of vehicle

2.9.33 For a bus stop the details box shall show:

- Display identification (bus stop name);
- Display status (on/off);
- Any commercial message;
- And for services using that stop within the next 60 minutes:
  - Route number;
  - Destination;
  - Departure time;

2.9.34 For those bus stop displays equipped with audio announcers:

- Loudspeaker status (on/off).





### Notebook

2.9.35 Where specified, an electronic notebook shall allow every user (on the control stations) to execute the following functions:

- Send messages to one or several users;
- Read and acknowledge messages; and
- Delete messages.

2.9.36 It should be possible to set up an address list for personal and public messages and for notes.

### Diary

2.9.37 An electronic diary shall be provided to allow users (on the control stations) to execute the following functions:

- Enter appointments;
- Read and acknowledge appointments; and
- Delete appointments.

2.9.38 Two types of appointment are required, normal and alarm. These shall be represented differently in the event queue. The colour and acoustic signal shall be adjustable. Appointments shall be entered with an accuracy of 1 minute and are to be identified with a short text of up to 10 characters.

### Journal

2.9.39 This function should allow users to create and manage freely entered texts. The texts should be able to be edited, printed and saved using appropriate file names.

### Reference Book

2.9.40 This function shall allow every user the possibility of selecting predefined text and graphic files and viewing them on screen or printing them out. The System Manager will be responsible for creating and managing these files. Such texts will include:

- Address lists;
- Telephone directories;
- Catalogue of actions;
- City maps;



- Street directory; and
- Schedules of other transport operators.

#### Vehicle fleet table

2.9.41 A vehicle fleet table shall log the jobs of all relevant vehicles and the drivers associated with them. From this evaluation it will be possible to determine which vehicle was on which job (route/run or block) and with which driver.

2.9.42 The data should be sorted according to the following criteria:

- Vehicle number;
- Route/run;
- Block; and
- Driver.

2.9.43 The vehicle fleet table shall contain a complete list of the bus operator's vehicles. For each vehicle the table shall display:

- Fleet number;
- Vehicle type;
- Status:
  - Not assigned;
  - Assigned;
  - In service;
  - In maintenance;
- If the status is assigned or in service:
  - Bus service number;
  - Running board number;
  - Scheduled time of exit from depot;
  - Scheduled time of return to depot;
  - The name of the depot.

2.9.44 Buses whose driver logon is late and buses that are not assigned shall appear in distinctive colours.



2.9.45 It should be possible to display a table listing the current version of the on-board unit software on each equipped vehicle. Copies which are out-of-date should be capable of being highlighted.

#### Bus driver table

2.9.46 The bus driver table shall contain a complete list of the bus operator's drivers. For each driver the table shall display:

- Driver name and number;
- Status:
  - Not assigned;
  - Assigned;
  - On duty;
- If the status is assigned or on duty:
  - Duty number;
  - Running board number;
  - Scheduled duty start time;
  - Scheduled duty finish time;
  - Type of duty:
- Depot exit;
- Relief;
- Special;
- Maintenance;
- Location where the duty starts.

2.9.47 Drivers whose logon is late and drivers that are not assigned shall appear in distinctive colours.

#### Table of running boards

2.9.48 The table of running boards shall contain a complete list of running boards for the current day of operation. For each running board the table shall display:

- Running board number;
- Driver duty number assigned to the running board;
- Fleet number of the vehicle assigned to the running board;
- Fleet number of the vehicle which is carrying out the running board;



- Scheduled time of exit from depot;
- Achieved time of driver logon;
- Location where the logon is to be carried out or where it was achieved.

2.9.49 Running boards whose driver logon is carried out late or that are not assigned for shall appear in distinctive colours.

2.9.50 By clicking on a running board, the table of driver duties shall be activated showing the driver duties associated to the selected running board and the table of driver reliefs shall be activated showing the reliefs scheduled for the selected running board.

#### Table of driver duties

2.9.51 The table of driver duties shall contain a complete list of driver duties for the current day of operation. For each driver duty the table shall display:

- Driver Duty number;
- Name and number of the driver assigned to the driver duty;
- Scheduled time of driver logon;
- Achieved time of driver logon;
- Type of driver duty:
  - Exit from depot;
  - Relief;
  - Special service;
  - Maintenance service;
- Location of where the logon is to occur; and
- Explicit reference to the vehicle's operating base.

2.9.52 Driver duties whose logon is carried out late or that are not assigned for shall appear in distinctive colours.

2.9.53 By clicking on a driver duty, the table of running boards shall be activated showing the running boards associated to the selected driver duty and the table of driver reliefs shall be activated showing the reliefs scheduled for the selected driver duty.



### Table of driver reliefs

2.9.54 The table of driver reliefs shall contain a complete list of driver reliefs for the current day of operation. For each driver relief the table shall display:

- Running Board number;
- Driver Duty number;
- Scheduled time of relief;
- Achieved time of relief;
- Location of where the relief is to occur; and
- Explicit reference to the vehicle's operating base.

2.9.55 Late reliefs shall appear in distinctive colours.

2.9.56 By clicking on a relief, the table of running boards shall be activated showing the running boards associated to the selected relief and the table of driver duties shall be activated showing the driver duties associated to the selected relief.

### Operational messages

The system will be required to provide three types of messages:

- Driver messages
- Mechanical alarms
- Vehicle messages

2.9.57 Driver messages are to be initiated by the driver of the vehicle using the keyboard of the on-board unit. These messages shall be then transmitted to the control centre and displayed to the dispatcher.

- Standard messages will include:
- Request to talk calls;
- Priority calls;
- Emergency calls and
- Passenger load (if available).

2.9.58 It should also be possible to transmit other messages that have been defined by the transport authority, for example:



- Overloaded;
- Street blocked; and
- Lost & found.

2.9.59 Alarm messages should be generated if any device monitored by the on-board unit exceeds its standard operating parameters. such alarm messages shall be transmitted automatically and will be displayed in the control centre. It should be possible to select which alarms are transmitted to the control centre and which ones are only displayed to the driver.

2.9.60 Vehicle messages are to convey the status of third-party devices or systems in the vehicles. These messages shall be transmitted automatically.

#### Passenger information messages

2.9.61 The system shall enable the preparation and display of general information messages for passengers. Such messages shall be prepared at an operator workstation.

#### Message library

2.9.62 The core system will hold and manage a library of standard messages.

2.9.63 Creation, modification and deletion of messages in this library are carried out at operator workstations

#### Sending a message

2.9.64 A dispatcher will have the ability to define:

- the message to be transmitted,,
- the recipient(s), and
- the dates of beginning and end of the display.

2.9.65 The dispatch of any passenger information messages shall to be recorded in the daily log.

## 2.10 FLEET MANAGEMENT FUNCTIONS

2.10.1 The following paragraphs describe the fleet management functions required for workstations. Functionality of on-bus systems and real-time information signs are detailed elsewhere.



### Minimum requirements

- 2.10.2 The system shall have the ability to register the position of each bus whenever the vehicle generates an event transmission and to log the position of the vehicle when the event took place. The parameters for such event logging shall be configurable by the user.
- 2.10.3 All external equipment connected to the system shall be monitored for correct operation such that where a fault in the equipment or a loss of communications to it is detected an appropriate alarm is raised and logged within the system. Thus the system needs to be fully self-monitoring with all incidents logged through the system. A fully functional on bus unit should record all its own faults. The monitoring of equipment must be carried out within the equipment and reporting carried out on an exceptions basis wherever possible.

### Time synchronisation

- 2.10.4 All systems, subsystems and radio-partners must be time synchronised within the control system. The core system shall be supplied with the current time (including date) via a radio time transmitter.
- 2.10.5 Radio partners should be synchronised at least every 60 seconds. Tenderers must explain how this will be achieved.

### Position determination

- 2.10.6 Vehicle locations may be determined by any combination of GPS, differential GPS, odometer pulses and door opening contacts. Tenderers must state their preferred strategy and the accuracy achieved (95th percentile value for +/- x metres). Alternative options may be offered with corresponding locational accuracy. Tenderers should state the advantages and disadvantages of the solutions offered in terms at least including cost savings, robustness and maintenance.
- 2.10.7 Tenderers should clearly state whether they can utilise existing GPS capability associated with ticket machines and if they intend to do so.
- 2.10.8 Tenderers must explain and justify their preferred position determination strategy (polling frequency / exception / event reporting). This must include a commentary on the balance between accuracy, the capacity of the proposed communications system and operating costs. Care should be taken to identify the mechanism by which bus priority will be achieved and then to identify the implications for the required level of positional accuracy. For example, it



will be important to ensure a vehicle stopped at a stop near a traffic signal is not given priority until it has closed its doors and set off.

- 2.10.9 The system shall contain a facility whereby the on-bus system generates a heartbeat pulse to indicate that the vehicle is live. This shall be user configurable in one-minute intervals and shall only be transmitted where the period between regular or other operational events or exception reports exceed the configured heartbeat period.
- 2.10.10 The system must automatically and reliably detect when a vehicle is off route. Tenderers must explain how this is managed. Note: Some express or rural services will stop infrequently giving few opportunities to confirm position the position of the vehicle when doors open. Tenderers must explain how positional accuracy and off route occurrences will be managed in such circumstances.
- 2.10.11 The on-bus computer will also report additional operational information to be analysed, stored, actioned and disseminated by the system.
- 2.10.12 It is envisaged that each vehicle shall continuously assess and report any deviation from its schedule or defined route. This will include the monitoring of vehicle headways on routes where this is defined as a key service parameter. The core system will record, analyse and disseminate this information and raise alarm messages when necessary.
- 2.10.13 The dispatcher will have the facility to:
- Insert a revised journey time between affected stops, which will subsequently be monitored and smoothed by the journey time algorithms; and
  - Display free-text messages for the benefit of passengers at the affected stops.

#### Predicted departure times at downstream stops

- 2.10.14 The system shall incorporate appropriate algorithms to enable prediction of arrival times at downstream stops. The algorithms shall reflect historic data relating to time of day and other factors together with more recent journey time data from previous trips.
- 2.10.15 Tenderers shall explain the principles behind any recommended algorithms and state the level of accuracy achieved in other projects.
- 2.10.16 It shall be possible to initiate more complex algorithms, if required, or to adopt a distance / schedule based calculation.





- 2.10.17 If a vehicle deviates from route, the system (with dispatcher confirmation if necessary) shall automatically ensure (with optional dispatcher acknowledgement and / or confirmation) that downstream RTI signs show sensible displays. For example, if a short unplanned detour is detected the system shall have the facility to suspend RTIS messages displays for that vehicle until it rejoins the route or until the dispatcher acknowledges the problem and details the necessary temporary alternative actions. If the vehicle subsequently rejoins the original route downstream it must be possible to generate appropriate new RTIS messages.
- 2.10.18 To minimise the impact of “stretchy minutes”, the system shall continually monitor the progress of all buses against a set of configurable criteria and automatically detect when a vehicle is experiencing unusual delay. When this occurs, arrival time predictions at downstream stops shall be replaced automatically by a “delayed” message. Real-time predictions shall commence once the system recognises that the vehicle is again making “normal” progress. Typical threshold criteria for the “on-set of delay” would be when a vehicle takes 240s to travel a distance which, according to the schedule should only take 60s, and “end of delay” when a vehicle takes 120s to travel a distance which should take 60s. The delay monitoring facility should not be triggered by the bus is waiting at a stop during regular service conditions. “Delayed” messages shall be available in both RTPI and workstation environments.
- 2.10.19 The system must be running-board based to provide cross-service predictions at stops.
- 2.10.20 The system must take account of dead-runs and layovers (distinguishing between “protected” and “unprotected” layovers) to enable accurate cross-service predictions at down-stream stops.

#### Layover monitoring

- 2.10.21 The scheduled time between arrival at the terminal point and the beginning of the next trip in the opposite direction is termed the ‘layover’. A delayed arrival shortens the actual layover (called the layover balance); as the journey in the return direction should begin as near to the scheduled time as possible.
- 2.10.22 When a vehicle may be subject to considerable delay. the entire layover will be used up and there will be a negative layover balance resulting in the return journey commencing with a delay. Such situations should be detected as early as possible so that the dispatcher can take appropriate action.
- 2.10.23 The layover balance is to be monitored at the installation. During the trip the vehicle will transmit the most recent value of schedule deviation. From this value and the scheduled



layover, the control computer shall calculate the layover balance. The dispatcher should be alerted when a vehicle has insufficient layover.

#### Monitoring vehicle logon and logoff

- 2.10.24 The system shall periodically check whether all planned runs are actually logged on to the system. This shall allow the system to detect when a trip has not commenced on time, is missing completely or has ended early. The messages will be entered in the event queue and recorded in the operations log.
- 2.10.25 It should be possible to monitor expected vehicle log-ons 'x' (variable) minutes before their scheduled departure, allowing any necessary action to be taken by the dispatcher.
- 2.10.26 The scheduled logoff of runs shall also be monitored. Vehicles that exceed a certain predefined threshold value when logging off are to be displayed to the dispatcher and logged.
- 2.10.27 If vehicle log-on/off is via the ticket machine (rather than the OBU), the vehicle shall not be logged-off the system when a driver removes his individual ticket machine module or logs off the ticket machine e.g. during a scheduled driver relief on the daily running-board. Tenderers must explain how this scenario is managed. Similarly, the vehicle must not be logged off or "lost" during a block or running board simply because the engine has been switched off. Log-offs in the above scenarios can significantly disrupt real-time predictions along the route.

#### Managing guaranteed connections

- 2.10.28 The core system will monitor guaranteed connections that have been defined in the schedule generation program. The connection definition will include the main parameters of the routes (route/route path) involved in the connection as feeder and receiver route paths as well as the transfer stopping points. Other parameters such as passenger transfer time and maximum permitted delays will determine the reaction of the control computer during connection monitoring.
- 2.10.29 The core system will take these parameters into consideration and recommend the appropriate action to be taken by the dispatcher e.g. delay the vehicle or cancel the connection altogether. The relevant vehicles are to be informed accordingly via data communications following confirmation by the dispatcher. The system will automatically implement the recommended connection management actions if this mode of operation is selected by the dispatcher.
- 2.10.30 The core system shall display a list of all services with guaranteed connections for the current operational day. This allows the success of past connections to be evaluated. For future



connections, the system should indicate whether they are predicted to take place, whether the available time for passenger transfer is lower than planned, or whether the connection should be cancelled.

- 2.10.31 The dispatcher should be able to activate and deactivate connection management (automatic or dispatcher) for individual transfers, stops or routes.

#### Monitoring driver reliefs

- 2.10.32 Reliefs shall be monitored in a similar manner to Transfers with recommendations for dispatcher actions. The system shall be intelligent enough to assess the overall situation and make appropriate recommendations for dispatcher action/confirmation.

#### Forms

- 2.10.33 The system should be able to produce standard forms for use by authorised personnel. The following functionality is required:

- Creation of form templates by the System Manager (form designer);
- Central management of the form templates;
- Allocation of form templates to events by the System Manager;
- Automatic generation of pre-completed forms when specific events occur;
- Manual request of a form;
- Form completion by the dispatcher directly on screen;
- Saving the form for later processing or as a data backup;
- Deleting saved forms;
- Printing the form on the standard printer; and
- Sending the form as a fax or e-mail (if the corresponding equipment is available).

- 2.10.34 Colours should be used in the dialogue window to indicate the information that has already been completed or automatically entered by the control computer (e.g. route/run, position) and which information needs to be manually entered.

#### Daily log

- 2.10.35 Configurable daily logs are to be generated by the core system computer at the end of every operational day. The log is to be saved in a file and if required be printed out. The System



Manager is to be able to call up the daily logs at a later date. The daily log should contain an excerpt of data from the operations log presented in a structured form and with an adjustable level of detail. It should be possible for every entry to log the total number of events summed up for the day and list these individually in chronological order.

#### Errors in the vehicle

- 2.10.36 The core system will keep a list of all the errors in each and every vehicle. The occurrence of an error message from a vehicle will trigger an event; another event is triggered when the corresponding device is returned to normal operation.
- 2.10.37 The system shall be capable of identifying, logging and reporting faults by exception. For example if a bus has been operational for several hours and there is no record of door openings then the door contacts should be reported as faulty or suspect. The system should assign a degree of confidence to such reports.

#### Odometer reading

- 2.10.38 If the proposed system uses odometer links, any odometer readings that are stored in the on-board computers are to be reported to the control centre at least once a day and it shall be possible to view these in tables and detail boxes.

#### Version check

- 2.10.39 The control computer shall cyclically request the version of the loaded software and data supply from every radio partner. This information shall be saved and it shall be possible to view this in a tabular overview at any time.

### 2.11 SIGN MANAGEMENT TOOLS

- 2.11.1 The overall system will use the following types of displays:
- Displays which are permanently "on";
  - Displays which are activated on request;
  - Displays which communicate over the Tenderers' data communications network; and
  - Internet based displays with fixed IP addresses at key locations
- 2.11.2 The following requirements apply to all sign types.
- 2.11.3 It must be possible to configure roadside displays from a workstation. Such configuration should be automated where possible.



2.11.4 Data messages from the core system to signs that are identified as unsuccessful should be re-transmitted. Any unsuccessful transmissions should be notified to an operator via the relevant workstation who should then have the possibility of manually repeating the transmission to the relevant display. Displays are to regularly transmit status messages and version information to the relevant core system.

2.11.5 The system shall log sign status and transmission error messages and produce fault reports and statistics on sign availability.

2.11.6 It shall be possible to monitor:

- Current display;
- Send user defined messages;
- Monitor operational performance (directly or indirectly by exception);
- Messages received successfully;
- On/off status;
- Failed components; and
- Overheating.

## 2.12 DEPOT DATA UPLOAD AND DOWNLOAD

2.12.1 It is envisaged that the nominated operator depots will be equipped with wireless LAN facilities and associated controlling PC to manage the upload and download of data to and from the on-bus units. If wireless LANs are already installed in depots the AVL system must use the existing infrastructure. Tenderers may submit and justify alternative proposals such as DECT if they feel that wireless LAN facilities are unnecessary in all or some of the operator depots.

2.12.2 Any WLAN supplied under this contract shall be capable of managing the upload and download of data from third party systems (subject to capacity constraints).

2.12.3 As an alternative, it may be possible for systems to perform “over air” uploads/downloads of data without the need for depot DECT or WLAN. Tenderers are invited to suggest how they might achieve this, with an estimate of the bandwidth required, a demonstration that the solution employs adequate headroom and resilience, and a demonstration of the reliability of the system and the time taken to upload and download data when operating with a full data set.



2.12.4 At the time of installation, tenderers will be required to survey the depots to ensure that adequate radio coverage can be obtained to ensure that any vehicle within the confines of the depot can be accessed by the system. Specific care must be taken to ensure that updates of data can be fully completed prior to buses leaving their depots.

2.12.5 In the event of a lack of communications the upload/ download of data shall be possible through a laptop, USB, RS232, or similar. The tenderer is to recommend and cost their preferred solution.

## 2.13 TESTS AND AUXILIARY PROGRAMS

### Vehicle simulator

2.13.1 A training system will be available. The system should be populated with actual schedule and running board data. The training facility should enable operators to practice responding to a variety of operational situations.

### Communication statistics, measuring availability

2.13.2 When required, the technical communications statistics (number of control centre telegrams, number of vehicle telegrams, successful repetitions, unsuccessful repetitions, synchronisation errors and communication problems) shall be recorded in the control computer. Using this information, the System Manager and Service Engineer shall be able to determine the quality of communications and whether there have been any significant changes over a long-term period.

2.13.3 Vehicles should be able to be selected on the control computer for a communications availability test. The test will be triggered and halted by the System Manager on the control computer with the results being displayed on the control computer or on a print out.

## 2.14 STATISTICS AND DIAGNOSTICS

2.14.1 Operational data shall be recorded using equipment fitted in the vehicles.

2.14.2 Recorded positional data is to be downloaded from vehicles to a central statistics database. Normally this will occur at the end of each operational day. It is essential that download is an automated facility, typically over depot WLAN. If the process is not automated, Tenderers should describe the process including a realistic estimate of staff time requirements. This will also provide a fall-back strategy if there are faults in the automated system or for depots with small numbers of vehicles.



2.14.3 A data analysis package is required that will enable various levels of enquiry and analysis to be made. The package will be menu driven and allow the user to drill down and establish cause and effect of poor performance. It will facilitate data download to a Business Intelligence and Data Warehouse system.

2.14.4 The system must include a comprehensive statistical analysis package, which allows the users to access historic data from their terminals. Users must have the ability to:

- Choose from a selection of pre-defined reports;
- Define new reports and report formats using any data parameters;
- When analysing data recorded at a fine level of detail, define reports which will aggregate and analyse small amounts of data on a daily basis. This is intended to minimise delays associated with accessing, collating and analysing very large volumes of operational data;
- Create maintenance reports which include reported faults and faults which are defined by exception i.e. expected events are not occurring with normal frequency. The system shall assign confidence levels to such faults;
- Create revised schedules reflecting actual running times which can be imported into their respective scheduling software (including OmniTimes and Trapeze);
- Nominate reports which must be generated automatically at defined periods (daily, weekly, monthly, annually);
- Distribute reports or report summaries automatically via e-mail to selected recipients chosen from a contact list;



- Retain valid data for incomplete trips (e.g. due to turning short, off-route occurrences, temporary de-localisation<sup>1</sup>) for inclusion in future analysis of stop sequences or part trips/chainages.

2.14.5 Security of commercially sensitive data and reports is of paramount importance. Tenderers must demonstrate how this will be achieved and that relevant systems are in place to ensure security is maintained.

2.14.6 With regard to standard reports, First in Edinburgh has identified 11 reports as a minimum requirement that must be achieved. These are listed below:

2.14.7 Report 1 – Timekeeping Analysis will show graphically the percentage of events that took place within certain defined time bands for selected periods and routes. There must be the provision to easily change the time bands and select any combination of routes and time bands. This will include a chart suitable for submission to the Traffic Commissioners showing the number and percentage of vehicles starting their journeys on time. The Vehicle and Operators Standards Agency publishes the guidance on standards for local bus services.

2.14.8 Report 2 – Compliance Analysis will probably be a table that will have the running board and depot name as a header and preparation date tolerance criteria and target as a footer. The table will be in date order, and show date, total number of visits to timing points, number of compliant visits to timing points and percentage compliant to the total. It must be possible to select any combination of dates for comparison.

2.14.9 Report 3 – Compliance Summary will be similar to Report 2 and have Division or Operating Region as a title and the from/to date of the analysis as a header and preparation date, tolerance criteria and target as a footer. The table will show parent depot of the service, bus

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<sup>1</sup> The term “de-localised” is used to describe events where vehicle location data conflict with other data.







number, running board number, total number of visits to timing points for the specific period, number of compliant visits to timing points and percentage compliant to the total.

- 2.14.10 Report 4 – Time Match Analysis is a table style document that shows the name of the timing point, the actual time at the timing point the scheduled time and the minutes difference between the two. The chart must ensure the correct colour notation of the difference. The header will show the date that has been analysed, the parent depot name and the running board number. The footer will show the date on which the analysis was carried out.
- 2.14.11 Report 5 – Cumulative Time Match Analysis will be a table showing the name of the timing point and seven columns – each titled with the date – showing the difference (as identified in Report 4) for the selected dates. The chart must ensure the correct colour notation of the difference. The header and footer will be as Report 4.
- 2.14.12 Report 6 – Daily Comparison will be a chart that shows how a particular trip performed on each day of a selected period. It is important that we are able to select the dates for analysis. The header will show parent depot, running board and trip number and the footer will show the date of analysis. The vertical axis will show minutes early and late (with zero as the central axis) and the horizontal axis will show (by name) the timing points and the scheduled time for these points. The legend will show the date and colour code of the lines.
- 2.14.13 Report 7 – Comparison of Days will be similar to Report 6 except that it will average the selected dates by day of the week. The system must allow the selection of any range of dates. In addition to Report 6's header and footer, the footer in Report 7 must show the date range of analysis and instead of dates the legend will show the day of the week.
- 2.14.14 Report 8 – Time Between Points will allow the definition or selection of two points either inbound or outbound on the selected route or service and selection of a series of from/to times for a selected period of days. For example, we would select the 1/52 between 05.00 to 0700, 07.30 to 10.00, 11.00 to 15.00 and 15.30 to 18.30 between Simpson Terrace and Grange Hill from 1 – 31 March 2009. The legend would show the time bands, the header would show parent depot and service number, the footer would show the selected dates and date of analysis. The vertical axis would show the percentage of occasions (frequency) and the horizontal axis would show minutes (time taken).
- 2.14.15 Report 9 – Survey Report will not carry out any schedule adherence comparison. It will record the cumulative time taken along a specific route or alignment that has identified Way-points. Ideally the horizontal axis will be to a geographical scale and the vertical will be elapsed



minutes. The Report will have the parent depot and route description as a header and the footer will carry the dates of the “surveys” and the analysis date. The chart must be capable of analysing more than one “journey” on the same Report. The legend will show the start/finish time of the “journeys”.

- 2.14.16 Report 10 – Headway Measurement table will show the headway between buses at selected points along the route for selected dates/times periods. This will only be applied when all buses operating the service are suitably equipped. The header will show the parent depot, service number and the footer will show the dates analysed and the date of the analysis.
- 2.14.17 Report(s) 11 – There is a requirement to provide an ad hoc query builder, which can be used to interrogate the data base using selected running boards, criteria and time periods. This part of the package will be used for information such as passenger boarding analysis or running time between points – i.e. total time minus dwell time at stops.
- 2.14.18 The statistical reporting systems must satisfy the aspirations of each of the various stakeholders.
- 2.14.19 The analysis suite must also be capable of the production of Excess Waiting Time statistics for any given route over defined time period.
- 2.14.20 Reports will be suitable for transmission to managers, schedulers and other interested parties via electronic. They must also be suitable for presentation as evidence to local authority partners or for use in discussions with or evidence to the Traffic Commissioners. Reports must be available to any user with appropriate authority to be able to produce, for any operating company, using remote password protected access.

#### On-Line Problem Identification and Analysis

- 2.14.21 It shall be possible to calibrate the system to compare historic data and current data for individual buses, groups of buses, road links, traffic signal installation sites, etc to produce an on-line overview at various on-screen resolutions. The purpose shall be to highlight significant deviations from the normal expected condition where the normal expected condition is a set value or one that is derived from a combination of recent historic values.
- 2.14.22 The system should be capable of performing its own diagnostics tests. For example, the correct operation of the door sensor could be monitored by comparing reported door openings to vehicle tracking information. Similarly the system should assist in identifying areas where communications between vehicles, workstations and road-side displays are not as expected.



2.14.23 The system shall be capable of combining historic values to determine an average or other calculated value that represents a normal expected value. The magnitude or thresholds of deviation acceptable from the expected condition should be user configurable. It should be possible to raise system alerts where such thresholds are exceeded. The facility shall make full use of the system’s GIS capability where appropriate. The full scope of this facility shall be agreed in the Joint Design Exercise. The Tenderer shall describe examples of how their system presents this information in their tender submission.

## 3 On-bus equipment

### 3.1 PRINCIPLES

3.1.1 It was noted in Part Two that the major bus operators have varying aspirations with regard to the functionality required of the AVL/RTPI system, particularly in relation to on-bus systems. One operator (First in Edinburgh) requires a highly functional AVL and fleet management system while this is not a core requirement of other operators. This section therefore includes a number of options with regard to on-bus equipment.

3.1.2 The reference specification is for a fully functional on-bus unit. Alternative options are required as described below. Tenderers should state the capability and the functionality of alternative designs relative to a fully functional on-bus unit. The specification for a fully functional OBU and associated driver display is included in paragraph 3.4.

3.1.3 It is important to stress, however, that the stakeholders are not committed to a particular solution at this stage. A range of on-bus solutions may be requested by bus operators to meet their particular needs. Tenderers must therefore clearly state their capabilities in this area.

### 3.2 DEFINING CHARACTERISTICS OF ON-BUS UNITS

3.2.1 The defining features of on-bus units are:

- The volume and complexity of network data they hold;
- The extent to which they interface with other on-bus components (radios / GPRS, GPS, odometers, engine management systems, on-bus signs etc) for both monitoring and control purposes
- The level of support offered to the driver regarding schedule adherence, service information, driver duties / reliefs and operational tools
- The extent to which operational data is stored for download in the depot
- Whether schedule adherence is calculated on or off-bus
- Whether the unit can operate autonomously if communication with the centre is lost
- Whether data communication is two-way or only one-way, from the vehicle to the centre
- If communication is two-way, the level and complexity of information received from the centre e.g. operational actions to turn-short etc and the extent they are incorporated into the planned network data.



- Management of bus priority requests

3.2.2 Tenderers must consider such aspects when considering and stating their proposals for this tender.

### 3.3 STATEMENT OF CAPABILITY

3.3.1 As a variety of on-bus unit configurations and levels of functionality may be selected by the bus operator stakeholders, Tenderers must clearly state:

- The functionality offered by their preferred OBU and any alternative or “lighter” versions they can offer
- Their preferred on-bus architecture;
- Which other architectures they can provide and support within a single system;
- The accuracy and robustness of the option or options they are willing to supply under this tender;
- The advantages and disadvantages of the various options they are willing to supply under this tender including stated performance levels;
- The degree to which all types of on bus unit are capable of future enhancement.

3.3.2 It is essential that the Tenderer identifies and assesses any risks regarding the quality, reliability and robustness of real-time passenger information and bus priority outputs before committing to a system specification.

3.3.3 These issues are critical to SEStran and their stakeholders as they want to achieve high levels of customer satisfaction. In addition, to ensure public perception of the existing BusTracker system is not undermined, City of Edinburgh Council and Lothian Buses will only accept real-time passenger information outputs from the SEStran system for onward transmission under the BusTracker brand if they are shown to be reliable and robust. Delivering RTPI across hundreds of BusTracker signs in Edinburgh is a major benefit for the bus-operators in the SEStran system and their passengers.

### 3.4 FULLY FUNCTIONAL ON-BUS UNIT

3.4.1 The fully functional on-bus unit as described in this sub-section is Option A. Other options are defined in further sub-sections.



## Overview

3.4.2 A fully functional bus unit will calculate schedule adherence on the vehicle. It will also interface with other equipment on the bus to enhance its determination of its location, update the ticket machine, request traffic signal priority and so on. A fully functional on-bus unit will therefore:

- Hold schedule data
- Monitor, corroborate and report vehicle location;
- Monitor and report progress against schedules or headways;
- Control voice and data communications;
- Control on-bus information;
- Control external destination displays;
- Controlling bus priority requests;
- Interface with the on-board ticket machine for driver log-on / log-off,
- Interface with passenger counting equipment;
- Interface with bus engine management systems;
- Be capable of interfacing with on bus CCTV
- Interface with data upload / download equipment in the depot;
- Store records of the above in fine detail for download over the depot WLAN; and
- Interface with other on-bus equipment.

3.4.3 Tenderers should confirm whether their fully-functional on-bus unit can provide the functionality identified above. The functionality of any "lighter", alternative must also be confirmed, highlighting the implications for fleet management, RTPI and bus priority. Optional functionality should be clearly identified.

3.4.4 Generally, a fully-functional on-bus unit will include:

- GPS receiver equipment;
- A microprocessor and data storage;
- On-bus radio communications equipment and/ or interface to voice radio equipment
- A driver terminal including a display, keyboard, microphones and other features as necessary;



- Links to other bus equipment (including the electronic ticket machine, destination blinds, CCTV, engine management systems, accelerometer etc);
- On-bus traffic signal pre-emption unit/ transceiver;
- Interfaces with on-vehicle sensors and switches where necessary including door sensors and any similar equipment;
- A peripheral equipment termination box to allow easy connection of any such equipment to the OBU;
- All necessary aerial units and connecting leads where they are not already provided as part of the bus infrastructure; and
- On-bus next stop visual display with optional audio announcement using DDA key fobs which comply with the emerging RTIG specification.

3.4.5 The computer should use a mainstream system operating system such as Windows CE or Linux unless an alternative system can be justified.

#### Driver's terminal

3.4.6 The driver's input device shall be capable of (but not be limited to) providing the following functionality:

- Allow a suitable method of logging onto the system unless such log on is performed through the ETM,
- Provide a visual screen capable of displaying service information and displaying text messages sent from the control centre;
- Have configurable single stroke action keys to allow the driver to initiate a minimum of 12 operator configured 'messages' to be relayed to the control centre;
- Allow the driver to request voice access to the centre;
- Allow the driver to initiate driver generated 'alarms' (including "bus full");
- Have an 'emergency' request key, which automatically establishes and maintains an "open mike" status on the vehicle and initiates automatic depot voice recording.

3.4.7 The base specification is for the fully functional on-bus unit includes a driver's terminal which will have an integrated display and keyboard. The display panel should also be capable of displaying other messages for the driver, but should not show any other message until such time as the driver has stopped the vehicle at the roadside, message display being triggered by



the activation of the ticket-issuing button on the ETM. In order to alert the driver that there is a message to read, the numerical schedule adherence display could be made to flash.

3.4.8 The base specification, for Tender purposes, is for the fully functional on-bus unit including a driver's terminal which will have an integrated display and keyboard. This defines the highest level of functionality required by a SEStran bus operator stakeholder.

3.4.9 Reduced functionality alternatives to for the driver's terminal may be offered as follows:

- i) Alternative 1 - information for the driver is displayed on the ETM display. The ETM should be augmented by a key pad unit or utilise existing ETM keys
- ii) Alternative 2 - Information is displayed on an auxiliary terminal with reduced functionality that displays basic schedule adherence information and short text messages.
- iii) Alternative 3 - No information is provided to the driver. All interaction with the system is via the ETM.

3.4.9.2 The attributes of a fully functional OBU are specified in greater detail below.

#### Schedule data

3.4.10 The fully-functional on-bus unit shall store, manage and disseminate route specific, schedule, running board and operational data to satisfy the on-bus, control centre and depot facilities and functions defined elsewhere.

3.4.11 The fully-functional on-bus unit will store the necessary route and schedule data to allow operation across all equipped routes and services. It shall have the ability to hold the current network and two future networks.

3.4.12 Ideally the OBU will manage the upload and download of data for both on-bus activities and ultimate data transfer within the depots.

#### Monitoring and reporting vehicle location

3.4.13 Vehicle location may be determined using:

- GPS;
- differential GPS;
- odometer links;
- door opening contacts;





- a combination of these features; and
- other techniques to be described by the Tenderer.

3.4.14 Tenderers should state the accuracy of vehicle locations determined by GPS in terms of confidence limits (e.g. the positional accuracy at the 95% confidence limit).

3.4.15 The on-bus unit will detect and report when the vehicle is off-route or incorrectly positioned in relation to the stop sequence. It shall automatically identify when the vehicle has returned to the route.

3.4.16 Location data obtained by GPS may be augmented by odometer readings or differential GPS. Tenderers should state the increase in positional accuracy so achieved.

3.4.17 Other devices may be used to improve positional accuracy if required. Such devices should be described if used.

#### Monitoring progress against schedules or headways

3.4.18 The on-bus unit will monitor progress against schedules and display summary information on the driver's display panel. Where necessary, this will include monitoring of vehicle headways. The display will notify the driver of the current status minutes in a manner appropriate to "schedule" or "headway" operation. On routes where headways are critical, system algorithms shall derive appropriate strategies to correct headway errors. Drivers will be informed of necessary action via the driver's display panel.

#### Controlling bus priority requests

3.4.19 It shall be possible to filter priority requests on the basis of the following criteria:

- Degree of lateness or loss of headways;
- Service priority / importance.

3.4.20 It shall be possible to vary the threshold criteria by time of day; day of the week etc. Setting of the bus priority control strategy will be the responsibility of the relevant local authority's Traffic Control Section. Access to the relevant database parameters must therefore be restricted to the local authority control centre. Setting up or varying the priority strategy should not require manual intervention at each traffic signal installation on-street.

3.4.21 Details of bus priority requests initiated by the on-bus unit are to be stored locally and downloaded via the depot WLAN. The data recorded include the time of day and the position of the vehicle at the time the various requests were made.



### Controlling voice and data communications

3.4.22 This shall include:

- Automatic changes to transmission frequencies where required;
- Quick-key facilities to enable the driver to request voice communication with the dispatcher. Three priority levels will be available:
  - Emergency which will immediately open one way communication between the vehicle and control centre;
  - Important requests – the 2-way communications link will be opened by the dispatcher;
  - Minor Requests - the 2-way communications link will be opened by the dispatcher;
- Quick keys to transmit user configurable data messages e.g. 'vehicle fault', 'lost property' etc where appropriate;
- Automatic transfer between radio and GPRS when appropriate; and
- A facility to record audio messages for transmission as data files over GPRS.

3.4.23 First in Edinburgh vehicles the computer shall communicate using:

- a MPT1327 trunked radio system, or
- a hybrid MPT1327 trunked radio / GPRS system to cater for areas where PMR is deemed inefficient or impractical.

3.4.24 Both communications solutions will be supplied by the Tenderer (incorporating existing First in Edinburgh radio equipment as necessary).

### Control external destination displays

3.4.25 The on-bus unit shall be capable of driving the existing external destination displays on the bus.

3.4.26 The Tenderer shall supply and install all cables and connectors required to drive the destination displays from the on-bus unit.

3.4.27 Tenderers shall provide details on which makes of sign they have previously interfaced with and how they will accommodate any new type under this contract.

### Controlling on-bus information

3.4.28 This shall include:



- A next stop display using either a single line LED display or a TFT display;
- The ability to display a route schematic on a TFT display;
- The capability to activate on-bus voice messages using a RNIB React proximity tag;
- The capability for on-bus audio messages within a particular vehicle to be enabled / disabled by the driver (e.g. at the request of a boarding passenger) or remotely from the control centre or operator terminals;
- Facilities for the driver to broadcast passenger information on-bus;
- Facilities for the dispatcher to broadcast passenger information on-bus;
- Display of location specific advertising or promotional material;
- Display of "connection" information.

#### Controlling external destination displays

3.4.29 The existing fleet incorporates a variety of destination blinds and displays. Tenderers should detail their capabilities in this area and provide examples of integration.

#### Controlling bus priority requests

3.4.30 The on-bus unit shall only initiate priority requests when it is established to be running late by an amount greater than user configurable thresholds. A complementary pre-emption unit shall be supplied and installed by the Tenderer in the traffic signal controller or UTC/UTMC System. Traffic signal priority is discussed further in Section 5.

#### Interface with ticket machine

3.4.31 The on-bus unit must interface with existing ticketing machines (ERG – Stagecoach; Almex – First in Edinburgh; Wayfarer – some smaller operators).

3.4.32 The driver will log on/off using either the ticket machine or the on-bus unit, which will automatically set the relevant details on the on-bus unit, avoiding the need for multiple entries by the driver. By referencing the AVL data, the on-bus unit will check that the log-on data supplied by the driver is appropriate to the current location. If the data is suspect, a warning message / alarm will be displayed prompting the appropriate driver correction. The driver will have the facility to confirm initial settings and over-rule the system (e.g. in the case of obvious vehicle tracking errors). The over-rule action will however be logged by the system.



- 3.4.33 It is essential that the driver logs on / off once using the electronic ticket machine which will relay the details to the on-bus unit. Double entry for log on or log off is unacceptable. A fall-back log-on option via the on-bus unit should be provided in case of faults on the ticket machine- on-bus unit interface.
- 3.4.34 The AVL/RTPI functionality must not be compromised if a driver logs off from the ETM or removes any driver module prior to the end of a duty.
- 3.4.35 In the event of a failure of communications between the on-bus unit and the ticket machine, the on-bus unit should provide a secondary log-on.
- 3.4.36 Stagecoach is fitting ERG TP5000 electronic ticket machines. First in Edinburgh is fitting Almex Optima electronic ticket machines. Details of the ETMs are provided in Appendix G.

#### Interface to passenger counting equipment

- 3.4.37 There are currently no passenger counting devices installed on any vehicles included in Phase 1. However Tenderers must state how any interfaces between passenger counting and AVLS would be configured together with accuracy levels and confidence limits.

#### Interface with engine management systems

- 3.4.38 Engine management will not be implemented under this Contract.
- 3.4.39 Tenderers should however note the partners' aspirations to manage the performance of future Euro V and Euro VI engines based on vehicle location should therefore provide examples of engine management functionality available through their systems, with particular emphasis on fuel efficiency and maintenance reports.

#### CCTV interface

- 3.4.40 The fully-functional on-bus unit should be capable of interfacing with CCTV equipment to facilitate automatic recording in the event of an emergency call, and to ensure that all CCTV data is time date and GPS location stamped.

#### Panic button

- 3.4.41 The fully-functional on-bus unit should include a 'panic button' that initiates emergency communications in the form of an open to the Control Centre. The panic button should trigger automatic recording of CCTV images where such equipment is fitted.



#### Interface with data upload / download equipment in the depot

3.4.42 In the event of equipment failure in the depot, it must be possible to download data over the regular communications network or to removable media (ideally including flash memory). Tenderers must clearly state the limitations of using these alternatives and the implications on staff time.

#### Record storage

3.4.43 The fully-functional on-bus unit should retain location data and event records in fine detail for subsequent download to the depot workstation.

#### Interface with other on-bus equipment

3.4.44 Interfaces should be provided on the on-bus unit that permit connection of the following equipment to the on bus equipment should be in the form of optional add-ons above the base specification, but to a standard design. These add-ons should comprise:

- A hands-free radio microphone;
- A loudspeaker;
- A hidden 'panic'
- On bus real time/next stop displays;
- On bus audio announcements of next stop;
- Two way link to ETM including automatic update of fare stages;
- One way feed from bus doors;
- One way feed from engine management system;
- Two way link to CCTV;
- One way feed to destination display (automatic update at journey change points);  
and
- One way feed from accelerometer (forward, reverse and lateral G force recording).

3.4.45 Tenderers are required to specify the design and installation for vehicle microphones which must be capable of hands free operation under all circumstances.

3.4.46 The tenderer is responsible for any on-bus modifications required to install the necessary links, including door mechanisms and the odometer.



### Time synchronization

- 3.4.47 Of paramount importance is an accurate clock. This should take the form of a clock display on the ETM screen and should be synchronized through the RTPI/AVL system to the National Physical Laboratory MSF Time Signal. This time should override any time data held on the ETM itself or elsewhere within the bus.

### Failure of on-bus unit

- 3.4.48 The on-bus unit must be designed to 'fail safely' such that when it fails to function it shall not adversely affect or prevent other bus systems equipment from operating to the extent that the bus cannot operate and continue in service. The design must ensure that a defective OBU does not make erroneous or unnecessary communications that may potentially overload the communications system or incur excessive communications charges.

### Installation

- 3.4.49 Each on-bus unit must be to a standard size and have standard electrical and data connections. The on-bus unit must be small, capable of fitting within the standard "locker" space on a modern bus, and secure but relatively accessible to maintenance staff. It should not be accessible to the driver or passengers. Good airflow is required to the location of the on-bus unit as the hot air generated by the processor and other components needs to be vented; if it is not the unit is likely to power down automatically due to overheating.
- 3.4.50 The on-bus equipment and its components shall be housed in a modular way, preferably in a rack system. This equipment shall be easily transferred to other vehicles with a minimum of effort and redundancy.
- 3.4.51 The on-bus unit itself should sit in a rack or cradle in a single robust and secure unit with key access to prevent unauthorised removal. It shall be capable of rapid removal and refitting by unskilled personnel to allow the unit to be swapped in or out in the event of maintenance requirements or failure.
- 3.4.52 Other on bus equipment shall connect to the on-bus units via a peripheral equipment databus, aligned with the type specified the IBIS/CAN Open Bus being specified by CEN TC278, or aligned with an Ethernet standard to aid connection facilities.



### 3.5 ETM-BASED OPTIONS

3.5.1 Stagecoach, a major SEStran stakeholder, would prefer to utilise their existing ETM which has GPS and GPRS capability rather than add a separate OBU, driver display unit and data radio. SEStran wish to explore the viability and implications of this option within the Tender.

3.5.2 As an alternative to a fully-functional on-bus unit (with optional driver display terminal), Tenderers may propose basing their on-bus capability on a GPS and GPRS enabled ETM. Drivers will log-on via the ticket machine. The ETM would hold schedule and running board data uploaded at the depot or on the driver's module.

3.5.3 Ant Tenderer offering this option, must clearly state the implications with regard to the functionality offered by a "fully functional OBU" (as defined above), RTPI, bus priority and GPRS data loadings / costs. Tenders should also confirm whether data could be transmitted from the ETM over the trunked data radio network. This statement should include but not be limited to:

- driver log-on;
- service operation;
- log-off conditions (both at the end of the day and during any driver reliefs or lay-over periods)
- storing of historic records and
- the accuracy of RTPI.

3.5.4 The Tenderer must also specify any minimum hardware and software performance standards associated with the ticket machine, GPRS service and GPS devices. The Tenderer should specify any requirements for system testing.

3.5.5 Tenderers should state whether an auxiliary display and auxiliary keypad would be required for this option.

3.5.6 Tenderers supporting GPS-enabled ticket machine solution should confirm that the embedded GPS device is fit for purpose. The Tenderer shall state the make and performance specification of the GPS receivers to be used, and their reasoning for their choice of receiver.

### 3.6 MISCELLANEOUS

3.6.1 The on-bus system shall include the supply and fitting of all necessary aerials, connections and cabling associated with on-bus computer, peripheral hardware and interfaces specified under



this contract. An appropriate termination unit will be included to allow easy connection and disconnection of peripheral devices from the on-bus computer. Aerials and antenna must be capable of passing through a vehicle wash facility and negotiating overhanging trees without damage. The antenna must not project more than 50mm (approximately). Wherever possible, all antennae should be combined in a single housing.

- 3.6.2 Tenderers must allow for the fact that on-bus systems will be retro-fitted to existing vehicles, which may not provide standard vehicle data-bus facilities. Fitting of new vehicles during production must be agreed with the relevant operator.

#### Installation

- 3.6.3 The Tenderer is to provide a copy of all test certificates for the relevant equipment being supplied, together with proof of RoHS compliance and their proposed process for compliance with the WEEE Directive.
- 3.6.4 Details of the current vehicle fleet are provided for information in Appendix B. However, fleet composition may vary before or during the contract period. Tenderers must list any vehicles which are incompatible with their proposed systems.
- 3.6.5 The Tenderer shall state typical installation times for their on-bus components and give at least two examples and references of buses where those installation times had been met.

#### Power Supply

- 3.6.6 The 24V bus supply will be available to power the on-bus unit and peripheral devices. Tenderers must therefore:
- State whether a permanent 24V supply is required for the OBU and any peripheral devices i.e. when the vehicle is switched off at night (at least until data download is completed or in layovers);
  - State the current drain of the OBU and peripherals during the various vehicle operating modes, and
  - Incorporate battery back-up facilities to maintain system memory should the 24V supply be lost. Tenderers must state the lifetime of the battery and recommend replacement periods as necessary.





### 3.7 SUMMARY OF ON-BUS UNIT OPTIONS

3.7.1 A summary of the options for the on-bus unit is given in Table 9.

**Table 9: On-bus unit option summary**

Option	On-bus unit functionality	Schedule adherence calculation	Driver’s terminal
A	Full-functional on-bus unit	On bus	Fully functional display and keypad ETM used as display Auxiliary display and keypad No display
B	Reduced functionality on-bus unit	Remote	ETM used as display Auxiliary display and keypad No display



## 4 Information display and dissemination

### General

4.1.1 The Purchaser envisages a system in which real-time passenger information will be displayed using a number of media including “traditional” displays and new media such as the mobile telephones and the world-wide web.

4.1.2 An information server will form a key part of the system, serving information to passengers via a number of channels. Tenderers should refer to the indicative system architecture diagram at Appendix D. Variations in the system architecture are permitted. A system architecture diagram should be included in the tender documentation even if it is exactly as per that shown in Appendix D.

### 4.2 DISPLAYS

4.2.1 Real time signs may be installed on-bus, at stops, interchanges and other key locations. The location of individual signs will be confirmed post-tender. Signs on-street shall be a mixture of shelter and pole mounted.

4.2.2 The tenderer must price on the basis of the sign specifications included in the relevant sections below. However, the tenderer must confirm that the specified signs are fit for their intended purpose and will perform satisfactorily in the ambient light conditions associated with the particular installation locations.

4.2.3 The following specifications for signs to be used both on and off vehicles are indicative and subject to more detailed specification in the Joint Design Exercise.

4.2.4 SEStran reserves the right to procure signs separately to this contract specification. It is envisaged that this will be achieved in one of three ways as follows:

- The chosen Tenderer makes available to sign manufacturers the communications protocol;
- The purchaser purchases signs from a third party and the chosen Tenderer provides the necessary communications interface, or
- A charge is made by the chosen Tenderer for integrating existing stakeholder signs into the new system.



4.2.5 Tenderers should clearly indicate how they would enable third party supply of signs and detail any additional costs involved in interfacing their systems with such signs in the appropriate area in the Bill of Quantities.

### 4.3 DISPLAY MESSAGES

4.3.1 Signs will display:

- Service number;
- Service provider ID (e.g. FE for First in Edinburgh) in a manner depending on sign type which can be
  - No operator designation;
  - One or two letters to signify the operator in multi-operator areas;
  - The full operator name (and possibly logo on TFT displays);
- Destination;
- Scheduled departure time which will ultimately change to a real-time countdown in minutes. when appropriate;
- A real-time countdown to departure in minutes (e.g. 7, 15, +1h for departures more than one hour in the future);
- Scheduled departure times when a vehicle is unequipped or de-localised<sup>2</sup>;
- Stand or Shelter number if the sign is at an interchange or other location with multiple boarding points;
- An indication of whether the service is operated by an easy access vehicle (using the standard UK icon – a blue wheelchair);
- Free text messages when required (on each line);

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<sup>2</sup> The term “de-localised” is used to describe events where vehicle location data conflict with other data.



- The words “Part Route” in place of the nominal service destination when a service is turned short;
- “Via” information where available (by scrolling on the same line or by using a second line where available);
- “Service diverted” when vehicles have been diverted and will not call at a given stop as a result of an authorised or planned diversion (note that stops beyond the diversion must display departure information and diversion information as normal making an appropriate allowance for the adjusted journey time associated with the diversion);
- “Out of service” or “Cancelled” for a period of 5 minutes after a specific trip has been cancelled at which point the individual trip should then be removed from the sign;
- The letters “DLY”, flashing, to indicate when a service is not making “normal” progress; and
- Optionally, “Service not started” and “Service finished” as appropriate.

4.3.2 Tenderers may comment on the appropriateness of using times to arrival rather than departure. If it is possible to display times to arrival there may still be some points (such as bus stations, interchanges and timing points) where time to departure may be more appropriate.

4.3.3 Note all trip predictions must be derived from running board information including deadheading and layover balance corrections, not from the commencement of individual trips.

4.3.4 Signs will be capable of listing departures in

- Chronological order;
- Service number order, or
- Service number order, grouped by operator.

4.3.5 The style of listing shall be configurable for each sign.

4.3.6 The duration of the real-time countdown period will be configurable, typically 20 minutes, with a maximum value of 59 minutes. Typically, when the vehicle is within 1 minute of arrival, the display will show “due”. This period shall be configurable between 1 and 3 minutes.



4.3.7 When displaying departures in chronological order, the top line of the display will be reserved for the next bus. The remaining lines will scroll up to 5 times with information on the later vehicles. Where particular service frequencies are high, it shall be possible to inhibit repeat displays in the scrolling sequence to maximise the benefits of real-time information on less frequent services. The scroll rate shall be variable. The "DUE" display will clear down within 3 seconds of the associated vehicle departing the stop.

4.3.8 Quick clear-down of signs within three seconds of the bus leaving the stop is desirable. Reliable control centre initiated clear-down within 10 seconds may be acceptable. Locally generated quick clear-downs should be confirmed by the sign to the central system within 10 seconds of the vehicle leaving the stop. If such a message is not received, the central system should initiate the clear-down.

4.3.9 Tenderers should state whether their system complies with the UK RTIG standard for bus stop clear-down..

#### 4.4 CONSTRUCTION

4.4.1 Signs and their associated fixings, fittings and connections must be designed with due regard for future maintenance requirements. Hidden catches and special fasteners should be used to improve security.

4.4.2 The tenderer must provide full technical specifications for their proposed signs including details of EMC and environmental certifications, mean-time between failures and lifetime guarantees.

4.4.3 It is recognised that a number of UK systems have successfully used ventilated signs. Signs which do not meet the stated IP ratings may be considered acceptable if the Tenderer offers sufficient operational guarantees under the terms of the maintenance agreement.

4.4.4 The Purchaser will arrange for a 230V mains supply where necessary at sign locations and will arrange any necessary modifications to shelters following consultation and agreement with the Tenderer.

4.4.5 Signs must include the necessary real-time information communications hardware.

4.4.6 Antennae for stops on-street must be concealed to minimise vandal and tree damage. Concealed antennae are desirable in all other locations.

4.4.7 be easily identified. Paragraph Omitted



- 4.4.8 The Tenderer shall supply a schematic diagram showing the electrical supply to the display.
- 4.4.9 Electrical Test certification shall be supplied for all electrical installations in accordance with appropriate British Standards.
- 4.4.10 The Tenderer shall provide the following details:
- Mean Time Between Failure (MTBF);
  - Mean Time To Repair (MTTR);

## 4.5 DISPLAYS AT STOPS

### LED bus stop displays

- 4.5.1 Three different at stop signs are required. For the purposes of tender evaluation, tenderers should supply in the Bill of Quantities indicative costs against the following specifications.
- 4.5.2 All LED bus stop display types offered shall have the following features:
- Amber or yellow on black nine-dot high LEDs in 2, 3 or 4 rows of 30 characters, 30mm high;
  - Upper and lower case text with "true" descenders;
  - The facility to page through up to five pages of information and to scroll individual lines;
  - Viewing distance: 8m;
  - Viewing angle 60 degrees, 60 degrees vertical;
  - IP65 rated (ideally IP657);
  - Operating Temperatures: -10 to + 45 degrees Centigrade;
  - Humidity: 10 – 90% non condensing;
  - Environmental Control Systems e.g. heater, cooling fan; impact alarms;
  - Pole mounted or on underside of shelter roof. (The successful tenderer must liaise with the shelter manufacturer to determine the integration of the display in the shelter roof. The Tenderer is not responsible for shelter modifications.);
  - Public address capability; and
  - Sign diagnostics and fault monitoring and reporting.



4.5.3 Full matrix LED signs may be specified in the Joint Design Exercise.

LCD bus stop displays

4.5.4 Three different at stop signs are required. For the purposes of tender evaluation, tenderers should supply in the Bill of Quantities indicative costs against the following specifications.

**Table 10: LCD sign characteristics**

LCD sign	Sides	Number of characters
2 line / 4 line	Single sided	30
4 line / 8 line	Single sided	30
4 line / 8 line	Double sided	30
3 line	Single sided	30
3 line	Double sided	30

4.5.5 All LCD bus stop display types offered shall have the following features:

- Green or yellow LCD characters in 2, 3 or 4 rows of 30 characters, 28mm high;
- Upper and lower case text with “true” descenders;
- Ability to display double height characters (e.g. 28 mm in 4 line mode, 56 mm in 2 line mode);
- The facility to page through up to five pages of information;
- Viewing distance: 8m;
- Viewing angle 140 degrees, 140 degrees vertical;
- IP65 rated (ideally IP657);
- Operating Temperatures: -10 to + 45 degrees Centigrade;
- Humidity: 10 – 90% non condensing;
- Environmental Control Systems e.g. heater, cooling fan; impact alarms;
- Pole mounted or on underside of shelter roof. (The successful tenderer must liaise with the shelter manufacturer to determine the integration of the display in the shelter roof. The Tenderer is not responsible for shelter modifications.);
- Public address capability; and
- Sign diagnostics and fault monitoring and reporting.



LED flag displays

4.5.6 Three different at stop signs are required. For the purposes of tender evaluation, tenderers should supply in the Bill of Quantities indicative costs against the following specifications.

**Table 11: LED flag characteristics**

LED flag	Sides	Number of characters
3 line	Single sided	15
6 line	Single sided	15
Full matrix	Single sided	15

4.5.7 All three types shall have the following features:

- Amber or yellow on black nine-dot high LEDs in rows of 15 characters;
- The facility to page through up to three pages of information
- Viewing distance: 8m
- Viewing angle 60 degrees, 60 degrees vertical
- IP65 rated (ideally IP657)
- Operating Temperatures: -10 to + 45 degrees Centigrade
- Humidity: 10 – 90% non condensing
- Environmental Control Systems e.g. heater, cooling fan; impact alarms
- Pole mounted.
- Public address capability
- Sign diagnostics and fault monitoring / reporting

LCD flag displays

4.5.8 Three different at stop signs are required. For the purposes of tender evaluation, tenderers should supply in the Bill of Quantities indicative costs against the following specifications.

**Table 12: LCD flag characteristics**

LCD flag	Sides	Number of characters
2 / 4 line	Single sided	15
3 / 6 line	Single sided	15
4 / 8 line	Single sided	15





4.5.9 All three types shall have the following features:

- Green or yellow LCD characters in rows of 15 characters;
- Ability to display double height characters (e.g. 28 mm in 4 line mode, 56 mm in 2 line mode)
- The facility to page through up to five pages of information
- Viewing distance: 8m
- Viewing angle 140 degrees, 140 degrees vertical
- IP65 rated (ideally IP657)
- Operating Temperatures: -10 to + 45 degrees Centigrade
- Humidity: 10 – 90% non condensing
- Environmental Control Systems e.g. heater, cooling fan; impact alarms
- Pole mounted.
- Public address capability
- Sign diagnostics and fault monitoring / reporting

#### Alternative displays

4.5.10 Tenderers are invited to offer a range of single and double sided displays with supporting specifications & photographs. Clear sign type references and costs for communications hardware and system interface should be added in the appropriate area of the Bill of Quantities.

## 4.6 LOW POWER SIGNS

4.6.1 The SEStran area includes rural areas of Scotland served by infrequent services.

4.6.2 The purchaser invites tenderers to include proposals for low power signs that might be suitable for rural use.

4.6.3 Preliminary discussions have identified that solar and wind might be suitable for use as power supplies. It is not necessary to have the sign permanently on. Signs can be woken up by proximity sensing, button pushes or by devices such as smart cards and key fobs as discussed in 4.9. Signs should carry appropriate information to indicate actions necessary to activate the sign.



4.6.4 Communications might be based on GPRS and virtual private networks. The time taken to activate the sign and to retrieve and display data should be estimated. Ideally this time would be under four seconds. The signs should include RTIG quick-clear-down.

4.7 DISPLAYS AT INTERCHANGES

4.7.1 The system will be required to provide data for displays at interchanges and bus stations. (Note that there are existing bus station displays supplied by NexusAlpha and Tandata. The system will supply information to these legacy installations through SIRI server to server interfaces)

4.7.2 Additional signs will be sited in interchanges. For the purposes of tender evaluation, tenderers should supply in the Bill of Quantities indicative costs against the following specifications.

**Table 13: Interchange display characteristics**

TFT size	Format	Brightness	Contrast	Resolution (pixels)
20" screen	4:3	400 Cd/m <sup>2</sup>	300:1	800 x 600
32" screen	16:9	500 Cd/m <sup>2</sup>	500:1	1366 x 768
46" screen	16:9	500 Cd/m <sup>2</sup>	600:1	1366 x 768

4.7.3 All interchange TFT displays offered in the Bill of Quantities should have the following common characteristics:

- TFT screen
- Upper and lower case characters with true descenders;
- Viewing angle 160 degrees to horizontal and vertical;
- IP54 rated (minimum);
- Operating Temperatures: -20 to + 55 deg C;
- Mounting: wall mounted as standard with ceiling and post mounted variants;
- Message clear down within 10 seconds of bus leaving the interchange; and
- Metallic non-corroding enclosures with powder coated finish.

4.7.4 The following LED departure board options are also required:

- 18 line - 60 character sign;
- 30 line – 60 character sign;
- 9 line – 45 character sign; and



- 3 line – 45 character sign.

4.7.5 The specification is similar to LED signs described above, viz:

- Amber or yellow on black nine-dot high LEDs
- Upper and lower case text with “true” descenders;
- The facility to page through up to 5 pages of information and to scroll individual lines;
- Viewing distance: 8m;
- Viewing angle 60 degrees, 60 degrees vertical;
- IP65 rated (ideally IP657);
- Operating Temperatures: -10 to + 45 degrees Centigrade;
- Humidity: 10 – 90% non condensing;
- Environmental Control Systems e.g. heater, cooling fan; impact alarms;
- Wall mounted as standard with post and ceiling options;
- Public address capability; and
- Sign diagnostics and fault monitoring / reporting.

4.7.6 All interchange displays should be configurable to receive data through fixed IP addresses.

#### 4.8 ALTERNATIVE DISPLAY SPECIFICATIONS

4.8.1 If the display specifications above are below the minimum offered by Suppliers, prices for displays with specifications as close to the required specification should be entered in the Bill of Quantities. Alternative display specifications may be offered in the area on the Bill of Quantities reserved for additional items.

4.8.2 If specifications above are above the maximum offered by Suppliers, no price should be offered against the particular item in the Bill of Quantities.

#### 4.9 DDA CONSIDERATIONS AND ACCESSIBILITY

4.9.1 The following optional audio facilities must be offered and costed:

- Public address announcements triggered using an RNIB React key fob;



- Public address announcements triggered using a Scottish National Entitlement Card and suitable card reader; and
- Public address announcement of all text (free or otherwise) displayed on the sign.

4.9.2 RNIB React announcements will operate as follows:

- A wayfinding announcement including the stop name triggered by the React proximity signal;
- Repeat wayfinding messages triggered by the arrival of further React key fobs but not the presence of the same fob (within a configurable period of time).
- Pressing the right key fob button will trigger audio announcement of the next four departures in chronological order, including service number, destination and expected departure time
- Pressing the right key fob again within a configurable period of time will trigger announcement of details on the next four services as above). Further pressing of the fob will trigger further announcements until there are no further departures to announce.

4.9.3 Announcements triggered by the Scottish National Entitlement Card will operate as follows:

- A smart card reader will be mounted in a suitable housing at the stop (design to be agreed) which will bear the SCTS logo.
- Presenting the card will trigger audio announcement of the next four departures in chronological order, including service number, destination and expected departure time
- Presenting the card again within a configurable period of time will trigger announcement of details on the next four services as above.

## 4.10 DATA STORAGE AND SIGN MANAGEMENT

4.10.1 Tenderers must state whether their signs:

- Hold full schedule details (and thus allow display of timetabled departures in the event of communications failure), or
- Are reliant upon the central control system or individual vehicle transmissions to deliver the relevant display messages



- 4.10.2 If both options are available, tenderers should clearly state the implications of the various signing strategies on the communications capacity of the system.
- 4.10.3 It shall be possible to display scheduled times for both RTIS equipped routes and non-equipped routes on the variable message displays. This facility will be configurable as a system wide, route / service specific or stop specific option.
- 4.10.4 Displays must be self-configuring. The system must be capable of identifying all relevant services and configuring the sign to display relevant information.
- 4.10.5 The effort required to configure RTPI displays must be minimised both within the sign and at the work-station. Ideally the sign will be configured with an appropriate reference ID. The central system will be configured with the sign attributes relative to the sign ID and the bus stop location. Thereafter, the system should identify all services using the stop and prepare default configuration options which can be accepted or amended as appropriate. Similarly, it should be possible to select a number of stop locations when configuring interchange or departure board signs.
- 4.10.6 Signs must be capable of monitoring and reporting their status and communicating fault information to the central system.
- 4.11 **INTERFACE WITH CITY OF EDINBURGH "BUS TRACKER" SYSTEM**
- 4.11.1 The system will overlap in geographical coverage with the City of Edinburgh Council BusTracker system.
- 4.11.2 Phase 1 requires a 2-way interface between SEStran and City of Edinburgh Council BusTracker RTPI system such that displays in both systems will display all information for all services calling at any given stop. Note that buses in the BusTracker system operate outside the City of Edinburgh Council boundary.
- 4.11.3 Dynamic data exchange can be accomplished using SIRI (Service Interface for Real-time Information) standards. The interface would be based on symmetrical TCP/IP links between RTPI servers.
- 4.11.4 It is anticipated that Server A would send to server B the list of all stops equipped with a system A sign. For each system B route calling at a system A stop, Server B would periodically send stops the waiting times and destinations of the next two system B buses. Server B would also send clear-down information when buses leave stops.



- 4.11.5 A static interface will be used to configure the "Bus Tracker" system. This will consist of files that define, for example, the service destination, name and number, and stop display characteristics. Bilateral configuration synchronization will take place daily.
- 4.11.6 The dynamic interface will use the SIRI syntaxes "Stop Monitoring (SM) Service" to send real-time arrival & departure information relating to a specific stop, and "General Message (GM) Service" to exchange informative messages between systems.
- 4.11.7 The above schema has been suggested the supplier of the City of Edinburgh Council BusTracker system. The Tenderer is responsible for checking the technical validity of the proposed solution with respect to their system. The syntax of the files exchanged between the systems will be defined during Joint Design Exercise.

#### 4.12 SIRI INTERFACES WITH THIRD PARTY INFORMATION SYSTEMS – ULTIMATE REQUIREMENTS

- 4.12.1 The SEStran AVL / RTPI system must provide real-time information updates to the following:
- BusTracker RTPI system (City of Edinburgh Council / Lothian Buses);
  - Tandata Bus Station Scheduled Information System in Edinburgh;
  - Tandata networked Bus Station Information System in Fife; and
  - Nexus Alpha Bus Interchange Information System in West Lothian.
  - TravelineScotland
  - Neighbouring RTPI systems
- 4.12.2 The SEStran AVL / RTPI system will receive real-time information updates from the following:
- BusTracker RTPI system (City of Edinburgh Council / Lothian Buses)
  - Neighbouring RTPI systems
- 4.12.3 Development and design of each of the SIRI interfaces will be achieved through:
- A Scoping Meeting between the relevant Client groups and System Supplier to agree which data elements are required, frequency of transmission of static and dynamic elements etc.;
  - Preparation of the appropriate SIRI specifications for each system;
  - Specification Review / Validation Meeting – to agree and finalise the proposed interface specifications;



- Interface Development and Testing – bench testing of the SIRI interfaces using sample data;
- Testing Review Meeting – to discuss results and agree any necessary modifications;
- Implementation of the SIRI interfaces – on each system;
- Live Tests – controlled tests on live systems;
- Full Commissioning of SIRI Interfaces; and
- Ongoing Monitoring - for an agreed period using agreed resources and procedures.

#### Tenderers Responsibilities – SIRI Outputs

4.12.4 The Tenderer is responsible for:

- Attendance at meetings;
- Development, implementation and testing of the SIRI interface to deliver an accurate and robust data stream to the third party system, meeting the requirements of the agreed specification including any performance indicators;
- Full commissioning; and
- Ongoing support within the terms of the maintenance and software licensing agreements.

4.12.5 The Tenderer is not responsible for:

- any modifications to the third party system, or
- the effective management and onward dissemination of transmitted data by the third party system.

#### Tenderers Responsibilities – SIRI Inputs from third party systems

4.12.6 The Tenderer is responsible for:

- Attendance at meetings
- Development, implementation and testing of the SIRI interface to receive a data stream from a third party system, meeting the requirements of the agreed specification including any performance indicators.
- Full commissioning



- Effective management and onward dissemination of the data received from the third party system across the SEStran platform (signs, web etc)
- Ongoing support within the terms of the maintenance and software licensing agreements.

4.12.7 The Tenderer is not responsible for:

- any modifications to the third party system
- the performance of the third party SIRI output

4.12.8 Tenderers must submit a fee for the elements for which they are responsible. This must cover software, hardware and project management costs. The funding of third party costs will be agreed by SEStran and the relevant third party Client.

#### SEStran - BusTracker SIRI Interfaces

4.12.9 The ultimate objective is to ensure that each system displays a complete set of accurate passenger information to the travelling public across all the supported information platforms:

- BusTracker and SEStran RTPI signs
- BusTracker and SEStran Web & Wap sites
- Any other emerging systems.

#### Interfaces with Scheduled Information Bus Station Systems

4.12.10 These are one-way SIRI outputs to the Tandata and Nexus Alpha systems displaying information across a variety of sign types. The aim is to display RTPI where appropriate and any relevant information on service disruptions.

### 4.13 WORLD-WIDE WEB AND OTHER INFORMATION CHANNELS

4.13.1 A WWW site is required relatively early on in the delivery of this system. SEStran will be "owner" of the real-time passenger information web site. Tenderers should indicate the capabilities of any "standard" web site they are able to offer and indicate the costs of customisation. A comment should be made regarding the use of third party web site designers in conjunction with the system to deliver the core functionality outlined below.

4.13.2 All information dissemination channels should permit access to real-time passenger information and allow interrogation of schedules and journey times.





## Web site design

4.13.3 The web site must support the following:

4.13.3.1 "Stop Code" based queries – giving direct access to real-time passenger information for all services using the stop with options to: filter results (by operator, service number, departure time ((e.g. after 1700), number of buses to be displayed for each service), auto refresh, use a full screen display

4.13.3.2 "Street Name / Post Code / Place of Interest" based queries – the results shall be displayed on a Google mash-up (or similar) with the following features:

- Highlight the chosen location
- Show all stops within approximately 500m (minimum)
- Clicking on a stop icon will:
  - Reveal the stop code
  - List all services using the stop
  - Provide an option to display the route path of a service using the stop
  - Provide an option to display real-time departures from the stop
- It shall also be possible to browse the map and request the display of all stops within 500m (approx) of the selected point, if not already shown

4.13.3.3 "Route / Service Number Based Queries" – allowing the user to select a service number, filtering by operator, if required. For the selected service the user will have the option of:

- Displaying the route path and all stops on it on Google map mash-up or similar
- Clicking on a stop will open the options above
- Where available, linking to any relevant bus operator information regarding the service.

4.13.3.4 "Displaying real time results" – having generated the real-time results, it shall be possible to filter the results by departure time, service number, operator, destination, number of departures for each service (1 – 4). The web based results shall include:

- Operator ID;
- Service No;
- Destination;



- Time to departure – the countdown time, clearly identifying when the information is schedule based rather than real-time;
- Low-floor accessibility indicator;
- A statement in the destination field when services are: delayed, cancelled, diverted or turned short (part-route);
- Any commercial or service specific messages generated by an authorised user.

4.13.3.5 “Personalised Stop” - the user must be able to create and bookmark a personalised stop combining up to 5 (min) selected services from a variety of stop locations.

4.13.3.6 “Alerts” – the system shall be capable of generating web and mobile alerts to subscribing users.

4.13.3.7 “Network messages” – the system shall be capable of displaying free text messages currently being displayed at relevant on-street signs.

4.13.3.8 “Gadgets” – the system shall be capable of supplying data to the Tender’s own or a third party’s gadget.

#### Architecture

4.13.4 Even if the Tenderer declines to offer a functional web and WAP service, the core system must include the necessary infrastructure to provide a servers and firewalls to support a WWW site, SMS messages, WAP application and any other information delivery channel agreed between the Tenderer and the Purchaser. Tenderers may offer alternative additional proposals if available. In either case systems must be supplied in a way that permits third party web applications to be deployed without additional cost.

4.13.5 System architectures should be designed to reflect the emphasis on provide a flexible platform capable of accommodating innovative information dissemination channels that may emerge or be expected by users in the future e.g. digital TV.

4.13.6 It is expected that some displays at interchanges may be configured using Internet Protocol. Tenderers should indicate whether their WWW offering can support such displays, including maintenance monitoring functions for SEStran managed signs.

4.13.7 The system must be capable of interfacing with a UTMC common database and associated web sites using standard data objects. Tenderers should briefly state their capabilities and experience in the UTMC area.



### Other channels

4.13.8 A mobile web application is required that provides customised content for mobile users. The Tenderer should state the limits of any functionality compared to the full web site and any limits within the offering regarding compatibility with various mobile browsers. Suppliers should state whether an application programme interface is available and the operating systems (including those of mobile and "smart" phones") with which the API is compatible. If no API is available the cost developing such an API should be included with the tender price and the tender should include a statement on compatible operating systems.

4.13.9 A wireless application protocol (WAP) application is required to accommodate simpler mobile devices and reduce costs for the user. The Wap service must support "stop code" based searches and a structured "service number based" search

4.13.10 Tenderers may include an SMS-based offering if they wish Any additional costs including those of third parties associated with SMS-based enquiries should be highlighted .

4.13.11 Tenderers should include options for an interactive voice response (IVR) enquiry service. This doe not have to operate at the full "free speech" recognition level. Traveline SMS codes may be used to identify stops.

## 4.14 REAL-TIME PASSENGER INFORMATION DISPLAYS IN VEHICLES

4.14.1 On-bus signs have the following specification.Costs against this specification should be included in the Bill of Quantities.

4.14.2 Two categories of on-bus sign are envisaged:

- Simple LED (orange) / LCD (green) next stop displays with 1 line, 15No. 30mm upper / lower case characters with true descenders, or
- Enhanced 15" TFT screen

4.14.3 On-bus signs would have the following attributes:

- Capable of being roof mounted near the front exit of the vehicle;
- Capable of being roof mounted at front on top deck of double-deck vehicles;
- Capable of being mounted to the rear of the driver;
- Flexible mounting options to cater for various vehicle types;
- Managed by the on-bus unit;



- Message clear-down within 3s of leaving a particular stop ;
- Commencement of Next Stop display and audio announcement to be activated at a defined distance to from the stop and repeat announcements to be configurable; and
- On the enhanced TFT the “Next stop” display to would alternate with a route diagram showing bus stop names and position of the bus along the route.

4.14.4 Optionally the on-bus signs should support

- Audio announcement functionality with quick key OBU options to inhibit / activate on request; and
- Automatic triggering audio announcements using the RNIB REACT key fob proximity signal.

4.14.5 Additional desirable TFT features are:

- Indication of bus route numbers of other bus routes at bus stops along the route;
- Real-time arrival predictions for the current bus and other bus services / trams (in the future) at predefined stops / interchange locations;
- Connection status for identified “connecting services”;
- When appropriate, display rail / airport departure information (NB: tenderers should state whether this would require 3G capability to link to existing web sites or if it could be supported over data radio updates; and
- Location specific advertising.

4.14.6 The displays shall be capable of being mounted on the vehicle ceiling or other suitable locations agreed with the bus operator. A range of configurations must be available, suitable for a wide range of bus types.

4.14.7 The Tenderer shall provide prices for the supply and fitting, including procurement where necessary of additional power supplies, of the above displays. The Tenderer shall describe fully the types of displays that can be offered.

4.14.8 The equipment offered must not draw excessive power from the bus either with the engine running or when stationary with the engine off. No excessive drain must be placed on the vehicle batteries such that if the equipment were to remain in display mode for a period of 24 hours with the vehicle engine off, no adverse effect would be caused to the vehicle batteries. Tenderers are to demonstrate the capability of their proposals in this respect.



## 5 Bus priority

### 5.1 GENERAL

5.1.1 The system must have within its functionality the ability for a late running bus (or, dependent on configuration, all buses) to trigger a call for signal priority through either a local authority Urban Traffic Control (UTC)/Urban Traffic Management and Control (UTMC) system or a local signal controller.

5.1.2 Paragraph Omitted.

5.1.3 Where traffic signal installations operate “locally”, priority requests will be generated on-bus and will be transmitted to a receiver housed within the signal controller cabinet.

5.1.4 Other signals are under the control of Urban Traffic Control Systems. Priority requests for such signals can be routed through the local signal controller to the UTC control centre. Tenderers should highlight any experience of sending priority requests directly to the UTC centre.

5.1.5 Tenderers are not responsible for configuration of the individual traffic signal controllers.

5.1.6 Where required, the Tenderer will be responsible for liaising with both the Local Authority and their equipment suppliers in order to ensure that their equipment will interface with both parties to provide the relevant priority at signals.

5.1.7 The Tenderer shall be responsible for liaising with the signal maintenance tenderer for the Local Authority, in order to connect the priority equipment to the signals and the installation of the equipment required within the controller or the UTC System.

### 5.2 PRIORITY REQUESTS

5.2.1 Requests for bus priority at a particular location will be filtered. Filtering of the requests can take place on-bus or at a control centre. Filtering criteria will be defined from the AVL system workstation(s) in the control centre and shall be capable of easy modification by the system operator.

5.2.2 The on-bus unit shall only initiate priority requests when it is established to be running late by an amount greater than user configurable thresholds. Comparing actual running against scheduled running time shall derive the late running amount. A minimum of 5 thresholds shall be configurable. A threshold value of zero shall ensure that priority is always demanded.



- 5.2.3 It shall be possible to add a weighting factor to be transmitted with the priority request message. This factor should have a range of values and be capable of being derived in the future by the OBU from information received from the ticketing machine and/ or by a passenger counting system if fitted. At the outset the weighting factor shall be set at a single value and this value shall be automatically applied when the driver manually sets and transmits the pre-coded 'bus full' alarm.
- 5.2.4 Detection of buses will generally be through 'virtual loops', these will be predefined, with the capability of being user configured. Each signal approach will have up to 3 'virtual loops', and capable of transmitting up to 3 requests for each bus movement. The Tenderer shall be required to provide assistance with the positioning of the 'virtual loops'. Traffic signal priority requests shall be transmitted immediately as a special message and shall not be subject to any normal polling regime. For stops which are particularly close to junctions, it is essential that requests are transmitted accurately and reliably as the vehicle leaves, or prepares to leave, the stop. This could be achieved for example by using links to the vehicle door closing mechanism or by detecting rotation of the wheels.
- 5.2.5 A complementary pre-emption unit shall be supplied and installed by the Tenderer in the traffic signal controller or UTC/UTMC System. The system shall be capable of interfacing with legacy traffic signal pre-emption equipment where their functionality is designed according to the TR2210 traffic control requirements
- 5.2.6 The pre-emption unit shall meet the following targets;
- Make a request with an accuracy of 5m or better (tenderer to advise accuracy) and that request shall be passed to the controller or UTC/UTMC within 3 seconds.
  - Work equally well with isolated sites and UTC/UTMC sites.
  - Record and maintain a historical record of each pre-emption request in the central database.
- 5.2.7 This unit shall have the processing capability to establish priorities between competing requests with differing priority levels and be capable of giving preference to requests with the highest priority. E.g. if a 'bus full' is received the unit may decide to give this priority over previously received demand.
- 5.2.8 The system should include an automatic fault transmission capability such that any vehicles or other component equipment developing a fault status have this recorded on the core system.



5.2.9 The Tenderer shall be responsible for ensuring that the pre-emption information is transmitted to the traffic signal controller and/or the UTC/UTMC core system. The unit shall provide information such that the controller/UTC/UTMC adequately identifies requests, its source and the stage being demanded in order to service the request promptly and safely.

5.2.10 Once a bus has cleared a traffic signal for which priority has been requested, the system should register a clear-down of priority and ensure that the request is recorded as having been granted or refused. Tenderers should explain the method by which they propose to effect such clear-down, whether by communication with the core system or by local communications between the vehicle and the signal. Tenderers should take account of the RTIG Traffic Signal Priority Requirements Specification RTIG T008 of July 2005 in designing their methodology.

5.2.11 The on-board unit shall log all bus priority related requests and transmissions for later download via depot network.

### 5.3 STANDARDS

5.3.1 All requests for priority shall be compatible with the TR2210 traffic control requirements.

5.3.2 The UK RTIG has proposed a Specification for the Radio Link for RTI driven Traffic Light Priority and Display Clear-down. The Specification is available from the UK Real Time Information Group and Tenderers should adopt this standard.

5.3.3 This document specifies:

- the message envelope;
- transmission strategy;
- message content; and
- the electrical characteristics of the transmitter and receiver.

5.3.4 OFCOM has made available a channel for this application throughout the UK, excluding Northern Ireland 188.175 MHz. The paired frequency associated with this channel is 180.175MHz. 180.175MHz is reserved.

5.3.5 Note also that even though this frequency has been reserved for this application, each individual local authority, PTE or bus operator intending to utilize this frequency must apply to OFCOM for a license before using this frequency in any particular area.

5.3.6 Tenderers must confirm whether the proposed system will utilise this frequency.



#### 5.4 LINE OF SIGHT AT TRAFFIC SIGNALS

5.4.1 Where line of sight communications are required to request priority at traffic signals, the tenderer will visit the installation to determine the most appropriate location for the radio antenna.

#### 5.5 LOCATIONS AND ACCOMMODATION WORKS

5.5.1 The Purchaser will arrange all accommodation works.





## 6 Communications

### 6.1 THE RADIO NETWORK

6.1.1 Part Two gave an overview of Stakeholder aspirations regarding communications. It is therefore expected that a dedicated radio network will form part of the system.

6.1.2 The radio network will be Professional Business Radio (PBR) system operating in Band III sub-band 1 and will give good radio communication over the majority of the SEStran area. Where coverage is lacking it is envisaged that public networks could give additional coverage for both voice and data if deemed necessary. The use of GPRS for data transfer will be considered if it can be shown that it is economically viable. The PBR network will be considered as the prime mode for voice communication. The radio network may be either analogue or digital or a combination of both within the constraints laid down by OFCOM for channel occupancy and interference.

6.1.3 There are several constraints which will be imposed on the radio system due to the requirements of AVL and RTPI functionality as there are several types of message which have to be transmitted. These messages may either be sent on demand, i.e. polled by the control system, or be unsolicited spontaneous transmissions initiated by an external stimulus such as a bus stop sign clear down command when a vehicle leaves a stop. The following indicates the form of these messages:

6.1.3.1 From vehicles to the central system:

- Location report;
- Leaving bus stop (for clear down);
- Sign-on, relief; and
- Status (alarms etc).

6.1.3.2 From the central system to a vehicle:

- Diversion control;
- Control action;
- Headway control;
- Driver messaging; and
- Sign-on, relief confirmation.



6.1.3.3 From the central system to passenger information signs:

- Predicted arrival times
- Cleardown control; and
- Sign messaging.

6.1.3.4 From the vehicle to signs and traffic signal controllers:

- Cleardown control;
- Bus priority.

6.1.4 The protocols used by the radio system shall be capable of supporting unsolicited voice and data calls as well as polling from the control centre for AVL updates. Some data messages will be very short (e.g. position updates) and others quite long such as a change in running board number which will cause a significant change in timetable information. The radio protocol shall be designed to support this functionality efficiently by optimum use of control and traffic channels. These channel types may be physically separate channels or, if capacity dictates, virtual channels on a single carrier (Time Division Multiplexed).

6.1.5 Any parallel public network which may be offered must support similar functionality including polling, unsolicited short and long data messages to and from vehicles and signs.

## 6.2 EXISTING SYSTEMS

### First in Edinburgh

6.2.1 Briefly, First in Edinburgh has a life expired Band III PMR voice system which is undergoing a partial upgrade to an MPT 1327 trunked system with voice and data capability and First in Edinburgh has offered its new MPT 1327 radio mobiles and base stations for use in this project. Section 6.5 describes the options that should be explored in terms of the trunk radio system.

6.2.2 The First in Edinburgh hardware should be utilised within the SEStran platform where possible.

6.2.3 A summary of recently acquired hardware is included below. Tenderers should confirm whether this is compatible with their system:

- Base Stations:
- Mobiles: Tait Radio TM8255
- Dispatchers: Tait Radio TM8255D



- Details are included in Appendix H.

6.2.4 First in Edinburgh has existing base stations at Dunearn and Fairmilehead (see Appendix F). Tenderers may propose that these base stations and associated masts be re-used in the SEStran communications network.

6.2.5 A detailed strategy for migrating the First communications network to the SEStran network must be agreed during the Joint Design Exercise.

### Stagecoach East Scotland

6.2.6 Stagecoach currently has no on-vehicle communications equipment on vehicles that normally operate in the SEStran area.

6.2.7 A limited number of vehicles (six) have RTPI equipment for use with the Dundee RTPI scheme.

6.2.8 Stagecoach Group is reviewing its communications strategy. It is possible that this review may recommend that any communications hardware fitted to Stagecoach vehicles be inter-operable to allow for the movement of vehicles between depots.

## 6.3 COMMUNICATIONS COVERAGE

6.3.1 Appendix B summarises coverage requirements for the First in Edinburgh radio communications systems. Tenderers must clearly identify the cost of any additional communications infrastructure required to meet requirements of First in Edinburgh. Tenderers are ultimately responsible for the effectiveness of the communications system.

6.3.2 Stagecoach currently has no fleet-wide on-vehicle communications equipment in the SEStran area other than the planned roll-out of GPRS capability on ERG ticket machines.

6.3.3 A small number of Stagecoach vehicles within the SEStran area have RTPI equipment for use with the Dundee RTPI scheme. Larger numbers of vehicles in Tayside (the former StrathTay operation) are equipped to participate in the Dundee system. Integration with the Dundee system is not a core Phase 1 objective of the SEStran project.

## 6.4 SESTRAN COMMUNICATIONS REQUIREMENTS

6.4.1 SEStran's core requirement is for a data radio facility which will:

- communicate in a cost effective manner with RTPI signs on-street; and



- allow existing and future operators to access the fleet management and RTPI benefits of the system.

6.4.2 The provision of voice communications for bus operators is not a core SEStran requirement but it is recognised as essential to satisfy the aspirations of First in Edinburgh.

6.4.3 It is envisaged that any audio announcements at on-street signs will be synthesised and communicated via the data radio system. As most special service announcements will be initiated by bus operator dispatchers, this avoids the need for RTPI on-street signs to communicate via a variety of operator voice radio systems.

## 6.5 FIRST IN EDINBURGH COMMUNICATIONS REQUIREMENTS

6.5.1 First in Edinburgh's core communications requirements are:

- That First in Edinburgh must retain direct responsibility for the management of their radio control system which is located in their Dalkeith depot;
- That the First in Edinburgh voice radio system should be incorporated within the RTIS, and that
- Faults in the RTPI system hardware or software will not prevent use of the existing First in Edinburgh voice radio system and its functions.

6.5.2 First in Edinburgh require voice and data communications with:

- Their depot at 14/16 Eskbank Road, Dalkeith EH22 1HH;
- Their depot at Deans Road, Livingstone,
- All their buses across their operational area, removing the existing barrier of 2 discrete systems
- Their maintenance vehicles; and
- Their on-street inspectors using hand-held roving devices

6.5.3 Although a trunk radio solution is desired, First in Edinburgh will accept a hybrid communications solution that makes use of GPRS in areas where providing PBR coverage is not cost-effective.



## 6.6 STAGECOACH BUSES COMMUNICATIONS REQUIREMENTS

6.6.1 Stagecoach has no current requirement for real-time transmission of vehicle location data. In addition, Stagecoach does not wish to hamper its ability to move vehicles between depots as operational requirements dictate.

6.6.2 The preferred method for the communication of vehicle location data is via GPRS.

6.6.3 Stagecoach has a group-level agreement with ERG for the supply of ticket machines. These can have both GPS and GPRS functionality but such functionality is not fitted as standard.

6.6.4 As Stagecoach does not require real-time vehicle location data, the cost of transmitting such data will be borne by the real-time passenger information scheme.

## 6.7 DEPOT SYSTEMS

6.7.1 Voice radio communications facilities are required within the depots but fully functional voice and data dispatcher workstations are not required at every location. "Mobile" or hand held facilities will be sufficient for depots where fleet management tasks are not undertaken.

6.7.2 It shall be possible for the dispatcher depot staff to use any depot terminal to send free text messages between dispatcher and depot terminals and selected vehicles. This is in addition to data transferred for upload/download to OBUs. Alarm facilities must be provided to highlight receipt of incoming messages.

## 6.8 COMMUNICATIONS OPTIONS AND COVERAGE REQUIREMENTS

6.8.1 In recognition of the varying Stakeholder aspirations, Tenderers must submit the following technical and costed proposals. Note that the communications options exclude the on-bus hardware costs which are covered elsewhere but must include all other elements including radio control equipment, GPRS gateways, proposed base stations, numbers of voice and data channels, OFCOM licences, site shares, leased lines, set up costs, GPRS data costs etc.

6.8.2 Tenderers must state whether GPRS based vehicles will be "always on" the proposed cellular networks or whether multiple registrations will be required to communicate with the central system. Any detrimental effects of repeat registrations on system operation must be highlighted.

6.8.3 A comparison of whole life costs is required assuming a 15-year operational period.



- 6.8.4 Communications Option 1 – full MPT1327 voice and data coverage of the entire SEStran area based on ultimate system requirements. The required area should extend across the Firth of Tay to include Dundee.
- 6.8.5 Communications Option 2 – full MPT1327 voice and data coverage of the entire SEStran area based on ultimate system requirements incorporating upgraded equipment from First in Edinburgh. The required area should extend across the Firth of Tay to include Dundee.
- 6.8.5.1 Additional items on the Bill of Quantities in relation to Option 2 include:
- Modifications to First system software
  - Modifications to First aerials
- 6.8.5.2 Tenderers should clearly state any additional costs that would be incurred in delivering this option. Any additional costs not listed in the Bill of Quantities will become the liability of the Tenderer.
- 6.8.6 Communications option 3 – a hybrid GPRS and MPT 1327 voice and data radio system based on ultimate system requirements providing MPT 1327 coverage of the central and northern elements of the SEStran area with GPRS coverage of other areas (e.g. the Scottish Borders) as necessary. GPRS data volumes and associated costs for buses should be based on high on-bus functionality and signs should be estimated.
- 6.8.7 Communications Option 4 - a partial solution in recognition of Stagecoach aspirations which provides GPRS based data communications for the Stagecoach fleet of 396 vehicles. NB: Tenderers should estimate the likely GPRS savings if Stagecoach data can be transmitted across the trunked voice / data platform.
- 6.8.7.1 This option could operate in conjunction in with one Options 1, 2 or 3 above.
- 6.8.8 If the tenderer does not wish to use the voice and data radios currently being fitted to First in Edinburgh vehicles, provision must be made to fit such radios to the remainder of the First in Edinburgh fleet. This will be approximately 70 vehicles. Tenderers should indicate which of any of the above communications options would be used and insert relevant costs in the Bill of Quantities.
- 6.8.9 Data volumes and associated costs per vehicle for Option 4 should be estimated for each of the 4 levels of operational functionality outlined above to provide an annual running cost.



6.8.10 Tenderers offering a wav file “voice” option (as outlined in Section 9) should also estimate the data size and associated cost of transmitting a 15 second voice recording, assuming 25,000 such transmissions per annum. Any tariff thresholds should be identified in terms of SIM numbers and data volumes. Tenderers should also provide estimates for cellular voice communications where voice calls to vehicles are established from a control centre (on a specific bulk voice contract) on the assumption that “requests to talk” are sent via data message by the driver of the vehicle in a similar manner to private radio solutions.

## 6.9 COMMUNICATIONS SURVEYS

6.9.1 Tenders must include the results of a desk-top study to assess the radio communications requirements for the initial system described above. This should detail the location of base stations and transmitters and the use of leased-line or microwave communications between the core system, remote workstations, radio base stations etc.

6.9.2 The successful tenderer will be required to undertake drive surveys to prove the communications system coverage for the initial system requirements defined above.

## 6.10 PERFORMANCE REQUIREMENTS

6.10.1 The Tenderer should note that this requirement includes the need for the communications system to be operationally efficient and cost effective and be capable of remaining so and supporting the system as it expands and develops over its life cycle. A Service Level Agreement (SLA) will apply to the provision of radio services, both in respect of voice and data, and tenderers are invited to advise the overall % uptime for (separately) voice and data transmission expressed in terms of a 24-hour 365 day service. Provided that this is agreed by the Purchaser, these percentages will form the basis of the SLA.

## 6.11 MASTS AND BASE STATIONS

6.11.1 It is the Tenderer’s responsibility to ensure that communications requirements are met, as no additional monies will be supplied for upgrading such capability this after award of contract. for a particular area or operating company. First in Edinburgh have existing radio transmission towers which may be suitable for re-use. It will be the responsibility of tenderers to satisfy themselves of the suitability of any such tower for the purposes of fulfilling the requirement for radio coverage. If the tenderer does not believe that this location is capable of providing suitable radio coverage, it is the responsibility of the tenderer to identify an alternative suitable site for a radio transmission mast and aerial. Funding of such a new facility must fall within the contract price.



- 6.11.2 In establishing locations and installations for any other base station the Tenderer must be aware that full responsibility for obtaining planning consent and any other applicable permissions and licenses (including the radio transmission license) will lie with the Tenderer and the Tenderer alone. The Purchaser (and where appropriate its local authority partners) will provide assistance and evidence in support of any applications for these made by the Tenderer in pursuit of such permissions and licenses. The ongoing annual cost of any licenses must be identified in the tenderer's submission.
- 6.11.3 The Tenderer shall be responsible for providing appropriate base stations, transmission equipment, and any other equipment and cabling required to bring them into service.
- 6.11.4 The Tenderer shall supply all necessary control equipment for controlling multiple base stations and for organising channel selection, synchronisation and switching any other equipment necessary to ensure that the system works in a wholly integrated manner.
- 6.11.5 The Tenderer shall provide the means of connecting the base stations with the core system and for further delivering the transmitted data to the bus operators' depots as appropriate.
- 6.11.6 The Tenderer shall provide full descriptions of their proposal for each operating company installation including technical details, cost of supply, cost of operation (including all necessary licenses and site rental costs) and cost of maintenance based upon the system meeting the requirements.
- 6.11.7 The Tenderer shall identify all costs including maintenance within the Bill of Quantities.
- 6.11.8 A map (at a scale of 1:10000) showing the area of where communications is provided by GPRS, rather than Band 3 PBR, must be provided for each bus operating company.

## 6.12 ALTERNATIVE COMMUNICATIONS OPTIONS

- 6.12.1 Tenderers may propose alternative communications options if operational or financial benefits are thought likely to accrue. The performance of alternative systems must be stated and be sufficient to deliver the required level of functionality.

## 6.13 CONFIDENTIALITY

- 6.13.1 The proposed communications system must guarantee that public transport operators cannot gain access to a competitor's voice or data transmissions.





## 6.14 OFCOM LICENCES

6.14.1 Licence applications will be prepared by the Tenderer and submitted by individual operators or the Purchaser where necessary. Tenderers must provide annual operational cost summaries and guidance regarding this issue.

## 6.15 COMMUNICATIONS COSTS PRIOR TO TAKE-OVER

6.15.1 The Tenderer will be responsible for communications costs until satisfactory completion of an agreed Site Acceptance Test schedule and issue of an Interim Take-over Certificate. Satisfactory completion of an agreed Site Acceptance Test schedule and issue of an Interim Take-over Certificate will trigger the third milestone payment of the payment schedule.

6.15.2 Tenderers may offer an alternative option where they retain operational and financial responsibility for all communications links under the Maintenance Agreement.



## 7 Installation

### 7.1 GENERAL

7.1.1 The Tenderer is responsible for all works (permanent and temporary arrangements), associated with the supply and installation of the RTIS except where expressly stated otherwise. This includes any traffic or pedestrian related traffic management works.

### 7.2 ACCESS TO PREMISES

7.2.1 The Tenderer shall be permitted access to local authority and public transport operator premises and vehicles at the following times:

**Table 14: Access to premises**

Premises	Location	Weekdays	Weekends
Local Authority offices:	All	0800 – 1800 Mon- Fri	
Depots			
	First in Edinburgh	0700 – 1900 Mon – Sat;	0800 – 1700 Sunday
	Stagecoach East Scotland	0700 – 1900 Mon – Sat;	0800 – 1700 Sunday
Access to vehicles:			
	First in Edinburgh	1900 – 0500 Mon – Fri	1900 Sat – 0500 Mon
	Stagecoach East Scotland	1900 – 0500 Mon – Fri	1800 Sat – 0500 Mon

### 7.3 BUS FITTING SCHEDULE

7.3.1 Unless an alternative methodology has been agreed, buses shall be made available to the Tenderer at the above Premises in accordance with a "fitting schedule" agreed between the operators and the Tenderer during the Joint Design Exercise. Tenderers are requested to provide an outline Fitting Schedule which should include an indication of the Tenderer's capabilities in respect of retro-fitting RTIS hardware and associated cabling to a specified number of buses within a specified time frame (taking into account the Access to Vehicles times above).

7.3.2 Bus operators will ensure that vehicles are accessible for fitting, and that vehicles can be moved within the depot if necessary.

### 7.4 ACCESS BY AGREEMENT

7.4.1 Access to premises and vehicles is by agreement. In addition to any statutory obligations relating to health and safety, hazardous materials, Race Relations etc, the Tenderer shall abide



by any local rules and agreements governing the particular bus operator or local authority workplace, copies of which shall be made available on request.

## 7.5 METHOD STATEMENT

7.5.1 After appointment, the Supplier must write a method statement for the fitment of equipment to each combination of vehicle chassis and body type. The method statement will be subject to approval by the relevant operator. The method statement should include the procedure for commissioning a vehicle.

7.5.2 It cannot be guaranteed that a vehicle will be available for commissioning immediately after equipment fitting has been taken place.

## 7.6 ANCILLARY WORKS ARRANGED BY THE PURCHASER

7.6.1 Following consultation and agreement with the Tenderer, the Purchaser will arrange the following accommodation works:

- Within offices and depots: power points, ducting, trunking, reinstatement
- At stops and interchanges: power points, ducting, trunking, reinstatement, shelter modifications when necessary
- At key locations: power points, ducting, trunking, reinstatement, any structural requirements to allow mounting of large signs, at traffic signal installations
- At traffic signal installations: Power points, modifications to traffic signal controllers, footway ducts (including draw-ropes), opening / resealing traffic signal controller bases

## 7.7 ANCILLARY WORKS TO BE ARRANGED BY THE TENDERER

7.7.1 The Tenderer is responsible for all works associated with retro-fitting RTIS hardware and associated cabling to the public transport vehicle fleet. The public transport operators may be prepared to consider alternative arrangements given suitable training. If an alternative methodology is proposed, cost savings to the Purchaser should be identified.

7.7.2 Note that the Scottish Government is assisting bus operators in procuring new ticket machines. Ticket machines purchased by operators may already be fitted with, GPS and GPRS, or have the facility for upgrade.



7.7.3 The Purchaser will arrange access to traffic signal installations and will be responsible for ducting and cabling between the signal controller and any radio antenna on nearby signal poles, duct reinstatement and the resealing of traffic signal controller bases.

## 7.8 ACCOMMODATION

7.8.1 The successful tenderer must agree the location of hardware and systems within depots and offices and provide advice on necessary accommodation works.

### Line of sight at traffic signals

7.8.2 Where line of sight communications are required to request priority at traffic signals, the tenderer will visit the installation and agree the location(s) of radio antenna with local authority staff or their representative.

## 7.9 INFORMATION SUPPLIED BY THE PURCHASER

7.9.1 The Purchaser will supply the following:

- Base mapping: digital OS mapping is available in both raster and vector formats. The purchaser must be able to update the base mapping;
- Output from the Omnibus and Trapeze F/X scheduling systems for all routes and services;
- General locations of traffic signal installations staging and associated signal stage arrangements; and
- Proposed traffic signal priority "trigger points". Locations will be confirmed during line of sight discussions with the successful tenderer.

## 7.10 DATA FROM SURVEYS

7.10.1 The tenderer is responsible for the following:

- Communications surveys;
- Route surveys for test routes;
- Accommodation;
- Line of sight at traffic signals; and
- Test Routes



### Test routes & data integrity checks

- 7.10.2 Schedules and running boards will be provided from Stakeholders' systems and will form the core of the database during future expansion Stop co-ordinates have been collected as required by the UK for their inclusion in the UK National Public Transport Access Nodes (NaPTAN) database and will be made available.
- 7.10.3 However, poor data quality is recognised as a major issue which can degrade system performance during commissioning and roll-out.
- 7.10.4 To identify the scale of any data quality issues, the Tenderer will undertake the following as soon as possible after appointment:
- 7.10.5 Surveys of three routes from each Phase 1 bus operator – following the processes and procedures (including any survey tools) recommended by the Tenderer to achieve the performance, accuracy and reliability standards they claim for their operational system. Details of data requirements, recommended survey procedures and survey tools available must be included in the tender. For example, this will include collection of GPS c-ordinates for stops and bus depots and the distances between stops.
- 7.10.6 Data Integrity Check: - a comparison of surveyed results with data available from NAPLAN and bus operator schedules / running boards. The Tenderer will provide a short report highlighting the scale, frequency and nature of any errors. The impact of such errors on overall system operation will be predicted or, if possible, demonstrated by the Tenderer.
- 7.10.7 Wide Area Surveys – if existing data sources are considered unsatisfactory, SEStran will arrange surveys of the routes operating from Phase 1 operator depots. This may be undertaken by Stakeholders or commissioned from the Tenderer.



## 8 Acceptance testing

### 8.1 GENERAL

8.1.1 All system equipment and software supplied for this Contract shall be subject to Factory and Site Acceptance Tests (FAT and SAT respectively).

8.1.2 Before any part of the system is taken over by the Authority, the Tenderer shall be required to demonstrate by a comprehensive series of tests and operations that all items of equipment function satisfactorily in compliance with this specification. Testing will be required both independently and together as a system.

8.1.3 The Tenderer shall produce documentation to show which tests are to be carried out. The Engineer shall sign off all satisfactorily completed tests.

8.1.4 The Tenderer shall submit FAT and SAT specifications for the Engineer's approval three weeks in advance of commencement of FAT and SAT. These specifications shall describe in detail the objectives, parameters, procedures and expected results. Where simulators are to be used for any part of the tests, these shall be fully described.

8.1.5 FAT and SAT tests shall not commence until a schedule of tests has been agreed with the Engineer. Notwithstanding such agreement, the Engineer reserves the right to require tests not specified in the schedule. All test equipment and costs associated with the FAT and SAT shall be included in the tendered price.

### 8.2 FACTORY ACCEPTANCE TEST (FAT)

8.2.1 The FAT shall demonstrate all aspects of the system functions for each of the system elements.

8.2.2 Effective interfaces with third party systems shall be demonstrated including:

- The output of bus priority requests;
- The automatic transfer of TransXchange schedule data to and from the system;
- The output of analysed performance data in TransXchange format to allow the revision of existing schedules; and
- www interfaces and text messaging functions.



### 8.3 SITE ACCEPTANCE TESTING (SAT)

- 8.3.1 SATs shall not commence until FAT testing has been completed to the satisfaction of the Engineer.
- 8.3.2 The system shall be configured as a fully operational system for site acceptance tests.
- 8.3.3 Failure of third party systems (not supplied under the terms of this contract) shall not be deemed a system failure.
- 8.3.4 The SAT shall include:
- Drive surveys to prove communications
  - Comprehensive operational tests the satisfactory operation of system features and facilities
  - Where appropriate, multiple / repetitive tests will be carried out that reliability and/or performance targets are being achieved
- 8.3.5 To pass the SAT, core systems and facilities must operate for a defined period without exceeding agreed fault limits. The operational period for each defined test item shall not exceed 30 days.



## 9 Project team and Joint Design Exercise

### 9.1 JOINT DESIGN EXERCISE

9.1.1 The installation and commissioning of the RTPi and fleet management system will be managed by a Project Team including representatives of SEStran, local authorities, and bus operators. The roles and responsibilities of the Project Team members have been clearly defined in a separate agreement. Following commissioning, the Project Team will manage the system operation and any future expansion. This ongoing commitment is considered essential to the success of the system; the Tenderer will be a Project Team member for the duration of this Contract.

#### Part 1

9.1.2 Within two weeks of contract award, all parties involved shall undertake a Joint Design Exercise whereby any anomalies and misinterpretations of this specification will be clarified and resolved. The purpose of this exercise is to ensure that all parties have consistent expectations of what the system can and will deliver. No major diversions from the original specification that would require a revision of contract price will be allowed at this juncture. It is intended to be a mutually accepted exercise. At the end of the Joint Design Exercise, both parties will sign an agreement defining the scope of works to be covered under this tender.

9.1.3 The duration of this exercise will be 10 working days (maximum) and held at the SEStran offices in MacDonald Road, Edinburgh.

#### Part 2

9.1.4 Upon completion of the Joint Design Exercise Part 1, the Supplier shall prepare detailed system specifications for the various elements of the system. These will be delivered to an agreed rolling programme.

9.1.5 Each specification will be developed in conjunction with the Project Team and other stakeholder personnel as required.

9.1.6 The Tenderer should state how they intend to manage Phase 2 of the Joint Design Exercise. It is acceptable to convene one or more meetings for this purpose. Tenderers should indicate the price of attending such meetings. It may be appropriate to hold meetings over one day, three days or five days. The Bill of Quantities reflects this. Note that the Tenderer is not expected at this stage to determine how many such meetings will take place.





- 9.1.7 It will be acceptable that some meetings in Part 2 of the Joint Design Exercise are held by video conference.
- 9.1.8 Completed specification documents will be will be submitted for approval at Project Team meetings (see below).
- 9.1.9 The Supplier shall seek and obtain the approval of the Client to order long-delivery and / or low risk components. The Supplier shall not commence the system build until the relevant system specifications are approved by the Client.
- 9.1.10 The Final System Specification (FSS) document shall be an expanded statement and description of what the Tenderer shall provide under the Contract as required by this specification. The FSS shall reflect all clarifications, technical queries and changes to the Requirements agreed during the pre-award negotiations between the Tenderer and the Purchaser. The FSS shall provide the foundation for the design and implementation of the Works.

## 9.2 PROJECT TEAM AND MEETINGS

- 9.2.1 As a member of the Project Team, the Tenderer will attend monthly Project Team meetings. Additional meetings will be reimbursed on a pro-rata basis.
- 9.2.2 Project team meetings will take place in Edinburgh. The tender must include staff and subsistence costs for fourteen Project Team meetings.
- 9.2.3 The Tenderer will be represented by their Project Manager (identified in section 18).
- 9.2.4 Other representatives of the Tenderer may be asked by the Purchaser to attend Project Team meetings.
- 9.2.5 A video-conferencing facility is available at SEStran’s offices. The ability of the Tenderer to participate in video conferences would be advantageous. Tenderers should state their capacity in this regard.

## 9.3 SYSTEM ADMINISTRATOR

- 9.3.1 At an appropriate point in the Project, SEStran will appoint a system administrator who will, over time, become the primary point of contact with the Supplier.



## 10 Training

### 10.1 GENERAL REQUIREMENTS

10.1.1 Based on their previous experience, tenderers shall provide a detailed and costed training programme for local authority and bus operator staff. Training must cover all aspects of the system and include training of bus operator staff to carry out first-line maintenance and shall include but not be limited to the following:

- Systems Operators;
- Systems Support Staff;
- System Hardware Support Staff;
- Bus Drivers (using a “train the trainer” type approach; and
- Reports.

### 10.2 SYSTEMS OPERATOR

10.2.1 Training in the operation and use of all elements of the system for Radio Dispatchers, Bus Depot Operators and Traffic Control Room staff. A number of courses will be required for a number of staff and to fit in with work arrangements.

10.2.2 The training in this area shall be undertaken at a bus operator’s premises with at least one session for each operating company where a system is installed.

10.2.3 Training shall include at a minimum:

- System design overview;
- Radio operation;
- Graphical user interface;
- System operating features and facilities;
- Reporting requirements; and
- Depot system administration.

10.2.4 The Tenderer shall detail exactly what is provided for this area of training, and the maximum number of staff appropriate to be trained in each session.



### 10.3 SYSTEMS SUPPORT STAFF

10.3.1 This training area shall provide a thorough understanding of the system and the underlying principles, covering the day to day use of its basic configuration options. The training should instruct system support staff in the use and configuration of the systems to maximise its effectiveness and be able to support it on an ongoing daily basis.

10.3.2 This area of training may take place at either the bus operator's premises or elsewhere where the system is installed.

10.3.3 Training in this area shall have a capacity for up to 6 staff per session.

10.3.4 Training in this area shall include as a minimum:

- System design overview;
- System operating features and facilities;
- System Database structure;
- 'Entering in' of the system database;
- System administration, configuration and routine management; and
- System calibration.

10.3.5 The Tenderer shall detail exactly what is provided for this area of training.

### 10.4 SYSTEMS HARDWARE SUPPORT

10.4.1 This training area shall provide bus operating company staff (and where appropriate Local Authority partners including signal maintenance engineers) who may be carrying out First-line maintenance support tasks with an understanding of the underlying design of the system(s) and how its components are installed and connected. It shall enable staff to provide 'First Line' management of its maintenance and support both the system and its users on a day to day basis. It shall cover all appropriate aspects of the system.

10.4.2 The location for this aspect of training will be determined in the Joint Design Exercise. It is envisaged that a limited number of courses with varying content may be required to accommodate the staff to be trained and the different types of equipment involved (bus maintenance engineers and optionally signal maintenance engineers of the local authority partners). Training in this area shall include as a minimum:

- System design and operation overview;



- Practical training on the type of equipment and utilities to be supplied;
- Basic hardware and systems maintenance regimes;
- System Database structure;
- 'Entering in' of the system database;
- System administration, configuration and routine management; and
- System calibration

10.4.3 The Tenderer shall detail exactly what is provided for this area of training.

## 10.5 BUS DRIVER INSTRUCTION

10.5.1 This area of training may take place in a suitable bus depot for each bus operating company where the is installed.

10.5.2 Training in this area shall include as a minimum:

- Radio system;
- Drivers input commands;
- System messages;
- User fault conditions;
- Radio procedures; and
- Fault reporting.

## 10.6 REPORTING SUITE

10.6.1 It is anticipated that up to six staff will be trained per installation, and there will need to be further training sessions for corporate users.

10.6.2 This area of training may take place in a suitable bus depot for each operating company where the system is installed.

10.6.3 Training in this area shall include as a minimum:

- Accessing and specifying data;
- Generating reports;
- Customising reports; and



- Bespoke reports.

## 10.7 TRAINING PROGRAMME

- 10.7.1 The tender must clearly specify the duration of the recommended training programme.
- 10.7.2 Tenderers must indicate the number of personnel in their training team and provide daily rates for each. The daily rate will include any expenses (accommodation, subsistence, car hire etc). Travelling costs per visit to / from Edinburgh must be identified separately.
- 10.7.3 Tenders will be assessed on the basis of a rationalised training programme.



# 11 Documentation

## 11.1 GENERAL DOCUMENTATION

- 11.1.1 Documentation shall be provided to support the design, testing, installation, operation, training and maintenance of the system. Documentation shall consist of design and testing reports and certificates and system operation and maintenance manuals.
- 11.1.2 The production and agreement of documentation shall be contained within the Tenderer's Quality Assurance system and be directly linked to the Quality approach adopted for the design and testing of the system and its component subsystems.
- 11.1.3 The production and submission of the documentation detailed herein shall have been set in place via the Tenderer's Quality Plan which dictates the framework of all Works.
- 11.1.4 The contents of all documentation to be supplied shall be listed.
- 11.1.5 All documentation shall be controlled, clearly marked with a title, date, issue number and referenced so that superseded parts may be easily replaced.
- 11.1.6 All manuals shall be of robust construction and capable of easy amendment and expansion.
- 11.1.7 The binding of documentation shall be 'multiple hole ring bound' which shall be durable, hard covered and easily identifiable such that pages can be opened flat. A4 documents shall have 4 holes and A5 documents 2 holes. Text pages shall be A4 or A5 in size (as specified).
- 11.1.8 Schematics and diagrams shall be incorporated within the documents where appropriate to assist in ensuring a clear concise document is provided. Drawings may appear within the text (largest size A3 folded) or be inserted in transparent plastic holders.
- 11.1.9 All documentation shall include comprehensive cross referencing and shall be issued to the Purchaser an electronically readable format on CD-ROM.
- 11.1.10 Each re-issue of a document shall state the section and paragraph number of any changes from the previous issue and the reason for the change shall be briefly described (e.g. documentation error, Tenderer requested modification, Engineer requested modification etc).
- 11.1.11 The documentation supplied shall become the property of the Purchaser and the free right to reproduce for its own internal use only shall be granted by the Tenderer.



11.1.12 The Tenderer shall also supply all standard manufacturer’s documentation, manuals and handbooks for bought-in ‘Other Equipment Manufacturer’s’ items of equipment and software supplied as part of this System.

11.1.13 All final documentation shall be submitted no later than two weeks before the system Site Tests.

## 11.2 DOCUMENT APPROVAL PROCESS

11.2.1 All documentation submitted for approval by the Tenderer shall be subject to a process of review and comment by the Engineer.

11.2.2 For all items discussed herein, the Tenderer shall make an initial submission of one paper copy or one copy in an electronically-readable format to be agreed with the Engineer for review thereby.

11.2.3 Subsequent to the submission of each item, the Engineer will review it and if the Engineer has comments on the item, the Engineer will review and return documentation within 2 weeks. Returned Submissions will be marked “NO COMMENT” or “COMMENTS”.

11.2.4 If the submission is deemed unacceptable and marked with the “COMMENTS” stamp, the submission will be returned to the Tenderer for amendment and subsequent resubmission within two weeks (four weeks after the initial submission). If second submission is not complete and does not address all comments and deficiencies noted by the Engineer this process will be repeated

11.2.5 The “NO COMMENT” stamp shall not relieve the Tenderer of any responsibilities under the Contract for full performance of the work should errors or omissions be discovered at a later date.

11.2.6 The work associated with a particular documentation submission shall not commence until the said document has reached the “NO COMMENT” stage

11.2.7 Once a document has reached the “NO COMMENT” stage the Tenderer shall provide a Final soft version of that document, in an electronically-readable format, to the Engineer for his records.

11.2.8 Following final acceptance of each document the Tenderer shall provide a Final soft version of that document in an electronic format to the Engineer for his records and issue the prescribed number of Final paper copies.



11.2.9 The Tenderer must make adequate allowance for the preparation, submission and amendment of all required submissions in his programme.

**11.3 REQUIRED DOCUMENTATION**

11.3.1 Submissions to be made by the Tenderer as part of this Contract are as indicated in Table 15 below.

**Table 15: Documentation requirements**

Document Description	Timeframe	Final Copies,
Final System Specification	6 weeks after Contract Award	1
Design Documentation	As per Quality Plan/ Programme	1
Test Specifications	4 weeks prior to Testing	
Test Results Documentation	2 weeks after Completion of Testing	1
System Training Documents	2 Weeks prior to training	1
System Manuals	2 weeks prior to Site Test	As stated below

11.3.2 Where the system supplied by the Tenderer includes equipment from Other Equipment Manufacturers (OEM), copies of the relevant handbooks and manuals shall be provided as part of the Final System Specification following award of the Contract.

**11.4 DESIGN DOCUMENTATION**

11.4.1 This documentation shall detail all of the hardware and software elements that will form part of the system. It shall also detail the key parameters and processes that the design is based upon.

11.4.2 For parts of the system that are existing established products, full details of hardware and software based on the product’s standard documentation shall be provided.

11.4.3 For elements of the system that are not existing established product and are being designed and developed within this contract the Tenderer shall provide full design details of hardware and software. This shall be provided to the Engineer during the Contract as part of the Quality Procedures associated with the design process.

**11.5 TEST SPECIFICATIONS**

11.5.1 This documentation shall for all levels of testing separately detail in full how compliance with the user requirements as detailed herein will be ensured and shall at a minimum include:

- Testing procedures including self-certification





- Test set up including test equipment used;
- Desired results; and
- The format of test results documentation.

11.5.2 Test Specification documentation shall include copies of relevant system manuals relating to the system component(s) under test. Where such manuals have been previously supplied as part of other documentation submissions duplicates need not be submitted.

11.5.3 The Test Results Documentation shall present for all levels of testing, in the format accepted as part of the Test Procedures Documentation, the results obtained including details of equipment tested, results obtained; areas of non-compliance; and remedial action taken or proposed for areas of non-compliance.

## 11.6 SYSTEM UPGRADES

11.6.1 The requirements of sections 11.3 to 11.5 are to be met by any upgrade to the system or to its component software. Changes are to be tested using the environment described in paragraph 15.1.5.

## 11.7 SYSTEM TRAINING DOCUMENTATION

11.7.1 This documentation set shall outline the training plan set in place to meet the requirements of the Contract and provide appropriate notes, information and examples to support the various training sessions supplied under the Contract. Draft versions of System Manuals may be used as part of this documentation.

## 11.8 SYSTEM MANUALS

11.8.1 The System Manuals shall provide a comprehensive set of reference material and documentation to support the ongoing management, operation and maintenance of the system and its hardware and software component parts.

11.8.2 The System Manuals documentation shall cover at least the following items:

- System Manual;
- Software Manual;
- Equipment Manual;
- Maintenance and Service Manual;
- Operation Manual; and



- Information and instruction cards.

11.8.3 The System Manual document shall summarise in a concise format the overall system both technically/ functionally, as well as operationally. This document shall serve as a stand-alone document and may draw upon other documentation where appropriate. Three copies of this manual shall be provided for each bus operating company installation.

11.8.4 The manual shall be suitable for use by system engineers as an introduction to other parts of the documentation and management as a System description and reference guide. The manual shall give a complete specification of the System facilities in terms of operator inputs, inputs from and outputs to associated equipment and displays/outputs to the operator. The Specification shall include details of data stored and of System checks to establish the validity of the various stages of the system's processes.

11.8.5 The Software Manual shall detail all software provided as part of this contract. Three copies of this manual shall be provided for each operating company installation. It shall provide all necessary information and materials to allow modifications to be made by the Engineer or others subsequent to completion of the Contract. Accordingly this submission shall at a minimum include:

- Software Functional Design Documentation including, where appropriate, Pseudo-Code and Hierarchy Charts;
- Software Architectural Design Documentation;
- Software Debugging Procedures and Results Report;
- Hard Copy of all Source Code;
- Installation/Operation Procedures;
- Procedures for making alterations to the System database to allow for changes and expansion;
- Procedures for generating System graphics and dynamic screen displays;
- Maintenance/Service Procedures;
- All Applicable Licenses; and
- Non-disclosure Agreements (where applicable)

11.8.6 The Equipment Manuals shall be in two parts, one covering all workstation equipment and the other covering all other types of external equipment. The part of the manual relating to other



equipment may be subjected to use in an external environment and all the pages for one copy shall be individually enclosed in transparent plastic covers. Three final copies of this manual shall be provided for each operating company installation. The manual shall cover the following:

- Each unit of equipment shall be clearly labelled on at least one configuration in block diagram form;
- Details of the location of all units and boards within their cabinets and racks shall be given;
- The interaction of units shall be clearly shown on a configuration diagram;
- The method of connection of peripheral equipment to the System;
- The method of transfer of data between the outstations and the System;
- Interconnections between equipment;
- Detailed technical and functional descriptions of the data transmission equipment;
- Cross-referencing with Maintenance and Routine Service Manual;
- For each individual item of equipment, detailed technical and functional description shall be given together with logic and circuit diagrams;
- Parts lists and wiring schedules covering the whole of the System;
- All timings of data transmission equipment;
- Interaction timings between sub-systems; and
- Layout of all equipment with full details of all equipment interfaces including identification of cables at these interfaces.

11.8.7 The Maintenance and Service Manual(s) shall document in detail the maintenance and service aspects of the equipment on an item-by-item basis to enable bus operator technicians to carry out maintenance operations. This manual may be subjected to use in an external environment and all the pages for one copy shall be individually enclosed in transparent plastic covers. Three copies of this manual shall be provided for each operating company installation. The manual shall cover the following:

- Routine service procedures for each item of equipment including recommended frequency;
- Details of the operation of the core system and other equipment related Test sets and their use in fault location and identification;



- Details of other fault diagnosis, location and identification procedures related to observable effects of faults;
- List of equipment connected to the System;
- Details of setting up and adjustments including the actions to be taken for those items on which first-line maintenance may be carried out;
- Diagnostic programs to be used in fault analysis;
- Details of the procedures for replacement of faulty parts;
- Circuit diagrams and/or block diagrams of all equipment;
- Details of the operation of test equipment for maintenance and routine servicing; and
- Detailed procedures for testing each item of equipment and the interaction between associated equipment's and also the interaction between two or more items of equipment so as to determine correct functioning.

11.8.8 The Operation Manual shall document in detail the operation of all equipment on an item-by-item basis with clearly detailed illustrations. This manual shall describe in non-specialist language all System commands, operator commands, operator procedures, inputs, the results of these inputs, alarms and outputs not related to operator inputs. The manual shall be provided in A5 format and be structured for ease of use by system operators. Five final copies of this manual shall be provided for each operating company installation. The manual shall list specific procedures which must be followed:

- To start up and shut down the System;
- To carry out permitted System functions;
- List of unsolicited messages available;
- To define the System security access;
- Command/user access level allocations.

11.8.9 An information card or booklet shall be provided for OBUs, signal pre-emption units and operator terminals that provides concise guidance on the operation of the equipment. The information shall be targeted at the specific user of the equipment. The information cards or booklet shall be A5 format and provided with a laminated protective covering or protective folder. One information card/ booklet shall be provided per item of equipment as defined in this paragraph, including spare items held.



11.8.10 The Tenderer shall undertake, without additional charge, to update (and replace in appropriate circumstances) all manuals and system documentation supplied under this Contract for the initial warranty period. The systems manuals and any updates shall be supplied in the agreed compatible electronic format. Appropriate circumstances may be taken to result from but are not limited to:

- Modification to correct deficiencies which have become apparent during the use of the system supplied under this or other contracts;
- Development of improvements subsequent to installation but excluding any which extend the function of the system.

11.8.11 The following shall be provided:

- Three (3) sets of printed system documentation;
- For each OBU (including spares) a "Drivers Booklet" giving straightforward and concise advice shall be provided;
- For each signal pre-emption unit an information card or booklet to be left in the on-street cabinet; and
- Three (3) copies of a CD-ROM containing all printed documentation. The documentation shall be in a standard format and capable of being printed. PDF format is preferred.

11.8.12 All relevant local authorities, the initial bus operators and future entrants have the right to make additional electronic and paper copies of system documentation for the use within their organisations.

11.8.13 Documentation must be in clear English.



## 12 Project management

### 12.1 PROGRAMME

12.1.1 Tenderers must clearly state how the project will be managed and implemented. This should include a detailed and costed breakdown of the work schedule.

12.1.2 Items of the tenderer's proposal that require software, hardware or other development should be clearly identified.

12.1.3 Tenderers must provide a Project Management Summary with their tender which clearly identifies the following:

- The Project Manager;
- Members of the Project Team with CV's provided;
- The office location from which the project will be managed;
- Hourly rates for individual members of the project team. These will be used should the Purchaser require additional advice / services outwith the scope of the tender;
- Tender assumptions regarding the amount of time to be spent on the project by individual members of the project team;
- Travel costs;
- Expenses; and
- Project Programme.

12.1.4 Tenders will be assessed on the basis of a rationalised project management commitment.

12.1.5 See Section 9 for details of the client side 'Project Team' and associated meetings.

12.1.6 Tenderers must clearly indicate how the project will be resourced and the extent to which personnel will be on-site during installation testing, training and handover.

### 12.2 RISK MANAGEMENT

12.2.1 A risk management plan should form part of the project management proposal.

12.2.2 The risk management plan should identify risks to the timely delivery of the project from the **technological** (use of technology to achieve objectives), **project**, (project planning and



management procedures) and **innovation**: (exploitation of opportunities to make gains) perspectives.

12.2.3 Further information on risk management is available from the Scottish Government<sup>3</sup>.

## 12.3 CONSTRUCTION (DESIGN & MANAGEMENT) REGULATIONS

12.3.1 The Construction (Design & Management) Regulations 2007 (CDM 2007) came into force on 6 April 2007.

12.3.2 The Purchaser will appoint a CDM Coordinator with whom the successful tenderer will be expected to work.

## 12.4 SECURITY

12.4.1 The security, integrity and confidentiality of data are of great importance in this project. Tenderers must recognise the need to keep operator data private, and to ensure that only relevant data can be viewed by any given stakeholder.

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<sup>3</sup> <http://www.scotland.gov.uk/Topics/Government/Finance/spfm/riskannex3>



## 13 Equipment design and manufacture

### 13.1 GENERAL EQUIPMENT

- 13.1.1 The Contract Works shall be installed and all component parts designed and manufactured to ensure satisfactory operation in which continuity of service is the first consideration and to secure maximum safety and accessibility of all parts for connecting, inspecting, cleaning, repair, and operation.
- 13.1.2 Industry standard interfaces shall be used throughout.
- 13.1.3 All parts of the system shall be designed and constructed in a modular fashion to facilitate simple maintenance, replacement and enhancement activities.
- 13.1.4 All design drawings shall make use of the metric range of preferred dimensions and tolerances.
- 13.1.5 Where multiple assemblies and components are supplied they shall be fully interchangeable with similar units.
- 13.1.6 All modular components shall be suitably marked with a reference identification, which shall be clearly shown on appropriate drawings.
- 13.1.7 All modules and cable terminations shall be installed so that they are easily accessible for maintenance and replacement.
- 13.1.8 Wherever possible, equipment shall be designed so that installation and maintenance can be accomplished without using special tools.
- 13.1.9 It shall be impossible to install modules incorrectly, by using keyed connectors or other suitable means.
- 13.1.10 To ease maintenance, equipment shall, wherever possible, be constructed from lightweight materials.
- 13.1.11 To provide protection against the ingress of dust and moisture, all outstation equipment shall be designed to appropriate British Standard or equivalent standards, to be agreed with the Engineer. The Tenderer shall also ensure that adequate security protection is provided to all cabinets. At a minimum, the external doors shall be fitted with two tamper-proof locks. On equipment cabinets of the same type all locks shall be identical in pattern.





- 13.1.12 Mounting attachments and electrical connections on equipment shall incorporate locking mechanisms to prevent loosening caused by vibration.
- 13.1.13 Any fully functional on-bus unit shall be constructed as a modular unit capable of being readily modified to increase or decrease its functionality.
- 13.1.14 All on-bus units shall be capable of rapid removal and refitting by unskilled personnel. It shall be housed within a secure unit with key access to prevent unauthorised tampering or removal.
- 13.1.15 All on-bus equipment, at bus stop equipment and signal pre-emption equipment shall be installed by experienced personnel.
- 13.1.16 The Tenderer must be prepared to work with the suppliers of new buses to bus operators to facilitate the incorporation of all on-bus equipment at the time of building new vehicles. This could involve the tenderer's own staff fitting the equipment at the premises of the vehicle manufacturer, or the manufacturer's own staff fitting the equipment following all necessary training to be provided by the tenderer. The Tenderer should explain how they propose to meet this requirement.
- 13.1.17 The Tenderer shall follow safe working procedures with respect to both electrical and traffic safety aspects of installation work.
- 13.1.18 The Tenderer shall be responsible for managing the activities involved in the execution of works. This will involve co-ordination with other bodies such as statutory undertakers.
- 13.1.19 The Tenderer will be responsible for arranging the communications interface for bus-stop information displays and on-bus equipment, where specified.

## 13.2 ELECTRICAL REQUIREMENTS

- 13.2.1 The Tenderer shall comply with the requirements of the latest edition of BS7671 (formerly the IEE Regulations for Electrical Installations 16th Edition 1991) in all aspects of design, selection, installation, inspection and testing of electrical installations.
- 13.2.2 The Tenderer shall comply with the requirements of the current edition of the Electricity at Work Regulations. These regulations require precautions to be taken against the risk of death or personal injury from electricity in work activities. They impose duties on persons involved in the design, installation and maintenance of equipment. Some of the hazards that can result from electrical causes in connection with work activities are: electric shock, electric burn, fires of electrical origin, electric arcing and explosion initiated or caused by electricity etc.



- 13.2.3 All equipment working at a voltage in excess of 120V DC or 50V AC shall be protected by an earthed metal cover, which shall be fixed by means of screws, bolts or quick release devices. The cover shall be sign written in red with the words "Danger .....V AC (or DC)". The highest voltage to which access can be had by removal of the cover shall be shown where several different dangerous voltages exist.
- 13.2.4 Cabinets containing equipment working at a voltage in excess of 50V AC or DC shall be suitably labelled to BS5378 Part 1.
- 13.2.5 Terminals carrying electrical power shall be appropriately labelled, shielded and segregated from terminals carrying control signals.
- 13.2.6 All terminal strips, terminals and terminated cables shall be clearly labelled in English in a manner agreed with the Engineer.
- 13.2.7 Not more than two cable cores shall be retained by any terminal; multiple cores shall be adequately terminated.
- 13.2.8 Earthing shall be done in accordance with BS 7430:1998.
- 13.2.9 Equipment shall be supplied to operate from a voltage of 230V AC unless otherwise specified, and shall operate correctly within voltage tolerances of +10% and –10%, and a frequency range of 47Hz to 52Hz.
- 13.2.10 All apparatus supplied shall be designed to ensure satisfactory operation under the atmospheric conditions prevailing at the site.
- 13.2.11 The Tenderer shall make adequate provision to prevent the system causing interference beyond the limits laid down in BS800, Limits of Radio Interference.
- 13.2.12 The supply and use of electricity supplies for field equipment and cabinets shall be a matter for negotiation with the local authority partners in those bus depots where such work is required. The Purchaser will in all such cases provide the appropriate contact with the local authority.
- 13.2.13 Electricity supply company requirements shall be met for all equipment to be connected to the electricity supply. The Tenderer will be required to complete a 'Notice of Completion' form and all required test certificates for all electrical work.



### 13.3 WIRING

- 13.3.1 All wiring external to cabinets shall be neatly, securely and safely installed avoiding damage to existing cables and services and be to the satisfaction of the Engineer. All cable routes shall be agreed with the Engineer in advance of work commencing.
- 13.3.2 All cables shall be clearly labelled using a proprietary, permanent, cable marking system. The marking system shall not rely on any hand written elements. The cable markers shall be applied within 300 mm of each cable termination. In the case of multi-core cables both the cable sheath and the individual cores shall be identified.
- 13.3.3 The tenderer shall adopt a consistent method of identification of cables and cores and this identification system shall be consistently reflected in all cable schedules and documentation. The proposed marking system and identification convention shall be submitted to the Engineer for his approval.

### 13.4 WORKSTATIONS AND BUS DEPOT ELECTRICAL POWER

- 13.4.1 The Purchaser will arrange for a dedicated single phase, 230 V, 50 Hz power supply to be made available to the Tenderer at all depots and any other sites where equipment is to be installed. The Tenderer shall specify the required power rating of these supplies. The Purchaser shall also provide a protective earth termination adjacent to the power supply point and the Tenderer shall provide any additional earthing arrangements required.
- 13.4.2 Supply circuits (including any necessary sub-circuit breakers) between the termination point of the provided power supply as described in paragraph 9.4.1 and the equipment shall be provided by the Tenderer.
- 13.4.3 All System cables within any designated Control Centre shall be provided and installed by the Tenderer. The Tenderer shall be responsible for the installation of socket outlets and telephone connection points. The requirements and provision of all such supply points and circuits shall be clearly stated and agreed with the Engineer at Final System Specification.
- 13.4.4 A standby supply shall not be provided by the Purchaser. A form of Battery back-up or uninterruptible power supplies (UPS) shall be supplied by the Tenderer, the back-up time of which should be sufficient to allow correct shutdown of each sub-system provided under the Contract. The tenderer shall state the period which the alternative supply will support the system following mains failure and the equipment supported during this time.



- 13.4.5 Any additional electricity supplies required at a Control Centre or a Depot shall be specified by the tenderer. Any requirements for additional power outlets for operator terminals shall be provided by the Tenderer.
- 13.4.6 The Tenderer shall ensure that the mains supply is adequate and shall provide all reasonable protection against surges, line noise and radiated interference so as to ensure optimum performance of the operation of all equipment.
- 13.4.7 The Tenderer shall provide an adequate number of socket outlets for the operation of test equipment and this shall be agreed with the Engineer at Final System Specification.
- 13.4.8 All connectors and interconnecting cables between any equipment forming a Control Centre shall be supplied and installed by the Tenderer. All cabling shall be neatly and clearly identified with marked up labels and generally comply with the existing structured cabling system to the satisfaction of the Engineer.

### 13.5 SITE ELECTRICAL POWER AND ASSOCIATED WORK

- 13.5.1 The Tenderer is required to liaise as appropriate with local authority stakeholders in determining the specification and requirements for any power supplies, cabling or associated works required to enable connections to bus stop or shelter signs/displays and roadside traffic signal equipment or cabinets.

### 13.6 ENVIRONMENTAL REQUIREMENTS

- 13.6.1 It is the Tenderer's responsibility to ensure that each item is designed for the purpose for which it will be used, and is fit for the environment in which it will be used.
- 13.6.2 Equipment to be installed in bus operator premises shall be suitable for continuous operation in a normal office environment within a temperature range of 10°C to 35°C and a maximum relative humidity of 80%. Where the use of standard equipment necessitates a relaxation of this requirement, this shall be agreed with the Engineer.
- 13.6.3 All equipment to be installed in bus operator depot premises shall be suitable for continuous operation within a temperature range of -15°C to 60°C and a maximum relative humidity of 95%.
- 13.6.4 The Tenderer is required to liaise as appropriate with the local authority partners in determining the operational environmental requirements for bus stop or shelter signs/displays and roadside traffic signal equipment or cabinets. All roadside equipment shall be suitable for



continuous operation within a temperature range of -15°C to 60°C and a maximum relative humidity of 95%.

13.6.5 Where equipment which would not otherwise meet the environmental requirements is installed in environmentally-controlled housings, an automatic shutdown capability, or other form of protection, shall be provided to prevent damage to the equipment upon failure of the environmental control mechanism and exposure of the equipment to temperatures outwith its operating range. Any such faults shall be communicated to the core system and recorded by the system.

13.6.6 The Tenderer shall demonstrate that the equipment is fit for use in the environment that it is intended to operate by complying with the tests requirements stated in this specification.

13.6.7 All equipment installed on buses shall be designed and constructed to be suitable for prolonged operation under the range of environmental conditions prevalent within buses and the automotive industry in general.

13.6.8 All equipment shall be provided with certification verifying compliance with appropriate environmental standards.

13.6.9 Tenderers shall provide full details of environmental certification that the equipment has with the Tender.

## 13.7 ELECTROMAGNETIC COMPATIBILITY REQUIREMENTS

13.7.1 All equipment shall comply with current standards and regulations relating to Electromagnetic Compatibility and must comply with the protection requirements of the EMC Directive 89/336/EEC (EMC Regulations 1992, Statutory Instrument 1992 NO. 2372 as implemented in the UK) and as subsequently amended by Directives 91/263/EEC, 92/31/EEC, 93/68/EEC and 93/97/EEC.

13.7.2 Computer equipment shall comply with BS6527 1988 (CENELEC EN 55022).

13.7.3 All the roadside equipment mounted in traffic signal cabinets shall meet the requirements of TRG 1068, Electromagnetic Compatibility for Motorway Communications and Portable and Permanent Traffic Control Equipment. The method of screening used to comply with the EMC requirements shall use screens for cables, individual cards or shelves, and shall not include screening of the complete cabinet or rack unless previously agreed with the Engineer.



13.7.4 All bus stop displays shall be 'CE' marked and designed to comply with directives EN 55011, EN 55014, and EN 55020 for conducted and radiated interference. The units shall comply with directive IEC 801 for immunity against interference from external sources.



## 14 Maintenance

14.1.1 The Tenderer should provide quotations for the maintenance of all system components and define the level of maintenance cover being offered. This must include software support and a telephone help-desk facility accessible to all local authority and operator stakeholders. Also included should be detail of any initial warranties provided with the proposed equipment. The Tenderer must describe how their system will cater for 24hr, 7 days per week operational requirements in respect of critical components and software.

### 14.2 GENERAL

14.2.1 The Tenderer shall recognise and respond to maintenance faults reported by relevant local authorities and the bus operators even though the bus operators are not signatories to the contract.

14.2.2 Fault reports and clearances shall be recorded on standard system forms available at Operator Terminals. It is envisaged that these will be e-mailed to the Tenderer's fault management centre.

14.2.3 The core system shall store a complete record of fault reports and clearances which will be available to the local authority System Administrator and other authorised users. It shall be possible to sort and report faults by user, equipment type, current status, equipment reference number etc.

14.2.4 The system should be self-monitoring with respect to faults. The ability to automatically pass faults detected by the system to the relevant maintenance contractor would be advantageous. If available, this should be a configurable option.

14.2.5 The ability to automatically monitor, detect and manage faults "by exception", in addition to a definitive system fault message, would be particularly advantageous. "Exception" faults would be detected by an unexpectedly high or low level of activity associated with an individual component. A confidence level would be applied to the report depending upon the variation from operational norms. It is envisaged that virtually all system components could be assessed in this way by analysing a selection of live and historic system data. Bespoke "exception" fault reports would be targeted at the appropriate maintenance staff within the supplier and stakeholder groups. Tenderers offering this functionality should offer costed proposals for providing "exception" reporting software for the Stakeholders or, alternative, a fully monitored maintenance service provided by the Tenderer.



### 14.3 BUS OPERATORS

- 14.3.1 Each Operator shall establish his own, single point of contact for fault reporting. This individual shall be responsible for filtering fault reports from their organisation's depots and for contacting the maintenance contractor when it has been decided that faults are outside the scope of first-line maintenance.
- 14.3.2 The Bus operators shall be responsible for performing initial fault investigation on equipment on buses. This shall be known as first-line maintenance and shall be limited to module replacement and the repair of physical disconnections. The Tenderer will train bus operators' personnel to perform module replacement (OBUs, screens, next stop displays etc) and return to Tenderer. The cost for this training shall be identified in the Bill of Quantities.
- 14.3.3 An initial spares holding, for all on-bus equipment, of 10% of the supplied units shall be provided as part of the maintenance provision. These spares shall be distributed around the operators' depots in proportion to the number of vehicles operating out of each depot.
- 14.3.4 Control and usage of these spares shall be the responsibility of the Fault controller. Where units are replaced under warranty, these shall be repaired and returned to the fault controller within 21 days.
- 14.3.5 First-line maintenance of the control system shall be performed by the system administrator and shall be limited to system re-starts following failure and for general administrative functions. The Tenderer shall provide a remote system management facility to allow on-line interrogation of system faults from the Tenderer's location.
- 14.3.6 The Tenderer shall be responsible for establishing an operational Maintenance presence within 4 hours travelling time of Edinburgh.
- 14.3.7 First-line maintenance of on-bus equipment shall take place during the times noted in Section 7. Tenderers shall provide rates for alternative periods, e.g. 24 hour coverage, 7 days per week etc.
- 14.3.8 Maintenance of local authority workstations (including depot systems) shall take place between the hours of 0900 to 1700 Monday to Friday inclusive.
- 14.3.9 Maintenance of depot workstations shall take place during the times noted in Section 7.
- 14.3.10 Maintenance for radio base stations must be provided 24 hours a day, seven days a week.





- 14.3.11 The Tenderer shall carry out his business in accordance with an agreed quality system covering his operational practices. This system shall be aimed at producing traceable records of such activities and for having defined procedures for covering the way he carries out his activities.
- 14.3.12 The Tenderer shall ensure that he holds sufficient spares from the start of the contract to allow fault rectification. Where elements of maintenance are out-sourced to third parties, they also shall hold sufficient spares to ensure efficient repair.
- 14.3.13 The tenderer shall ensure that a one hour call out is available for faults with the radio system and that this call out is available 24 hours per day, seven days per week.
- 14.3.14 For faults defined as critical by the fault controller, attendance shall be within four contract hours. Any fault confirmed as critical shall be repaired within 6 hours for system faults and 24 hours for on bus faults, from the original time of notification.
- 14.3.15 All other faults defined as non-critical shall be attended within 12 contract hours and repaired within 36 hours from time of original notification.
- 14.3.16 Faults defined as critical shall include:-
- Major failure of the entire control system;
  - Failure of the operator interface;
  - Loss of communication to 5 or more vehicles on the same route;
  - Failure of signal priority units;
  - Vandal damage where equipment is left in a dangerous condition to members of the public; and
  - All other faults are considered non-critical.
- 14.3.17 The tenderer shall provide first-line maintenance for signs and displays.

## 14.4 REQUIREMENTS

- 14.4.1 A five year maintenance / warranty period is required extendable annually thereafter.
- 14.4.2 The Tenderer shall propose a maintenance regime for the system. Preference in adjudication of tenders shall be given to regimes judged to give best value to the Authority. The maintenance regime should avoid or minimise the use of "chargeable repairs". If required, "Chargeable" items should be restricted to repairs arising from third party or vandal damage.



- 14.4.3 For items which are subject to first-line maintenance by an operator, the Tenderer shall provide Mean Time Between Failure (MTBF) Rates for equipment components and systems. In this context, equipment shall be taken to mean readily identifiable units which may consist of one or more sub-systems or components.
- 14.4.4 The tenderer shall provide a comprehensive price list for replacement parts which shall be applicable to any “chargeable” repairs during the 5 year maintenance period (alternatively, the Tenderer may propose appropriate index linking tendered prices to the UK retail price index).
- 14.4.5 If the maintenance regime includes “Chargeable repairs”, the Tenderer must provide hourly rates for chargeable maintenance which shall be applicable throughout the Maintenance period (alternatively, the Tenderer may propose linking of labour rates to the UK retail price index).
- 14.4.6 The Tenderer will be required to supply monthly maintenance reports detailing:
- Routine maintenance carried out measured against declared targets;
  - Non-routine maintenance due to vandalism, accident, instruction by the Authority or similar;
  - Costs of replacement parts and equipment due to vandalism, accident, instruction by the Authority or similar;
  - Non-routine maintenance due to equipment failure or malfunction; and
  - Costs of replacement parts and equipment due to equipment failure or malfunction.

## 14.5 WARRANTY / MAINTENANCE PERIOD

- 14.5.1 Equipment shall be taken into concurrent warranty / maintenance after passing Site Acceptance Testing. First year maintenance costs should be zero or a small proportion of the typical annual charge to reflect ongoing warranty periods. The Tenderer shall be responsible for the administration of this procedure. Accurate records of commissioning dates will be stored in a spreadsheet. Copies will be retained by the Tenderer and Purchaser.
- 14.5.2 The maintenance contract will be signed following the take over of the system by the purchaser and its partners.
- 14.5.3 All equipment shall be provided with a unique serial number that shall be recorded in a master records index. Copies of this index shall be provided to the Operators fault controllers at regular intervals.



## 15 Software support & system upgrades

### 15.1 SOFTWARE LICENCES

- 15.1.1 The Tenderer shall supply appropriate and sufficient software licences with the system to allow the bus operator to operate it fully and deploy it as stated in this Specification. A schedule should be appended to the Bill of Quantities identifying each software module and the basis upon which it is licensed (by system, server, workstation, depot, vehicle or other as appropriate). Any re-occurring software licence costs shall be clearly stated and detailed.
- 15.1.2 Copies of all system software shall be provided at least one location (to be nominated by the Purchaser) to allow re-installation following a major failure of the system or any of its associated applications. The Tenderer is to advise the minimum number of copies that should be held under full roll out conditions
- 15.1.3 All Tenderers must either provide source code to the Purchaser or lodge the aforementioned source code in ESCROW, the cost of such lodging to be included in the Tender price..

#### Updates and support

- 15.1.4 Not less than annually, the Tenderer shall supply and install the most recent version of operating software throughout the system. The costs for this are to be included within the maintenance costs mentioned above. All software changes arising as a result of Government legislation must be included within the annual support charge at no extra cost.
- 15.1.5 It is imperative that any changes to software to reflect such developments are tested fully, prior to roll out. This testing must be undertaken in a way which does not compromise the operation of any of our operations and as such a dedicated "test bed" environment, separate from any operating company installations, will be required. This will need to include links to the central server to prove that changes do not compromise the communications and visibility of data.
- 15.1.6 Minor changes and 'fixes or patches' arising from the quarterly progress meetings are to be instigated immediately and without charge.
- 15.1.7 In the event of total system failure, it is required that software support be provided on site within 6 hours of fault report.
- 15.1.8 The Tenderer shall supply all telecommunications equipment necessary to allow remote access for diagnostic and maintenance purposes.



15.1.9 All software should be developed in accordance with recognised Quality Assurance standards and the standards used should be stated.

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## Appendix A - Bill of Quantities

Note the requirement at the bottom of the Bill of Quantities to provide information about pricing points for smaller quantities of equipment, in particular signs and on-board units.

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Enter company name in header

No.	Item	Unit	Phase 1 quantity	Ultimate system quantity	Software licence type	Unit cost (£)	Phase 1 Total cost (£)	To be carried forward to Phase 1 cost?	To be carried forward to ultimate cost?	Total cost to carry forward for Phase 1	Total cost carried forward for ultimate system	First and second line maintenance per annum (%)	Second line (only) maintenance per annum (%)	Recurring charges including software support for Phase 1	Recurring charges including software support for ultimate system
<b>A</b>	<b>SYSTEM HARDWARE &amp; SOFTWARE</b> <i>All supply and installation items below include all necessary fixtures, fittings, cabling and connections and software installation.</i>														
	<b>Core system software</b>														
A1	Supply and installation of core system software to support Phase 1 requirements on server farm (including hosting fees). <i>State capacity of this system configuration in terms of number of operators, signs, vehicles etc supported etc.</i>	Item	1	1				Yes	Yes						
A2	Additional cost of expanding in-station to support ultimate system requirements.	Item	0	1				Yes	Yes						
	<b>Workstations</b>														
A3a	Supply and installation of voice capable remote workstation including software functionality as specified, but <b>excluding</b> software costs	Number	5	8				Yes	Yes						
A3b	Supply and installation of remote workstation including software functionality as specified, but <b>excluding</b> software costs (no voice)	Number	10	30				Yes	Yes						
A3c	Supply and installation of other remote workstation (if required) including software functionality as specified, but <b>excluding</b> software costs (Tenderer to describe)	Number	0	0				Yes	Yes						
	<b>Other hosted servers (as required)</b>														
A4	Supply and installation of core system server hardware and firewalls (excluding web site functionality) to manage information dissemination to signs, web and 3 <sup>rd</sup> party systems		1	1											
A5	WWW server (if required)	Item	1	1											
A6	WAP server (if required)	Item	1	1											
A7	IVR server (if required)	Item	0	1											
A8	GPRS gateway/server (if required)	Item	1	1											
A9	PBR gateway (if required)	Item	1	1											
	<b>Workstation Software</b>														
A10	Supply and installation of Batch Time Server interface software to any suitable Workstation	Number	3	3				Yes	Yes						
A11	Supply and installation of Dispatcher Voice communications software to any suitable Workstation	Number	5	8				Yes	Yes						
A12	Supply and installation of Dispatcher Fleet management software to any suitable Workstation	Number	5	8				Yes	Yes						
A13	Supply and installation of RTPi sign management software to any suitable Workstation	Number	7	15				Yes	Yes						
A14	Supply and installation of "Window" on AVL / RTPi operations software to any suitable Workstation	Number	11	19				Yes	Yes						
A15	Supply and installation of Depot Data upload / download software to any suitable Workstation	Number	3	20				Yes	Yes						
A16	Supply and installation of Statistics Analysis software to any suitable Workstation	Number	3	12				Yes	Yes						
A17	Supply and installation of Maintenance analysis software to any suitable Workstation	Number	3	5				Yes	Yes						
	<b>Web Site</b>														
A18	Supply and installation of Suppliers' standard web offering	Item	1	1				Yes	Yes						
A19	Supply and installation of customised version of Suppliers' web offering to meet SEStran functionality	Item	1	1				Yes	Yes						
A20	150 man hours of specialist systems support and liaison with 3 <sup>rd</sup> web site developer	Item	1	1				Yes	Yes						
A21	Web site API	Item	1	1											
A22	Smart phone API	Item	1	1											
	<b>3<sup>rd</sup> Party System Interfaces</b>														
A23	SIRI output interface to Tandata systems	Item	1	2				Yes	Yes						
A24	SIRI output interface to Nexus Alpha systems	Item	0	1				Yes	Yes						
A25	SIRI interface to send data to and receive data from BusTracker	Item	1	1				Yes	Yes						
A26	SIRI interface to send data to and receive data from other 3rd party real-time passenger information systems	Item	0	7				No	No	Not carried forward	Not carried forward				
A27	TransXchange interface to bus operator scheduling system or SEStran bus service registration system	Item	2	4				Yes	Yes						
	<b>Data Collection</b>														
A28	Test Route data collection - 3 routes, 50 stops per route	Item	1	1				Yes	Yes						
A29	Test Route data integrity check	Item	1	1				Yes	Yes						
A30	Test route data entry	Item	1	1				Yes	Yes						
A31	Extended data collection exercise (Provisional)	Per 100 stops	1	1				No	No	Not carried forward	Not carried forward				
A32	Extended data entry (Provisional)	Per 100 stops	1	1				No	No	Not carried forward	Not carried forward				
	<b>Additional items</b>														
A33	Tenderers to detail any further items as necessary		0	0				Yes	Yes						
A34	Tenderers to detail any further items as necessary		0	0				Yes	Yes						
A35	Tenderers to detail any further items as necessary		0	0				Yes	Yes						
	<b>TOTAL CARRIED FORWARD (A)</b>									£0.00	£0.00				

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No.	Item	Unit	Phase 1 quantity	Ultimate system quantity	Software licence type	Unit cost (£)	Phase 1 Total cost (£)	To be carried forward to Phase 1 cost?	To be carried forward to ultimate cost?	Total cost to carry forward for Phase 1	Total cost carried forward for ultimate system	First and second line maintenance per annum (%)	Second line (only) maintenance per annum (%)	Recurring charges including software support for Phase 1	Recurring charges including software support for ultimate system
<b>B</b>	<b>ON – BUS SYSTEM</b>														
	<i>Note: 'Supply and installation' items include all necessary fixtures, fittings, cabling and connections, factory acceptance tests</i>														
B1	Supply and installation of fully functional On-Bus Units with hybrid MPT 1327 / GPRS capability - including system software, differential GPS, schedule database, all necessary peripheral switches, connections, cables etc. Includes necessary input / output ports for optional on-bus facilities detailed below.	Number	140	1000				Yes	Yes						
B2	Supply and installation of dashboard mounted driver display / RTIS interface unit	Number	140	1000				Yes	Yes						
B3	Supply and installation of log-on Interface to ticket machine facility including all software modifications, cabling and fittings	Number	140	1000				Yes	Yes						
B4	Supply and installation of WLAN transceiver for depot upload/downloads of data	Number	140	1000				Yes	Yes						
B5	Supply and installation of facility to drive existing electronic bus destination boards including all cabling and fittings, hardware / software modifications to the OBU or 3 <sup>rd</sup> party equipment.	Number	140	1000				Yes	Yes						
B6	Supply and installation of low power radio hardware to communicate with traffic signal installation bus priority units including all cabling and fittings (if required)	Number	140	1000				Yes	Yes						
B7	Supply and installation of on-bus audio announcement capability (assuming use of existing on-bus speakers)	Number	0	1000				Yes	Yes						
B8	Supply and installation of driver "security alert" button	Number	140	1000				Yes	Yes						
B9	Supply an installation of MPT1327 voice and data radio	Number	0	1000				Yes	Yes						
B10	Supply and installation of MPT1327 data only radio	Number	0	1000				No	No	Not carried forward	Not carried forward				
B11	Supply and installation of GPRS modem within items B1, B9 or B10 (to suit suppliers system design)	Number	0	1000				Yes	Yes						
	<b>Additional items</b>														
B9	Tenderers to detail any further items as necessary		0	0				Yes	Yes						
B10	Tenderers to detail any further items as necessary		0	0				Yes	Yes						
B11	Tenderers to detail any further items as necessary		0	0				Yes	Yes						
	<b>TOTAL CARRIED FORWARD (B)</b>									<b>£0.00</b>	<b>£0.00</b>				

<b>Alternative OBU Proposal Costs</b>															
	Tenderers should enter relevant costs for the OBU options they can provide and support. The levels of functionality are outlined in paragraph 2.12.4. Tenderers do not have to make an offering in every category.														
B12	<b>Hybrid MPT 1327 / GPRS Data only OBU</b> Fully functional OBU First Bus PBR stands alone and alongside	Number	0	500				No	No	Not carried forward	Not carried forward				
B13	<b>MPT 1327 Voice and Data OBU</b> Fully functional OBU No GPRS capability	Number	0	500				No	No	Not carried forward	Not carried forward				
B14	<b>MPT 1327 Data only OBU</b> Fully functional OBU No GPRS capability	Number	0	500				No	No	Not carried forward	Not carried forward				
B15	<b>GPRS Voice and Data OBU</b> Fully functional OBU Voice calls established from centre not vehicle	Number	0	500				No	No	Not carried forward	Not carried forward				
B16	<b>GPRS Data only OBU</b> Fully functional OBU	Number	0	500				No	No	Not carried forward	Not carried forward				
B17	<b>ERG GPRS enabled ticket machine as OBU for Stagecoach vehicles</b> Reduced functionality	Number	0	500				No	No	Not carried forward	Not carried forward				
										<b>£0.00</b>	<b>£0.00</b>				

Signed:

No.	Item	Unit	Phase 1 quantity	Ultimate system quantity	Software licence type	Unit cost (£)	Phase 1 Total cost (£)	To be carried forward to Phase 1 cost?	To be carried forward to ultimate cost?	Total cost to carry forward for Phase 1	Total cost carried forward for ultimate system	First and second line maintenance per annum (%)	Second line (only) maintenance per annum (%)	Recurring charges including software support for Phase 1	Recurring charges including software support for ultimate system
<b>C</b>	<b>REAL -TIME INFORMATION SIGNS</b>														
	<i>Supply and installation of signs includes the appropriate RTIS &amp; communications hardware/software for the defined application, all cabling, connections, fixings, poles (including installation and reinstatement), factory acceptance tests, site acceptance tests and commissioning.</i>														
	<b>Bus Stop Signs: shelter mounted</b>														
	<b>LED bus stop displays</b>														
C1	2 line 30 character single sided	Number	0	0				Yes	Yes						
C2	3 line 30 character single sided	Number	28	100				Yes	Yes						
C3	4 line 30 character single sided	Number	0	0				Yes	Yes						
C4	2 line 30 character double sided	Number	0	0				Yes	Yes						
C5	3 line 30 character double sided	Number	0	0				Yes	Yes						
C6	4 line 30 character double sided	Number	0	0				Yes	Yes						
	<b>LCD bus stop displays</b>														
C3	3 line, Single sided	Number	0	0				Yes	Yes						
C4	3 line, Double sided	Number	0	0				Yes	Yes						
C5	5 line, Double sided	Number	0	0				Yes	Yes						
	<b>Interchange signs – TFT</b>														
C6	20" screen	Number	0	20				Yes	Yes						
C7	32" screen	Number	0	20				Yes	Yes						
C8	46" screen	Number	0	10				Yes	Yes						
	<b>Interchange LED Signs</b>														
C9	3 line 45 character	Number	0	0				Yes	Yes						
C10	10 line 30 character	Number	0	0				Yes	Yes						
C11	16 line 60 character	Number	0	0				Yes	Yes						
C12	18 line 45 character	Number	0	0				Yes	Yes						
C13	18 line 60 character	Number	0	0				Yes	Yes						
C14	30 line 60 character	Number	0	0				Yes	Yes						
	<b>Additional sign functionality</b>														
C15	24 hr clock facility within any LED interchange sign	Number	0	25				Yes	Yes						
C16	Addition of synthesised text to speech audio announcement to any sign	Number	10	30				Yes	Yes						
C17	Addition of RNIB REACT key fob facility to trigger audio announcements at any sign.	Number	10	30				Yes	Yes						
C18	Addition of Scottish National Entitlement Card (ITSO) smart card reader to trigger key fob facility to trigger audio announcements at any sign.	Number	10	30				Yes	Yes						
	<b>Auxiliary items</b>														
C19	Charge to release RTP1 communications protocols to 3 <sup>rd</sup> party suppliers. Interface is then 3 <sup>rd</sup> party responsibility.	Item	1	1				Yes	Yes						
C20	Alternative to C18 - Technical staff support to develop interfaces to new 3 <sup>rd</sup> party sign types. (Suppliers' responsibility)	Item	1	1				No	No	Not carried forward	Not carried forward				
C21	Hardware necessary for third party sign supplier (per sign)	Number	30	30				Yes	Yes						
C22	Software for third party sign supplier (per sign)	Number	30	30				Yes	Yes						
C23	Any Other modifications necessary for third party sign supply (tenderer to describe)	Item	1	1				Yes	Yes						
C24	<b>Supplier's Alternative Sign Proposals</b>														
C25	<i>Tenderers are invited to offer a fully costed range of additional sign facilities including</i>														
C26	Flag pole mounted display options	Number	0	0				No	No	Not carried forward	Not carried forward				
C27	Low power displays	Number	70	450				No	No	Not carried forward	Not carried forward				
C28	Others as appropriate	Number	0	0				No	No	Not carried forward	Not carried forward				
	<b>Additional items</b>														
C29	<i>Tenderers to detail any further items as necessary</i>		0	0				Yes	Yes						
C30	<i>Tenderers to detail any further items as necessary</i>		0	0				Yes	Yes						
C31	<i>Tenderers to detail any further items as necessary</i>		0	0				Yes	Yes						
	<b>TOTAL CARRIED FORWARD (C)</b>														
			98	600						£0.00	£0.00				

<b>D</b>	<b>BUS PRIORITY</b>														
D1	Supply and installation of bus priority items includes: all cabling; connections; fittings; wiring of outputs to controller terminal blocks within controller cabinet; factory acceptance tests; site acceptance tests and commissioning.	No	1	150				Yes	Yes						
D2	Supply and installation of radio receiver and associated antenna	No.	1	150				Yes	Yes						
	<b>Additional items</b>														
D3	<i>Tenderers to detail any further items as necessary</i>		0	0				Yes	Yes						
D4	<i>Tenderers to detail any further items as necessary</i>		0	0				Yes	Yes						
D5	<i>Tenderers to detail any further items as necessary</i>		0	0				Yes	Yes						
	<b>TOTAL CARRIED FORWARD (D)</b>														
										£0.00	£0.00				

No.	Item	Unit	Phase 1 quantity	Ultimate system quantity	Software licence type	Unit cost (£)	Phase 1 Total cost (£)	To be carried forward to Phase 1 cost?	To be carried forward to ultimate cost?	Total cost to carry forward for Phase 1	Total cost carried forward for ultimate system	First and second line maintenance per annum (%)	Second line (only) maintenance per annum (%)	Recurring charges including software support for Phase 1	Recurring charges including software support for ultimate system
<b>E</b>	<b>COMMUNICATIONS</b>														
	<i>The aspirations of the various stakeholders may ultimately require a range of communications strategies. Tenderers must cost the options outlined in the specification providing supporting information on buses / signs per channel and GPRS data volumes where appropriate. All assessment and design costs are to be included.</i>														
	<b>Option 1 – Hybrid MPT 1327 / GPRS comms with fully functional OBU</b>														
E1	Design work	Item						Yes	Yes						
E2	MPT 1327 control node	Number						Yes	Yes						
E3	MPT 1327 base stations	Number						Yes	Yes						
E4	MPT 1327 data channels	Number						Yes	Yes						
E5	MPT 1327 Voice channels	Number						Yes	Yes						
E6	Microwave links	Number						Yes	Yes						
E7	Leased line communications set up (including links to server farm, base stations and stakeholder workstations)	Item						Yes	Yes						
E8	Base Station Site Share set up costs	Item						Yes	Yes						
E9	Server Farm – service set up costs	Item						Yes	Yes						
E10	OFCOM licence procurement costs	Item						Yes	Yes						
E11	GPRS gateway	Item						Yes	Yes						
E12	GPRS leased line connection to cellular network provider set up costs	Item						Yes	Yes						
E13	SIM Costs – included in on-bus /sign hardware	Item						Yes	Yes						
E14	15 year leased line costs (MPT)	Item						Yes	Yes						
E15	15 year site share costs	Item						Yes	Yes						
E16	15 year server farm support service costs	Item						Yes	Yes						
E17	15 year Occam licence costs	Item						Yes	Yes						
E18	15 year leased line cost to cellular network	Item						Yes	Yes						
E19	15 year standing charge for SIMS	Item						Yes	Yes						
E20	15 year GPRS data costs for GPRS managed signs	Item						Yes	Yes						
E21	15 year data costs for GPRS buses	Item						Yes	Yes						
E22	Any Other annual costs (excluding Supplier Maintenance costs)	Item						Yes	Yes						
	<b>Option 1 Sub Total</b>										£0.00				
	<b>OPTION 2 – the following options 2A to 2D assess the implications of managing the Stagecoach fleet exclusively on GPRS</b>														
	<b>Option 2A – ERG Ticket machine</b>							No	No	Not carried forward	Not carried forward				
	AVL / RTP1 driven solely by the electronic ticket machine utilising GPRS communications with no other on-bus links														
E23	Design work	Item						No	No	Not carried forward	Not carried forward				
E24	GPRS gateway	Number						No	No	Not carried forward	Not carried forward				
E25	GPRS leased line connection to cellular network provider set up costs	Number						No	No	Not carried forward	Not carried forward				
E26	SIM Costs – included in on-bus /sign hardware	Number						No	No	Not carried forward	Not carried forward				
E27	15 year leased line cost to cellular network	Number						No	No	Not carried forward	Not carried forward				
E28	15 year standing charge for SIMS	Number						No	No	Not carried forward	Not carried forward				
E29	15 year data costs for GPRS buses operating at functionality A	Number						No	No	Not carried forward	Not carried forward				
	Other costs	Item						No	No	Not carried forward	Not carried forward				
	<b>Sub Total 4A</b>										£0.00		£0.00		
	<b>Option 2B – ERG Ticket machine based linked to OBU</b>							No	No	Not carried forward	Not carried forward				
	AVL / RTP1 using the supplier's OBU linked to an existing ticket machine. The supplier's OBU relays information one-way to the centre but it provides no operational information to the driver. It does not require or receive network data downloads in the depot or over the air.														
E30	Design work	Item						No	No	Not carried forward	Not carried forward				
E31	GPRS gateway	Number						No	No	Not carried forward	Not carried forward				
E32	GPRS leased line connection to cellular network provider set up costs	Number						No	No	Not carried forward	Not carried forward				
E33	SIM Costs – included in on-bus /sign hardware	Number						No	No	Not carried forward	Not carried forward				
E34	15 year leased line cost to cellular network	Number						No	No	Not carried forward	Not carried forward				
E35	15 year standing charge for SIMS	Number						No	No	Not carried forward	Not carried forward				
E36	15 year data costs for GPRS buses operating at functionality B	Number						No	No	Not carried forward	Not carried forward				
	Other Costs	Item						No	No	Not carried forward	Not carried forward				
	<b>Sub Total 4B</b>										£0.00		£0.00		

Enter company name in header

No.	Item	Unit	Phase 1 quantity	Ultimate system quantity	Software licence type	Unit cost (£)	Phase 1 Total cost (£)	To be carried forward to Phase 1 cost?	To be carried forward to ultimate cost?	Total cost to carry forward for Phase 1	Total cost carried forward for ultimate system	First and second line maintenance per annum (%)	Second line (only) maintenance per annum (%)	Recurring charges including software support for Phase 1	Recurring charges including software support for ultimate system
<b>Option 2C – ERG Ticket machine based linked to OBU</b>															
AVL / RTPI using the supplier's OBU linked to an existing ticket machine. The supplier's OBU relays information to the centre and receives driver updates over the air, displayed on a bespoke driver display or on an existing ticket machine screen. It does not require or receive network data downloads in the depot or over the air.															
E37	Design work	Item						No	No	Not carried forward	Not carried forward				
E38	GPRS gateway	Number						No	No	Not carried forward	Not carried forward				
E39	GPRS leased line connection to cellular network provider set up costs	Number						No	No	Not carried forward	Not carried forward				
E40	SIM Costs – included in on-bus /sign hardware	Number						No	No	Not carried forward	Not carried forward				
E41	15 year leased line cost to cellular network	Number						No	No	Not carried forward	Not carried forward				
E42	15 year standing charge for SIMS	Number						No	No	Not carried forward	Not carried forward				
E43	15 year data costs for GPRS buses operating at functionality C	Number						No	No	Not carried forward	Not carried forward				
E44	Other Costs	Item													
<b>Sub Total 4C</b>										<b>£0.00</b>	<b>£0.00</b>				
<b>Option 2D – ERG Ticket machine based linked to OBU</b>															
OBU holding full network details linked to an existing ticket machine. 2-way communications with the centre, receiving updates relating to diversions and network changes etc. Capable of supporting a display unit in "autonomous mode".															
E45	Design work	Item						No	No	Not carried forward	Not carried forward				
E46	GPRS gateway	Number						No	No	Not carried forward	Not carried forward				
E47	GPRS leased line connection to cellular network provider set up costs	Number						No	No	Not carried forward	Not carried forward				
E48	SIM Costs – included in on-bus /sign hardware	Number						No	No	Not carried forward	Not carried forward				
E49	15 year leased line cost to cellular network	Number						No	No	Not carried forward	Not carried forward				
E50	15 year standing charge for SIMS	Number						No	No	Not carried forward	Not carried forward				
E51	15 year data costs for GPRS buses operating at functionality D	Number						No	No	Not carried forward	Not carried forward				
E52	Other Costs	Item													
<b>Sub Total 4D</b>										<b>£0.00</b>	<b>£0.00</b>				
<i>Tenderers must highlight any capacity or administrative constraints on expansion.</i>															
<b>Additional items</b>															
E53	Tenderers to detail any further items as necessary		0	0				Yes							
E54	Tenderers to detail any further items as necessary		0	0				Yes							
E55	Tenderers to detail any further items as necessary		0	0				Yes							
<b>Sub total (additional items)</b>										<b>£0.00</b>	<b>£0.00</b>				
<b>TOTAL CARRIED FORWARD (E)</b>										<b>£0.00</b>	<b>£0.00</b>				

<b>F</b>	<b>WARRANTY AND MAINTENANCE</b>														
Stakeholders may opt to carry out first line maintenance															
F1a	Total annual first and second line maintenance per annum (sum of individual costs identified above)	Item	1	1				No	No	Not carried forward	Not carried forward				
F1b	60 months first and second line maintenance	Item	1	1				Yes	Yes						
F2	60 months parts and labour warranty / maintenance of system software and hardware for items not included in F1b above.	Item	1	1				Yes	Yes						
F3	By exception' fault monitoring and reporting software	Item	1	1				Yes	Yes						
F4	By exception' fault monitoring and reporting service managed by Tenderer for 60 months	Item	1	1				Yes	Yes						
F5	Optional 24/7 software helpdesk by telephone	Item	1	1				Yes	Yes						
F6	ESCROW of system software	Item	1	1				Yes	Yes						
<b>TOTAL CARRIED FORWARD (F)</b>										<b>£0.00</b>	<b>£0.00</b>				

Signed:

Enter company name in header

No.	Item	Unit	Phase 1 quantity	Ultimate system quantity	Software licence type	Unit cost (£)	Phase 1 Total cost (£)	To be carried forward to Phase 1 cost?	To be carried forward to ultimate cost?	Total cost to carry forward for Phase 1	Total cost carried forward for ultimate system	First and second line maintenance per annum (%)	Second line (only) maintenance per annum (%)	Recurring charges including software support for Phase 1	Recurring charges including software support for ultimate system
<b>G</b>	<b>PROJECT MANAGEMENT AND TRAINING</b>														
	<i>Suppliers should provide a breakdown of project management costs reflecting the key phases of the system design and installation, testing and commissioning.</i>														
G1	Project Management costs (Tenderer to make an estimate for ultimate project)	Item	1	1				Yes	No		Not carried forward				
G2	Phase 1 Joint Design Exercise Part 1 total (including travel and subsistence)	Item	1	1				Yes	Yes						
G3	Phase 1 Joint Design Exercise Part 2 - production of specifications	Item	1	1				Yes	Yes						
G4	Phase 1 Joint Design Exercise Part 2 - one day meeting in Edinburgh including travel and subsistence	Number	To be agreed - enter cost for <b>one</b> meeting					No	No	Not carried forward	Not carried forward				
G5	Phase 1 Joint Design Exercise Part 2 - three day meeting in Edinburgh including travel and subsistence	Number	To be agreed - enter cost for <b>one</b> meeting					No	No	Not carried forward	Not carried forward				
G6	Phase 1 Joint Design Exercise Part 2 - five day meeting in Edinburgh including travel and subsistence	Number	To be agreed - enter cost for <b>one</b> meeting					No	No	Not carried forward	Not carried forward				
G7	Phase 1 Joint Design Exercise Part 2 Meeting using video conference	Number	To be agreed - enter cost for <b>one</b> meeting					No	No	Not carried forward	Not carried forward				
G8	Project Team Meeting attendance in Edinburgh	Number	18	50				Yes	Yes						
G9	Project Team Meeting by video conference	Number	18	50				Yes	Yes						
G9	System and software development costs (excluding writing of specifications included in Joint Design Exercise Part 2) <i>(Please provide as much detail as possible)</i>	Item	1	1				Yes	Yes						
G10	Further expenses and disbursements in relation to Project Management	Item	1	1				Yes	Yes						
G11	Training Support Package - suppliers should provide a detailed breakdown of training proposals and costs separately	Item	1	1				Yes	Yes						
G12	Training Costs - Phase 1	Item	1	1				Yes	Yes						
G13	Documentation Costs - Phase 1	Item	1	1				Yes	Yes						
G14	Training Costs - further phases		0	1				Yes	Yes						
G15	Documentation Costs - further phases		0	1				Yes	Yes						
	<b>Additional items</b>														
G16	<i>Tenderers to detail any further items as necessary</i>							Yes	Yes						
G17	<i>Tenderers to detail any further items as necessary</i>							Yes	Yes						
G18	<i>Tenderers to detail any further items as necessary</i>							Yes	Yes						
	<b>TOTAL CARRIED FORWARD (G)</b>									<b>£0.00</b>	<b>£0.00</b>				

SECTION	Phase 1		Ultimate	
	TOTALS CARRIED FORWARD	CARRIED FORWARD	TOTALS CARRIED FORWARD	CARRIED FORWARD
A SYSTEM HARDWARE AND SOFTWARE		£0.00	£0.00	£0.00
B ON - BUS SYSTEM		£0.00	£0.00	£0.00
C REAL -TIME INFORMATION SIGNS.		£0.00	£0.00	£0.00
D BUS PRIORITY		£0.00	£0.00	£0.00
E COMMUNICATIONS		£0.00	£0.00	£0.00
F WARRANTY AND MAINTENANCE		£0.00	£0.00	£0.00
G PROJECT MANAGEMENT		£0.00	£0.00	£0.00
<b>GRAND TOTAL</b>		<b>£0.00</b>	<b>£0.00</b>	<b>£0.00</b>

SMALL ORDERS		Quantity in tender	Lesser quantities (Percent multiplier)					Tenderers should amend percentage in <b>RED</b> as necessary
On-board units	500	250	100%	100%	100%	100%	100%	
Real-time passenger information signs	100	50	100%	100%	100%	100%	100%	

Signed:

## Appendix B - Vehicle fleets

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First in Edinburgh

Count of Body_Type	Body_Type																	Grand Total
Chassis_Ty	Alexander	Alexander Royale	East Lancs Omnidekker	Marshall	Optare Prisma	Plaxton Pointer	Plaxton Profile	Wright Access - Ultralow	Wright Eclipse Gemini	Wrights	Wrights Access Ultralow	Wrights Eclipse Gemini	Wrights Endurance	Wrights Pathfinder	Wrights Solar	Wrights Solar	(blank)	Grand Total
Dennis Dart SLF				1		30												31
Mercedes 0405					10													10
Scania L113CRL											7							7
Scania L94								8		1					15	1		25
Scania N113CRB													2					2
Scania N113CRL														2				2
Scania N94			24															24
Transbus Dart				3														3
Volvo B7R							5											5
Volvo B10M																		
Volvo B10M Citybus	5																	5
Volvo B7TL									15									15
Volvo B9TL												10						10
Volvo Olympian	12	34																46
Grand Total	17	34	24	4	10	30	5	8	15	1	7	10	2	2	15	1		185

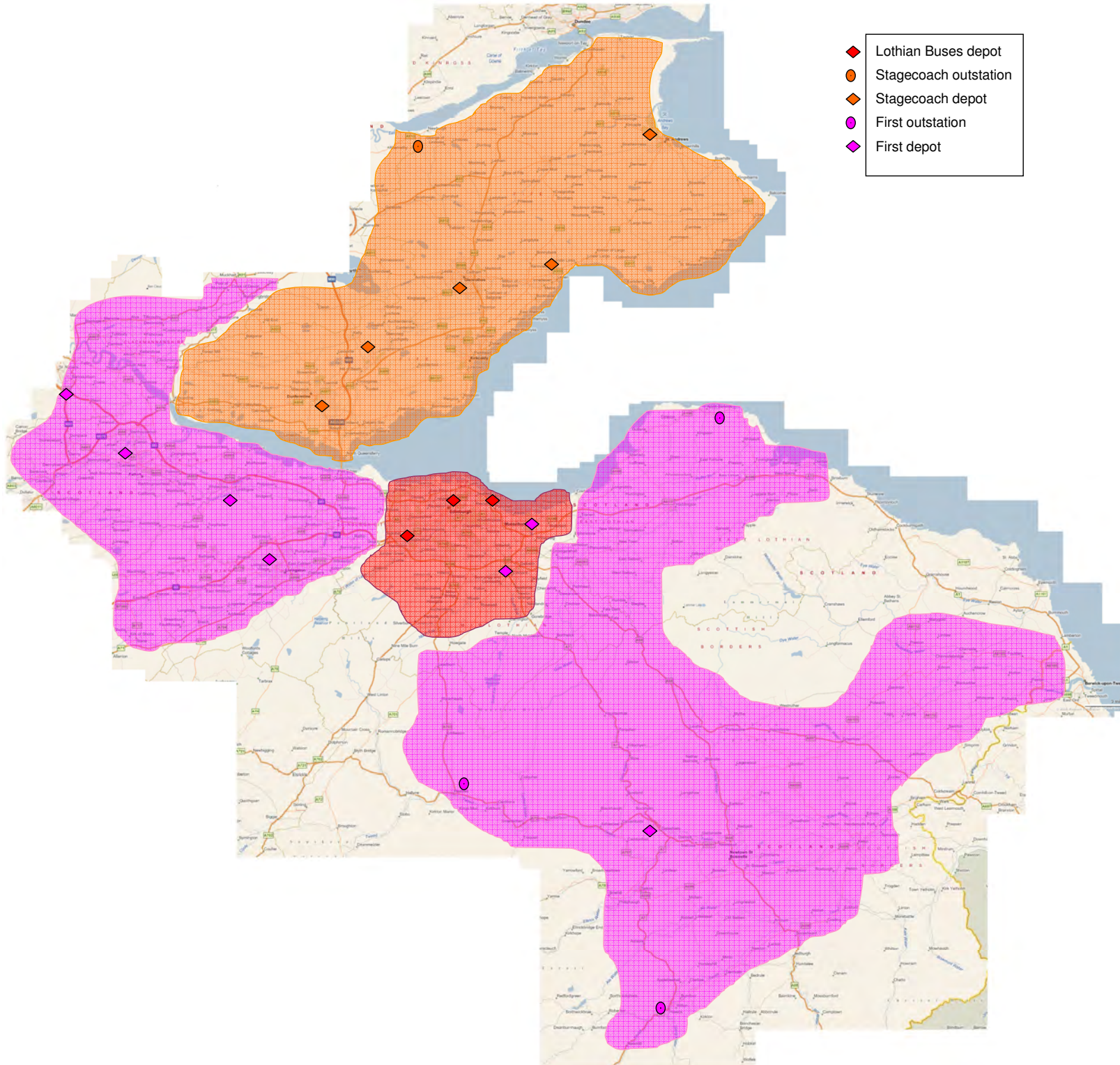


## Appendix C - Operational areas

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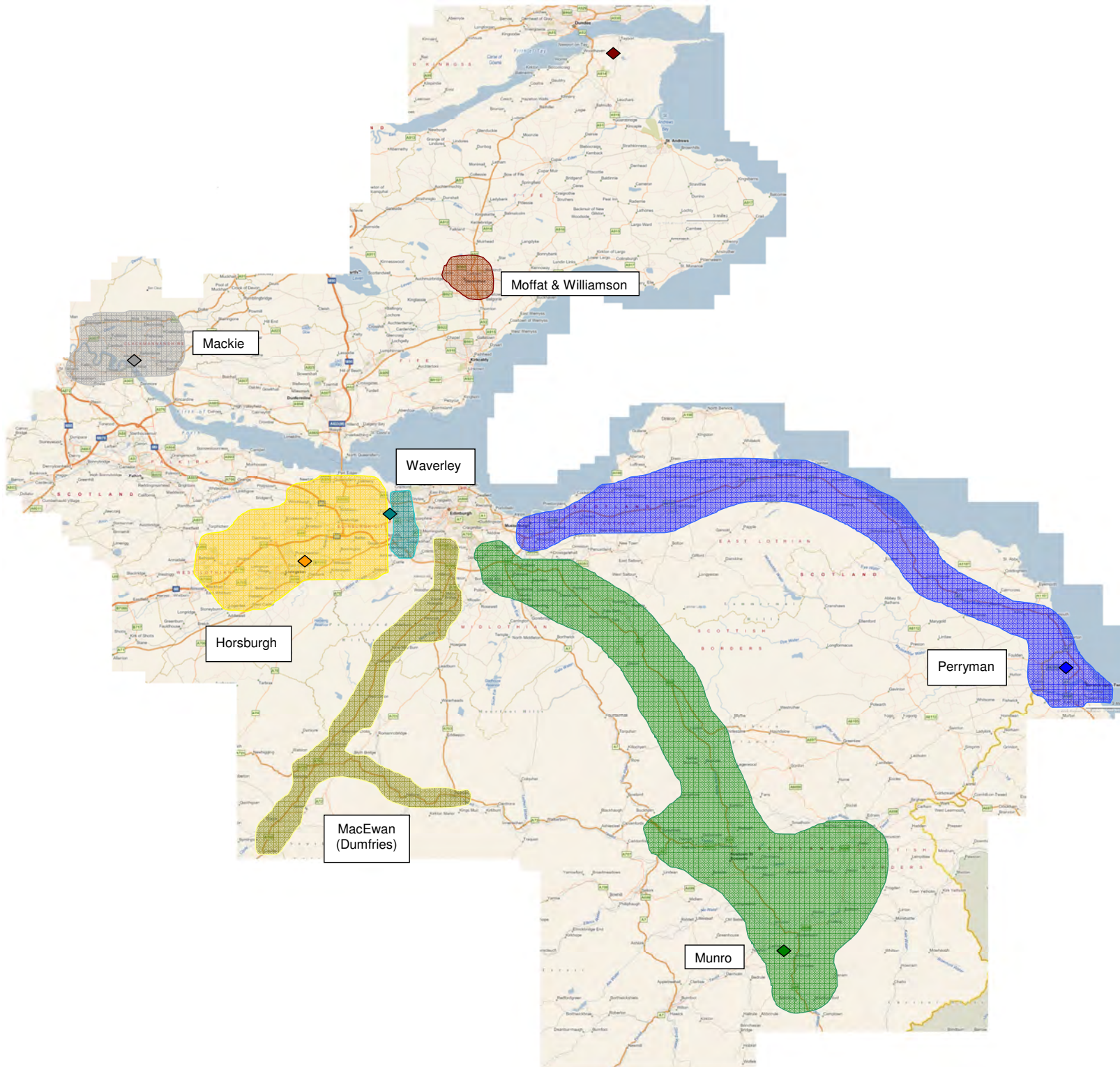
# Major Operators

- ◆ Lothian Buses depot
- Stagecoach outstation
- ◇ Stagecoach depot
- First outstation
- ◆ First depot





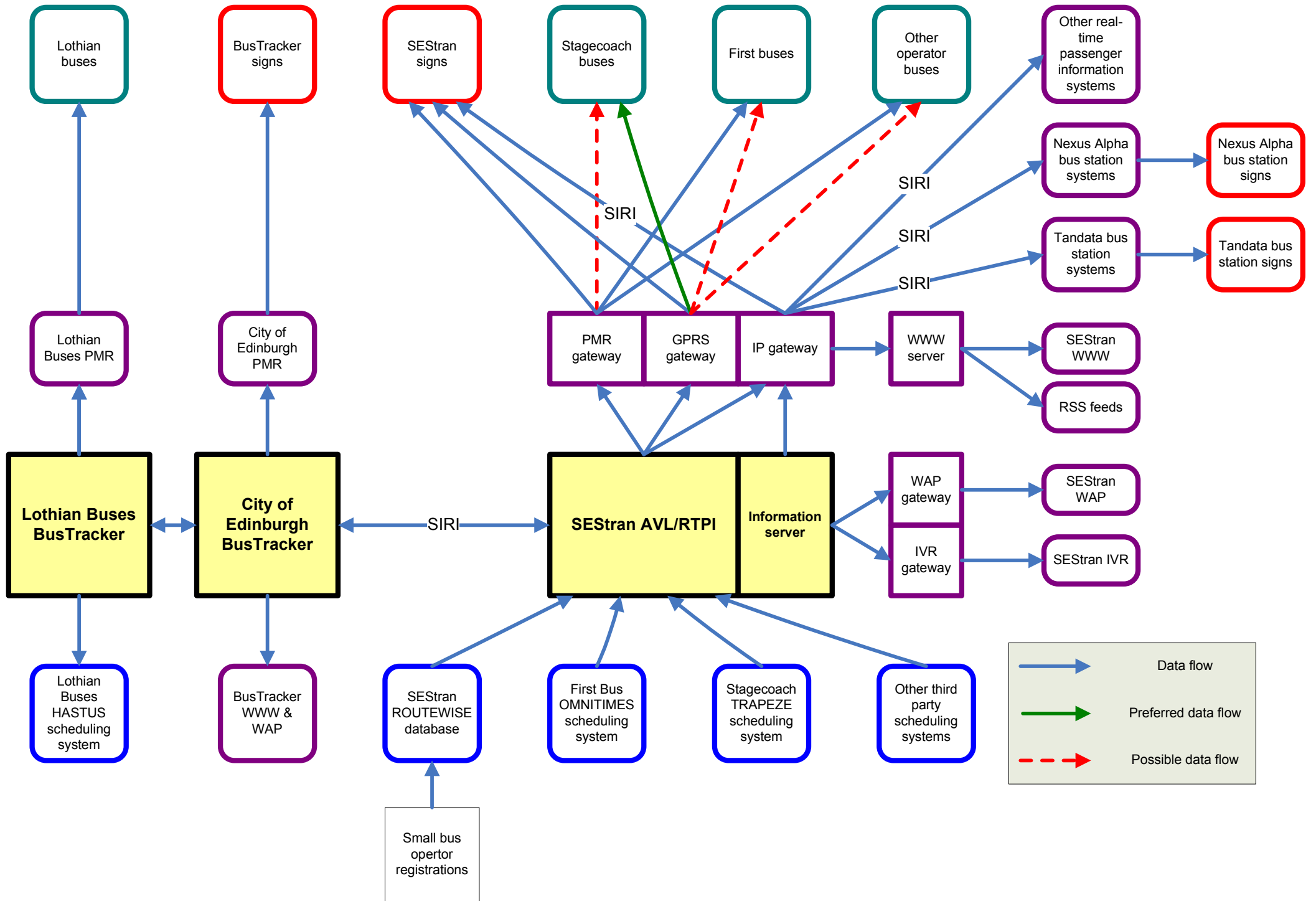
# Minor Operators



## Appendix D - System architecture

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## Appendix E - Workstation locations

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## Distribution of workstation functions

The functionality associated with workplace terminals or, or workstations, can vary considerably and can be tailored to suit individual business requirements. To ensure consistency within the tender document the following key functions have been identified:

- Batch time server interface – managing data upload to the batch-time server;
- Interface to third party scheduling software;
- Voice communications - to buses, roving terminals and, possibly, audio signs;
- Bus Operator Fleet Management Tools;
- RTPI Sign Management Tools;
- “Window” on bus and sign operations – without voice or management tools;
- Depot Data Upload / Download;
- Statistics Analysis; and
- Maintenance Analysis.

The following table indicates where key functions will be available for each stakeholder and the number of terminals required. An indicative system architecture is included in Appendix D. A map showing each stakeholder location is included in Appendix E. Note this map includes more operator terminals than are shown in the Bill of Quantities. Operator terminals for E&M Horsburgh are not included in the Bill of Quantities.

	Batch time server interface	Interface to third party scheduling software	Voice communications	Bus Operator Fleet Management	RTPI Sign Management Tools	Depot Data Upload / Download	Statistics Analysis	Maintenance Analysis	Window" on bus and sign operations (*1)
SEStran									
SES1	✓	✓			✓		✓	✓	✓
SES2					✓		✓	✓	✓
Local Authority Partners									
City of Edinburgh									
CEC1					✓		✓		✓
Fife									
FIF1					✓		✓		✓
Borders Council									
BOR1					✓		✓		✓
East Lothian									
ELO1					✓		✓		✓
Midlothian									
MID1					✓		✓		✓
West Lothian									
WLO1					✓		✓		✓
Falkirk									
FAL1					✓		✓		✓
Clackmannanshire									
CLA1					✓		✓		✓

	Batch time server interface	Interface to third party scheduling software	Voice communications	Bus Operator Fleet Management	RTPI Sign Management Tools	Depot Data Upload / Download	Statistics Analysis	Maintenance Analysis	Window" on bus and sign operations (*1)
First in Edinburgh									
First Regional Office, Tarbert									
FE-TAR1	✓	✓			✓		✓	✓	✓
FE-TAR2					✓		✓	✓	✓
First Linlithgow									
FE-LIN 1			✓	✓	✓				
FE-LIN 2						✓			
FE-LIN 3							✓	✓	✓
First Livingston									
FE-LIV1			✓	✓	✓				
FE-LIV2						✓			
FE-LIV3							✓	✓	✓
First Galalshiels									
FE-GAL1			✓	✓	✓				
FE-GAL2						✓			
FE-GAL3							✓	✓	✓
First Eskbank/Dalkeith									
FE-ESK1			✓	✓	✓				
FE-ESK2						✓			
FE-ESK3							✓	✓	✓

	Batch time server interface	Interface to third party scheduling software	Voice communications	Bus Operator Fleet Management	RTPI Sign Management Tools	Depot Data Upload / Download	Statistics Analysis	Maintenance Analysis	Window" on bus and sign operations (*1)
Stagecoach									
Stagecoach, Regional Office, Cowdenbeath									
STA-COW1	✓	✓					✓	✓	
STA-COW2							✓	✓	✓
Stagecoach Dunfermline									
STA-DUN1			✓	✓	✓				
STA-DUN2									✓
STA-DUN3						✓			
Stagecoach Glenrothes									
STA-GLE1			✓	✓	✓				
STA-GLE2									✓
STA-GLE3						✓			



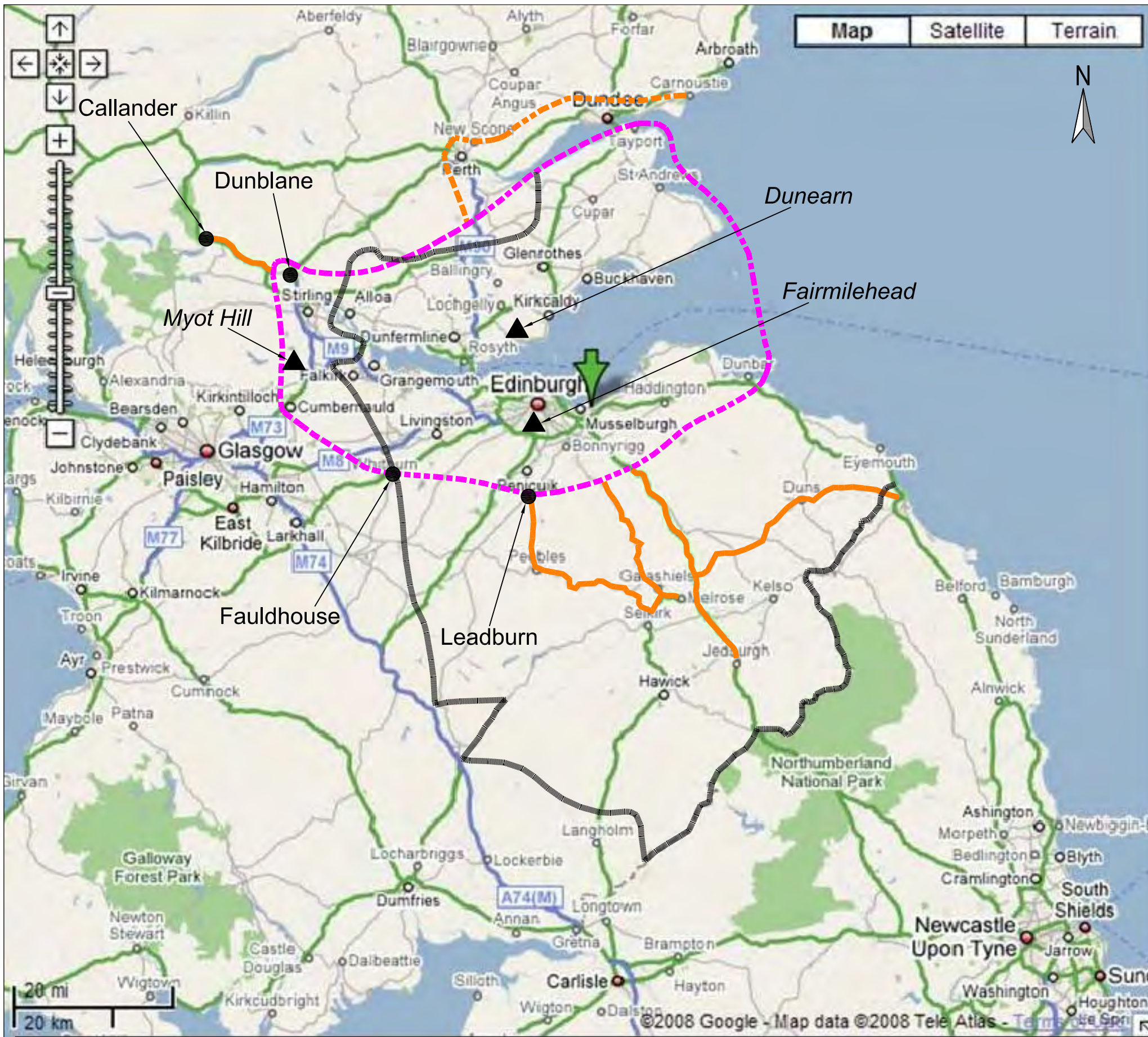
	Batch time server interface	Interface to third party scheduling software	Voice communications	Bus Operator Fleet Management	RTPI Sign Management Tools	Depot Data Upload / Download	Statistics Analysis	Maintenance Analysis	Window" on bus and sign operations (*1)
Small operators									
Munro's Jedburgh									
MUN-JED1			✓	✓	✓				
MUN-JED2									✓
MUN-JED3						✓			
E & M Horsburgh									
HOR-XXX1			✓	✓	✓				
HOR-XXX2									✓
HOR-XXX3						✓			
(provisional - not included in Bill of Quantities)									

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## Appendix F - First in Edinburgh radio details





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DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors

**KEY:**

-  Core MPT 1327 voice and data coverage area
-  Desirable MPT 1327 voice and data coverage area
-  Desirable MPT 1327 voice and data coverage of individual routes
-  SEStran boundary (approximate)

**Notes:**

1. Tenderers to propose a wireless communications solution to meet coverage requirements.
2. First Edinburgh would prefer an MPT 1327 solution across their entire operational area but appreciate this maybe uneconomic. (see Appendix C for Operational Area diagram)
3. MPT 1327 voice and data communications is required across the "core area" and is preferred in any areas or routes highlighted as 'Desirable'. Partial coverage of 'Desirable' areas or routes may be acceptable.
4. Tenderers to propose base station locations and provide coverage plots and assumptions for both MPT 1327 and GPRS communications.
5. Hybrid GPRS / MPT solutions will be considered outside of "core areas".
6. 'GPRS only' communications proposals may be submitted in addition to a MPT 1327 or hybrid MPT 1327 / GPRS option.
7. "Desirable Coverage" - Relative Importance. Dundee City and the routes between the 'core area' and Galashiels / Melrose are the most important "desirable" coverage areas.
8. The following First Bus base station sites may be utilised by the Tenderer, if appropriate:

-  Dunearn: OSGB Reference NT 213 874
-  Fairmilehead: OSGB Reference NT 249 686
-  Myot Hill: OSGB Reference NS 781 825

Dunearn and Fairmilehead have upgradeable MPT 1327 hardware. Myot Hill hardware is obsolete. All antennas are licenced at 15m.

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Executive Park  
Avalon Way  
Anstey  
Leicester  
LE7 7GR

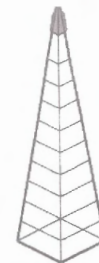
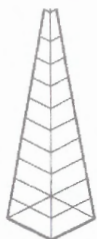
Tel: 0116 234 8000  
Fax: 0116 234 8001  
e-mail: leicester@wyg.com

**White  
Young  
Green**

**Consulting Engineers**  
Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project: SEStran AVL / RTPI		Client: SEStran	
Drawing Title: Communications Coverage Requirements		Scale: NTS	
Drawn By: CT	Date: 29/04/08	Checked By: RH	Date: 29/04/08
Approved By: MM	Date: 29/04/08	Project No.: E006915 - 63	Office: 35
Type: 01	Drawing No.: Appendix F	Revision: -	Approval: <input type="checkbox"/> APPROVAL <input checked="" type="checkbox"/> INFORMATION <input type="checkbox"/> TENDER <input type="checkbox"/> CONTRACT <input type="checkbox"/> CONSTRUCTION





### DUNEARN

Control Channel

Traffic Channel

Simoco  
TN10X  
Trunking Switch

Bus Data Channel

Microwave Link

4-wire Audio  
64K PCM

4-wire Audio

New 2Mb Multiplexer

Existing Microwave Link

Dunearn

### FAIRMILEHEAD

Control Channel

Traffic Channel

Microwave Link

4-wire Audio  
64K PCM

Bus Data Channel

Fibre Interface

2Mb Coaxial cable link

Existing Microwave Link

Annandale Street

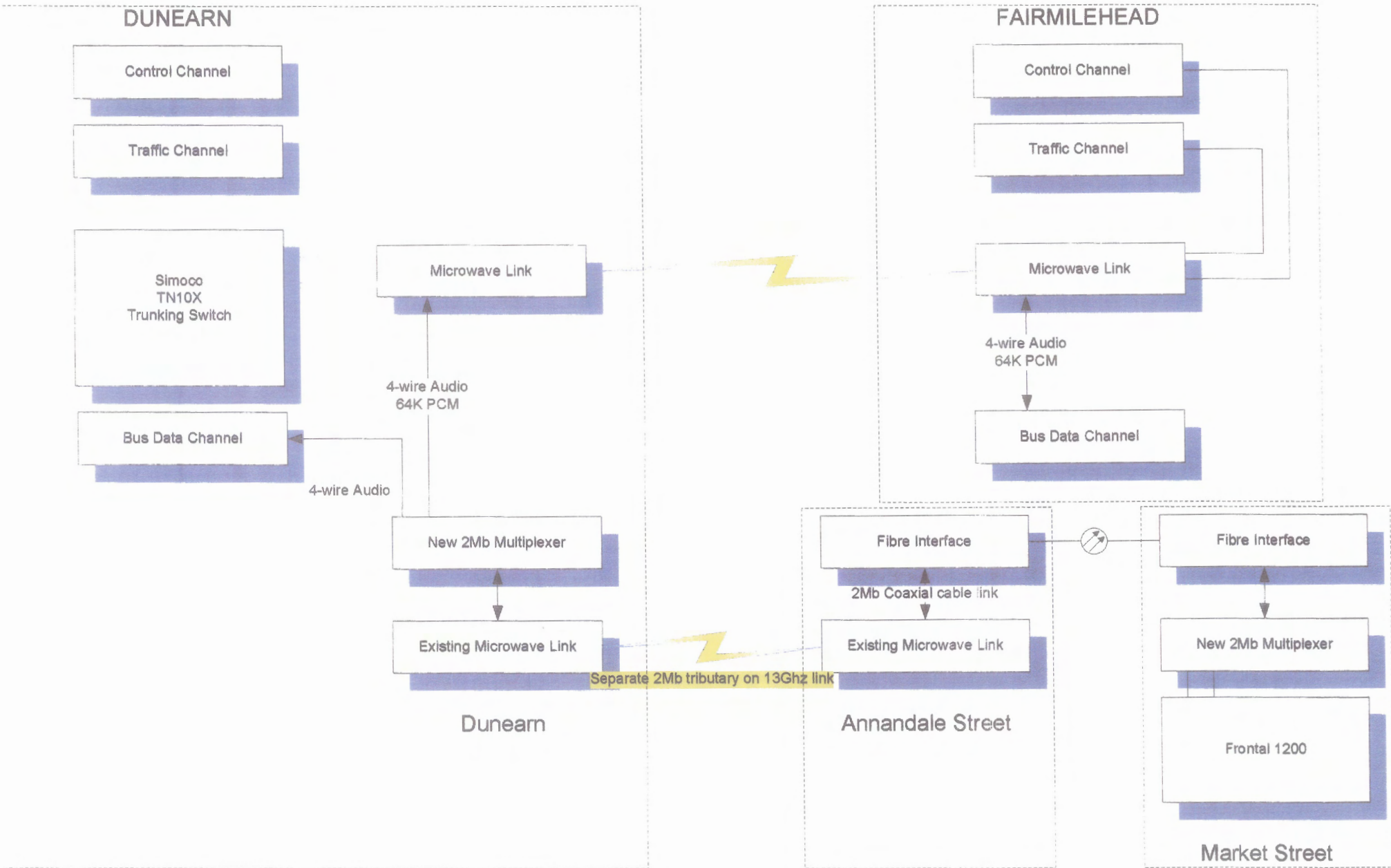
Fibre Interface

New 2Mb Multiplexer

Frontal 1200

Market Street

Separate 2Mb tributary on 13Ghz link



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- [Options and Accessories](#)
- [Encryption](#)
- [TM8000 Data Mobiles](#)
- [T2000 Mobiles](#)
- [TP8100 Portable Radios](#)
- [Tait Orca 5000 Portables](#)
- [Mobile Data](#)
- [TB8100 Base Station/Repeaters](#)
- [TB7100 Base Station/Repeaters](#)
- [T800 Base Station/Repeaters](#)
  
- **APCO P25 Digital series**
- [TM9155 Digital Mobile Radio](#)
- [TP9100 Portables](#)
- [TB9100 Base Station/Repeater](#)
  
- **TaitNet Networks**
- [TaitNet P25 Networks](#)
- [MPT 1327 Trunked Networks](#)
- [QS<sup>2</sup> Simulcast Systems](#)
- [Conventional Systems](#)

## TM8255 Specifications

Performance figures, unless otherwise stated, are typical figures measured in accordance with ETSI 300-086 (analogue) and ETSI 300-113 (digital). Tait Electronics Ltd reserves the right to alter these specifications.



**General**

	<b>Band</b>	<b>Operational Frequency</b>	<b>Transmit Power+</b>
<b>VHF</b>	A4	66-88MHz	25W
	B1	136-174MHz	25W
	B1	136-174MHz	50W
	C0	174-225MHz	25W
	D1	216-266MHz	25W
<b>UHF</b>	G2	350-400MHz	40W
	H5	400-470MHz	25W
	H5	400-470MHz	40W
	H6	450-530MHz	25W
	H7	450-520MHz	40W

<b>700/800MHz</b>	<b>K5</b>	<b>Transmit</b>	<b>Receive</b>
		762-776MHz	
		792-825MHz	762-776MHz 35W (>806MHz)
		850-870MHz	850-870MHz 30W (<806MHz)

<b>Frequency Stability</b>	+/-1.5ppm
<b>Channel Capacity</b>	1500 conventional channels 300 scan/vote groups 4 MPT 1327 trunked network
<b>Power Supply</b>	10.8-16VDC
<b>Channel Spacing</b>	12.5/20/25kHz
<b>Channel Increment</b>	7.5/12.5/15/20/25/30kHz
<b>Dimensions (LxWxH)</b>	
25W	185 x 182 x 70mm (7.3 x 7.2 x 2.8in)
40/50W	205 x 182 x 70mm (8.1 x 7.2 x 2.8in)
<b>Weight</b>	
25W	1.4kg (49oz)
40/50W	1.6kg (56oz)
<b>Operational Temperature</b>	-30°C to +60°C (-22°F to +140°F)
<b>Sealing</b>	Passes dust and rain testing to IP54
<b>RF Connector</b>	
25W	50 ohm BNC
40/50W	50 ohms BNC or Mini UHF
<b>Interface Connectors</b>	3 interface connectors with serial ports
<b>Internal Speaker Output</b>	3W rms

**Military Standards 810 F\***

<b>Applicable MIL-STD</b>	<b>Method</b>	<b>Procedure</b>
<b>Low Pressure</b>	500.4	2
<b>High Temperature</b>	501.4	1, 2
<b>Low Temperature</b>	502.4	1, 2
<b>Temperature Shock</b>	503.4	1
<b>Solar Radiation</b>	505.4	1
<b>Rain</b>	506.4	1, 3
<b>Humidity</b>	507.4	1
<b>Salt Fog</b>	509.4	1
<b>Dust</b>	510.4	1
<b>Vibration</b>	514.4	1
<b>Shock</b>	516.5	1, 6

\* \*Also meets equivalent superseded MIL-STD 810 C, D & E.

**Transmitter**

**VHF/UHF (TIA/EIA) 700/800MHz**

	<b>(TIA/EIA)</b>	
<b>Output Power</b>		
25W	25W, 12W, 5W, 1W	
30W		
35W		30W, 15W, 5W, 2W
40W UHF	40W, 20W, 15W, 10W	35W, 15W, 5W, 2W
50W VHF	50W, 25W, 15W, 10W	
<b>Modulation Limiting</b>		
12.5kHz	+/-2.5kHz	±2.5kHz
20kHz	+/-4kHz	±4kHz
25kHz	+/-5kHz	±5kHz
<b>FM Hum and Noise</b>		
12.5kHz	-38dB	-33dB
20kHz	-41dB	-38dB
25kHz	-43dB	-40dB
<b>Conducted/Radiated Emissions</b>	-36dBm < 1GHz	< -30dBm to 8GHz
	-30dBm > 1GHz	
<b>Audio Response Bandwidth</b>	300Hz-3kHz	300Hz-3kHz
<b>Audio Response</b>	Flat or pre-emphasised	
<b>Audio Distortion</b>	< 3% at 1kHz 60% deviation	< 3% at 1kHz 60% deviation
<b>Transmit Rise Time</b>	20ms	20ms
<b>Duty Cycle</b>		
25W	33%	
30/35W		20%
40/50W	20%	

**Receiver**

	<b>VHF/UHF (TIA/EIA)</b>	<b>700/800MHz (TIA/EIA)</b>
<b>Sensitivity VHF/UHF</b>	<-118dBm for 12dB SINAD (0.28µV)	-120dBm (0.22µV) for 12dB SINAD <-116dBm (0.35µV) for 20dB SINAD
<b>Intermodulation Selectivity</b>	67dB	82dB
12.5kHz	65dB	67dB
20kHz	70dB	75dB
25kHz	75dB	79dB
<b>Spurious Responses</b>	72dB	> 90dB**
<b>Hum and Noise</b>		
12.5kHz	-40dB	-44dB
20kHz	-41dB	-47dB
25kHz	-43dB	-48dB
<b>Audio Response Bandwidth</b>	300Hz-3kHz	300Hz-3kHz
<b>Audio Response</b>	Flat or de-emphasised	Flat or de-emphasised
<b>Audio Distortion</b>	< 3% at 1kHz 60% deviation	< 3% at 1kHz 60% deviation

All values quoted are typical. Specifications are subject to change without notice and shall not form part of any contract. They are issued for guidance purposes only. Please note that not all frequency bands and power outputs are available in all markets.

For further information please check with your [nearest Tait office](#) or authorised dealer.

Updated March 18, 2008

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## Appendix G - Ticket machine information

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Issue tickets effectively with the electronic ticket printer



almex.optima can be easily installed in the driver's compartment allowing mobile ticket sales in bus and train. The use of Windows CE.net 4.2®, the industry standard software, ensures a high degree of flexibility. The functional and rugged hardware is presented in Höft & Wessel industrial design. almex.optima will speed up ticket sales not only as a mobile unit but also when permanently installed in a kiosk system.

**FEATURES**

- Easy integration in the driver's workplace. Can be installed to suit left-handed or right-handed operation
- Available with monochrome keys or 10" colour touch screen
- Easy to use interface
- Customer display and various card readers can be integrated
- Fast ticket printer with partial or full cut allowing tickets to be kept in the output slot until removed
- Transfer of driver logs and tariff data via WLAN, driver module or GPRS/GSM
- Use of Windows CE.net 4.2® as operating system
- Operation in IBIS slave and IBIS master mode possible
- Can be modified to support customer's protocols

## TECHNICAL SPECIFICATIONS

### User Interface

- Backlit 1/4 VGA monochrome LCD graphics display (5.7") combined with 46 keys
- Alternatively: 10" colour graphics display with touch screen
- 2 x 5 Soft keys
- Scroll buttons
- Numeric keypad
- 12 programmable keys
- Input and delete key

### Printer

- Customised ticket design
- Up to 80 mm ticket print width
- Graphics capable
- Format control
- Integrated cutter
- Optional customer display

### Interfaces / Options

- RS 232, RS 422, RS 485, IBIS, Almex Highway, configurable as IBIS Master or IBIS Slave
- Digital I/O
- **almex.smartfare** and **almex.smartcash** readers can be connected
- Integrated chip card or magnetic card readers with or without contact optional

### Enclosure

- Compact ergonomic design using high quality plastic

### Dimensions

- Approx. 206 x 240 x 260 mm (H x W x D)

### Mounting

- Mechanic raster catch, lockable
- Compatible to **almex.A90**

### Operating voltage

- 24 VDC



*Also available:  
10" colour graphics display  
with touch screen*

## BACK OFFICE SYSTEM

- Almex offers an accounting system with easy to configure software providing detailed statistics.
- Easy handling by the user
  - Data interchange via wireless or driver module, GPRS or WLAN
  - Configurable receipt
  - Tariff and core data administration
  - Windows NT, MS SQL data base server, Crystal Report, ODBC
  - Industry standard hardware and network components
  - Detailed statistical sales analysis using any selection criteria such as
    - ▶ Line success calculation
    - ▶ Sales according to groups

## ACCESSORIES

- Vehicle antennas
- Terminal readout stations
- Basic WLAN installation
- Vehicle counter tables with integrated additional printer
- Ticket validator for contactless cards with needle or thermal printer
- Contrasting card reader: Smartfare (contactless)
- E-licence for in-car installation

## SERVICE

Apart from mature and proven products, the other prerequisite needed to ensure high availability of your vending machines is perfect service. Almex Information Systems offers a customised service package from telephone support through to complete on-site service. On request we will embed your existing service structures in an overall concept ensuring optimum technical support levels.



# OPERATOR CONSOLE & FARE PAYMENT DEVICE

TP5000



## ABOUT ERG

ERG Group is a world leader in the development, supply and operation of integrated fare management solutions for the transit industry. ERG has installed systems in major cities throughout the world including Hong Kong, Melbourne, Rome, San Francisco and Singapore with installations in progress in Gothenburg, Seattle, Stockholm, Sydney and Washington D.C. ERG has delivered systems that support more than 20 million smart cards in circulation and handle approximately 5 billion transactions per annum. ERG is an Australian-based company, listed on the Australian Stock Exchange, operating globally to deliver systems ranging from large multi-operator, multi-modal solutions to small, single operator solutions.

## DEVICE OVERVIEW

The TP5000 series combined paper ticket, smart card reading, automatic fare collection driver console has been proven in the field around the world. The TP5000 unit can operate as a stand alone device or be coupled to other devices in the bus, including, but not limited to, ERG's own smart card and/or magnetic ticket validators, bus computers and vehicle logging devices. The integrated functionality of the TP5000 is housed in an easy to install package. The graphics-rich, user friendly combination of LCD based icons and function keys, for both operator and patrons, has been developed with industry support and is widely accepted and used around the world.

## TP5000 FEATURES

The TP5000 uses ERG proven Multi-protocol Card Reader (MCR) series smart card readers for fast, high quality reading capability. In addition, the TP5000 supports many bus communication requirements. These include: RS422, RS232, ARCNet and Ethernet, as well as WLAN and IrDA. For applications that require even more advanced communication options, ERG provides the TP5600 model!

As with most ERG devices, multiple Security Access Module (SAM) support is standard.



**ERG**

TRANSIT SYSTEMS

# Technical Specifications for the TP5000



## COMBINED OPERATOR CONSOLE & FARE PAYMENT DEVICE

<b>OS</b>	MOS
<b>Processor</b>	Freescale
<b>Memory</b>	RAM, Static/Battery Backed up RAM, Ferro-Magnetic RAM, Flash Support
<b>Driver Interface</b>	Large Clear Backlit LCD Panel Silicon Keymat with configurable backlit keys: <ul style="list-style-type: none"> <li>• 10 Soft Keys around display</li> <li>• 10 Function Keys along the bottom</li> <li>• 4 Enlarged Navigation Key, I Power On/Off Key</li> </ul> Tricolour and monocolour LEDs Piezo Buzzer
<b>Patron Interface</b>	Left or Right hand orientation Speaker, Backlit LCD Pane, Bright LEDs - Red, Yellow, Green Contactless Smart Card Reader
<b>Printer</b>	Fast Thermal Line printer Integrated paper cutter Clamshell design for easy/fast paper loading
<b>Options</b>	Ethernet 802.11b/g WLAN IrDA ARCNet for connection to ERG's range of card processors RS232, RS422, RS485, Galvanically Isolated RS485 Ignition, Odometer, Ticket Punch, Other General Purpose IO Printer Flap Left or Right hand drive configurations available. Custom artwork, logos and plastics colours also available.
<b>Security Access Modules</b>	Supports multiple modules on-board
<b>Compliance</b>	ERG supplies products to meet many local and globally recognised standards such as CE, RoHS, FCC, various smart card standards and many others. For more details on how ERG meets your local requirements please contact ERG direct.
<b>Range</b>	Can be part of an entire bus solution from ERG with contactless smartcard and/or magnetic validators, bus computers, passenger information and announcements.

Stringent reliability testing on all equipment is undertaken. To ensure highest quality, specifications may change.

Contact ERG for more information about this and other products in the range.



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247 Balcatta Road  
Balcatta WA 6021  
Email: sales@erggroup.com  
Telephone +61 8 9273 1100

**Australia**  
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Phone: +39 06 5196 161  
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Phone: +46 8 659 0800  
**UK**  
Phone: +44 1204 384 709  
**USA**  
Phone: +1 925 686 8200



## Appendix H – Existing installations

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## **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.

## **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.

## **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).

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.

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## Appendix I - Certificates and labels

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**SEStran AVL and real-time passenger information:**

**Certificate of Insurance**

**(All Tenderers must complete this section)**

I/We hereby certify that: -

The under mentioned insurance policies are held by:

(Name of Insured) \_\_\_\_\_

of \_\_\_\_\_

Employer's Liability Policy No. (If applicable) \_\_\_\_\_

with \_\_\_\_\_

Public Liability Policy No. \_\_\_\_\_

With: \_\_\_\_\_

Professional Indemnity Policy No. \_\_\_\_\_

with \_\_\_\_\_

\_\_\_\_\_

The policies contain a Principal's Clause that will indemnify SEStran in respect of any claims that may arise in connection with the insured carrying out Services under a contract with SEStran.

The indemnity provided by the Public Liability Policy is not less than £5,000,000 for any one incident or any one claim. The indemnity provided by the Professional Indemnity is not less than £5,000,000 in respect of any one claim and in total.

The policy Premiums have been paid and the policies are in force until the dates shown below: -

Employers Liability (If applicable) \_\_\_\_\_ Date

Public Liability \_\_\_\_\_ Date

Professional Liability \_\_\_\_\_ Date

Signed \_\_\_\_\_

Name: \_\_\_\_\_

Position: \_\_\_\_\_

Name of Organisation: \_\_\_\_\_

Date \_\_\_\_\_ day of \_\_\_\_\_ 2009

**An Insurance Company or Broker must sign this form.**

Name: \_\_\_\_\_

Position: \_\_\_\_\_

Name of Organisation: \_\_\_\_\_

Date \_\_\_\_\_ day of \_\_\_\_\_ 2009

**SEStran AVL and real-time passenger information**

**Tender Certificate**

**(All Tenderers must complete this section)**

The essence of selective Tendering is that the client shall receive bona fide competitive Tenders from all those Tendering. In recognition of this principle, we certify that this is a bona fide tender, intended to be competitive, and that we have not fixed or adjusted the amount of the tender by or under or in accordance with any agreement or arrangement with any other person. We also certify that we have not done and we undertake that we will not do at any time before the hour and date specified for the return of this Tender any of the following acts

- A. Communicate to a person other than the person calling for those Tenders the amount or approximate amount of the proposed Tender, except where the disclosure, in confidence, of the approximate amount of the Tender was necessary to obtain insurance premium quotations required for the preparation of the Tender;
- B. Enter into any agreement or arrangement with any other person that he shall refrain from Tendering or as to the amount of any Tender to be submitted;
- C. Offer or pay or give or agree to pay or give any sum of money or valuable consideration directly or indirectly to any person for doing or having done or causing or having caused to be done in relation to any other tender or proposed Tender for the said work any act or thing of the sort described above.

In this certificate, the word "person" includes any persons and any body or association corporate or unincorporated; and "any agreement or arrangement" includes any such transaction, formal or informal, and whether legally binding or not.

Signed \_\_\_\_\_ Date \_\_\_\_\_

On behalf of \_\_\_\_\_

**TENDER**

I/We hereby offer to design supply and deliver and commission during the period of this contract with the South East Scotland Transport Partnership, the goods, materials and/or services referred to within this document at the prices/rates inserted herein all in accordance with the General and Special Conditions of Contract and appendices attached hereto, together with any specifications schedules and drawings

I/We further undertake that this offer is binding on me/us for a period of 6 months days from the Tender return date.

**N.B. The Schedules actually used for the quotation of prices must be signed by offerers on every page.**

Signed \_\_\_\_\_ Date \_\_\_\_\_

Name and Address of Firm \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**SEStran AVL and real-time passenger information:**

**Tender Declaration**

**(All tenderers must complete this section)**

To supply to SEStran an AVL and real-time passenger information system:

To: SEStran  
8b McDonald Road  
Edinburgh EH7 4LZ

\*I/We \_\_\_\_\_

Carrying on business at

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

hereby tender and undertake to execute and complete the Service, in accordance with the Preamble, Contract Conditions, Specification, Pricing Documents and any other documents.

\*I/We agree that the insertion by \*me/us of any conditions qualifying this tender or any unauthorised alteration to any of the tender document shall not affect the Contract Conditions and may cause the tender to be rejected.

\*I/We agree that this tender shall remain open to be accepted or not by the Partnership and shall not be withdrawn for a period of six months from this date.

And \* I/we further undertake to execute a Contract to be prepared at your expense for the proper and complete fulfilment of the Service.

*\*Delete as appropriate*

\*I/We certify that the details of this tender have not been communicated to any other person or adjusted in accordance with any agreement or arrangement with any other person.

\*I/We understand that you are not bound to accept the lowest or any tender you may receive

\* I/We certify that this is a *bona fide* tender.

**Contractors Signature(s)\*\$**

---

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---

---

**(Print name(s) in full)**

---

---

---

---

**Date**

---

**Name and Address of Firm/Company/Organisation**

---

---

---

---

*\*Delete as appropriate*

*\$. Where the Contractor is an incorporate association, the Company Secretary and a duly authorised Director should sign. In the case of a partnership, at least two duly authorised partners should sign. In the case of an individual, the individual should sign and have his signature witnessed.*



**SEStran AVL and real-time passenger information**

**TENDER FOR: SEStran AVL and real-time passenger information**

**TO: SEStran Secretary  
SEStran  
First Floor  
Hopetoun Gate  
8b McDonald Road  
EDINBURGH  
EH7 4LZ**

*For Office Use Only*

Date and Time Received:

Received By:

Tender opened on (date):

Opening Time:

Opened By:

In Presence of:

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## Appendix J - Compliance check list

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Section	Heading	Sub-heading	Compliant	Status of feature (pick from list)	Tenderer's document cross reference if necessary	Brief comments by Tenderer if necessary or example site
<p><b>1 General requirements</b></p> <p>1.2 System capacity and performance requirements</p> <p>1.3 Capacity</p> <p>1.4 Performance</p> <p>1.6 Compliance with standards</p>						
<p><b>2 Core system and workstations</b></p> <p>2.1 General</p> <p>2.2 Servers and workplace terminals functions and locations</p> <p>2.3 Core system</p> <ul style="list-style-type: none"> <li>Connecting remote workstations</li> <li>Remote maintenance</li> <li>Expansion</li> </ul> <p>2.4 workstations</p> <p>2.5 Database management</p> <ul style="list-style-type: none"> <li>Core Database</li> <li>Schedule and rota data</li> <li>Operational data</li> <li>Data entry, import and export</li> <li>Database structure</li> </ul> <p>2.6 Controlling voice communications</p> <ul style="list-style-type: none"> <li>Access to audio functions</li> <li>Driver request-to-talk calls</li> <li>Regular voice connection</li> <li>Call coding</li> <li>Conversations with selective calls</li> <li>Special announcements features</li> <li>Emergency call connection</li> <li>Shunting voice connection</li> <li>Listening in / joining in on the voice channel</li> <li>Announcements from a PC sound card (provisional)</li> <li>Fast function for reply and acknowledge</li> <li>Group call</li> <li>Instructions</li> </ul> <p>2.7 Dispatch actions</p> <ul style="list-style-type: none"> <li>Modification of driver assignment to driver duties</li> <li>Modification of vehicle assignment to running boards</li> <li>Modification of driver duty assignment to running boards</li> <li>Modification of driver reliefs</li> <li>Modification of timetables</li> <li>Order buses to turn short</li> <li>Program route diversions</li> <li>Holding a bus</li> <li>Timetable and headway regulation modes</li> <li>Defining the regulation mode</li> <li>Dealing with road works, diversions etc</li> <li>Repeating instructions</li> </ul>						

Section	Heading	Sub-heading	Compliant	Status of feature (pick from list)	Tenderer's document cross reference if necessary	Brief comments by Tenderer if necessary or example site
		<ul style="list-style-type: none"> <li>2.8 User interface               <ul style="list-style-type: none"> <li>Windowing technology on workstations</li> <li>Logging on and off the workstations</li> <li>Help text</li> <li>Workstation parameters</li> </ul> </li> <li>2.9 Monitoring tables and graphics               <ul style="list-style-type: none"> <li>Event queue table</li> <li>Timetable table</li> <li>Connecting services table</li> <li>Network overview</li> <li>Route overview</li> <li>Map view or Geographic Information System (GIS)</li> <li>Network overview table</li> <li>Bus and bus stop details</li> <li>Notebook</li> <li>Diary</li> <li>Journal</li> <li>Reference Book</li> <li>Vehicle fleet table</li> <li>Bus driver table</li> <li>Table of running boards</li> <li>Table of driver duties</li> <li>Table of driver reliefs</li> <li>Operational messages</li> <li>The system will be required to provide three types of messages:                   <ul style="list-style-type: none"> <li>Passenger information messages</li> <li>Message library</li> <li>Sending a message</li> </ul> </li> </ul> </li> <li>2.10 Fleet Management functions               <ul style="list-style-type: none"> <li>Minimum requirements</li> <li>Time synchronisation</li> <li>Position determination</li> <li>Predicted departure times at downstream stops</li> <li>Layover monitoring</li> <li>Monitoring vehicle logon and logoff</li> <li>Managing guaranteed connections</li> <li>Monitoring driver reliefs</li> <li>Forms</li> <li>Daily log</li> <li>Errors in the vehicle</li> <li>Odometer reading</li> <li>Version check</li> </ul> </li> <li>2.11 Sign management tools</li> <li>2.12 Depot Data upload and Download</li> <li>2.13 Tests and auxiliary programs               <ul style="list-style-type: none"> <li>Vehicle simulator</li> <li>Communication statistics, measuring availability</li> </ul> </li> <li>2.14 Statistics and diagnostics               <ul style="list-style-type: none"> <li>On-Line Problem Identification and Analysis</li> </ul> </li> </ul>				

Section	Heading	Sub-heading	Compliant	Status of feature (pick from list)	Tenderer's document cross reference if necessary	Brief comments by Tenderer if necessary or example site
<p><b>3 On-bus equipment</b></p> <p>3.1 Principles</p> <p>3.2 Defining Characteristics of on-bus Units</p> <p>3.3 Statement of capability</p> <p>3.4 Fully functional on-bus unit</p> <p style="padding-left: 20px;">Overview</p> <p style="padding-left: 40px;">Driver's terminal</p> <p style="padding-left: 40px;">Schedule data</p> <p style="padding-left: 40px;">Monitoring and reporting vehicle location</p> <p style="padding-left: 40px;">Monitoring progress against schedules or headways</p> <p style="padding-left: 40px;">Controlling voice and data communications</p> <p style="padding-left: 40px;">Control external destination displays</p> <p style="padding-left: 40px;">Controlling on-bus information</p> <p style="padding-left: 40px;">Controlling external destination displays</p> <p style="padding-left: 40px;">Controlling bus priority requests</p> <p style="padding-left: 40px;">Interface with ticket machine</p> <p style="padding-left: 40px;">Interface to passenger counting equipment</p> <p style="padding-left: 40px;">Interface with engine management systems</p> <p style="padding-left: 40px;">CCTV interface</p> <p style="padding-left: 40px;">Panic button</p> <p style="padding-left: 40px;">Interface with data upload / download equipment in the depot</p> <p style="padding-left: 40px;">Record storage</p> <p style="padding-left: 40px;">Interface with other on-bus equipment</p> <p style="padding-left: 40px;">Time synchronization</p> <p style="padding-left: 40px;">Failure of on-bus unit</p> <p style="padding-left: 40px;">Installation</p> <p>3.5 ETM-based options</p> <p>3.6 Summary of on-bus unit options</p> <p>3.7 Miscellaneous</p> <p style="padding-left: 20px;">Installation</p> <p style="padding-left: 20px;">Power Supply</p>						

Section	Heading	Sub-heading	Compliant	Status of feature (pick from list)	Tenderer's document cross reference if necessary	Brief comments by Tenderer if necessary or example site
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#### 4 Information display and dissemination

- General
- 4.2 Displays
- 4.3 Display messages
- 4.4 Construction
- 4.5 Displays at stops
  - LED bus stop displays
  - LCD bus stop displays
  - LED flag displays
  - LCD flag displays
  - Alternative displays
- 4.6 Low power signs
- 4.7 Displays at interchanges
- 4.8 Alternative display specifications
- 4.9 DDA Considerations And Accessibility
- 4.10 Data storage and sign management
- 4.11 Interface with City of Edinburgh "Bus Tracker" system
- 4.12 SIRI Interfaces with third Party Information Systems - Ultimate Requirements
  - Tenderers Responsibilities - SIRI Outputs
  - Tenderers Responsibilities - SIRI Inputs from third party systems
  - SEStran - BusTracker SIRI Interfaces
  - Interfaces with Scheduled Information Bus Station Systems
- 4.13 World-wide web and other information channels
  - Web site design
  - Architecture
  - Other channels
- 4.14 Real-time passenger information displays in vehicles

#### 5 Bus priority

- 5.1 General
- 5.2 Priority requests
- 5.3 Standards
- 5.4 Line of sight at traffic signals
- 5.5 Locations and accommodation works



Section	Heading	Sub-heading	Compliant	Status of feature (pick from list)	Tenderer's document cross reference if necessary	Brief comments by Tenderer if necessary or example site
<b>6 Communications</b>						
	6.1	The radio network				
	6.2	Existing systems				
		First in Edinburgh		N/A		
		Stagecoach East Scotland		N/A		
	6.3	Communications coverage				
	6.4	SEStran communications requirements				
	6.5	First in Edinburgh communications requirements				
	6.6	Stagecoach Buses communications requirements				
	6.7	Depot systems				
	6.8	Communications options and coverage requirements				
	6.9	Communications surveys				
	6.10	Performance requirements				
	6.11	Masts and base stations				
	6.12	Alternative communications options				
	6.13	Confidentiality				
	6.14	OFCOM licences				
	6.15	Communications costs prior to take-over				

Section	Heading	Sub-heading	Compliant	Status of feature (pick from list)	Tenderer's document cross reference if necessary	Brief comments by Tenderer if necessary or example site
<p><b>7 Installation</b></p> <ul style="list-style-type: none"> <li>7.1 General</li> <li>7.2 Access to premises</li> <li>7.3 Bus fitting schedule</li> <li>7.4 Access by agreement</li> <li>7.5 Method statement</li> <li>7.6 Ancillary works arranged by the Purchaser</li> <li>7.7 Ancillary works to be arranged by the Tenderer</li> <li>7.8 Accommodation <ul style="list-style-type: none"> <li>Line of sight at traffic signals</li> </ul> </li> <li>7.9 Information supplied by the purchaser</li> <li>7.1 Data from surveys <ul style="list-style-type: none"> <li>Test routes &amp; data integrity checks</li> </ul> </li> </ul>						
<p><b>8 Acceptance testing</b></p> <ul style="list-style-type: none"> <li>8.1 General</li> <li>8.2 Factory Acceptance Test (FAT)</li> <li>8.3 Site Acceptance Testing (SAT)</li> </ul>						
<p><b>9 Project team and Joint Design Exercise</b></p> <ul style="list-style-type: none"> <li>9.1 Joint Design Exercise <ul style="list-style-type: none"> <li>Part 1</li> <li>Part 2</li> </ul> </li> <li>9.2 Project team and meetings</li> <li>9.3 System Administrator</li> </ul>						

Section	Heading	Sub-heading	Compliant	Status of feature (pick from list)	Tenderer's document cross reference if necessary	Brief comments by Tenderer if necessary or example site
<p><b>10 Training</b></p> <ul style="list-style-type: none"> <li>10.1 General requirements</li> <li>10.2 Systems Operator</li> <li>10.3 Systems Support Staff</li> <li>10.4 Systems Hardware Support</li> <li>10.5 Bus Driver Instruction</li> <li>10.6 Reporting Suite</li> <li>10.7 Training programme</li> </ul>						
<p><b>11 Documentation</b></p> <ul style="list-style-type: none"> <li>11.1 General Documentation</li> <li>11.2 Document Approval Process</li> <li>11.3 Required Documentation</li> <li>11.4 Design Documentation</li> <li>11.5 Test Specifications</li> <li>11.6 System Upgrades</li> <li>11.7 System Training Documentation</li> <li>11.8 System Manuals</li> </ul>						
<p><b>12 Project management</b></p> <ul style="list-style-type: none"> <li>12.1 Programme</li> <li>12.2 Risk management</li> <li>12.3 Construction (Design &amp; Management) Regulations</li> <li>12.4 Security</li> </ul>						
<p><b>13 Equipment design and manufacture</b></p> <ul style="list-style-type: none"> <li>13.1 General Equipment</li> <li>13.2 Electrical Requirements</li> <li>13.3 Wiring</li> <li>13.4 Workstations and Bus Depot Electrical Power</li> <li>13.5 Site Electrical Power and Associated Work</li> <li>13.6 Environmental Requirements</li> <li>13.7 Electromagnetic Compatibility Requirements</li> </ul>						
<p><b>14 Maintenance</b></p> <ul style="list-style-type: none"> <li>14.2 General</li> <li>14.3 Bus operators</li> <li>14.4 Requirements</li> <li>14.5 Warranty / maintenance period</li> </ul>						

Section	Heading	Sub-heading	Compliant	Status of feature (pick from list)	Tenderer's document cross reference if necessary	Brief comments by Tenderer if necessary or example site
<b>15 Software support &amp; system upgrades</b>						
15.1 Software Licences						
Updates and support						
Distribution of workstation functions						

Status codes (column D)		Compliance codes (column E)	
AL	Already live	FC	Fully compliant
UD	Under development	PC	Partially compliant
SD	Specific development	NC	Not compliant
NA	Not available	N/A	Not applicable