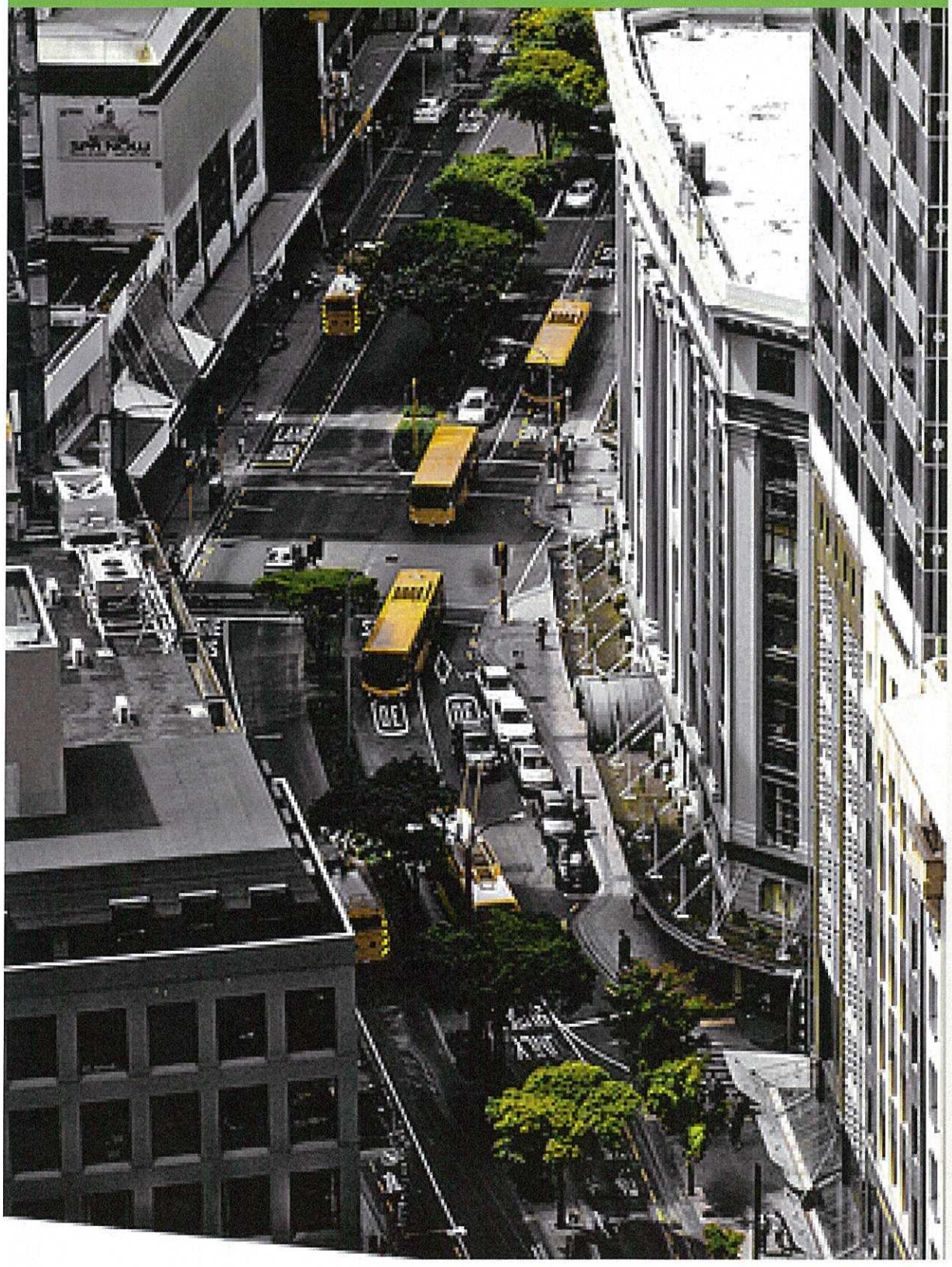
VIX

Greater Wellington Regional Council Real Time Information System

C1299

Final System Specification

GS3775 – Issue 3



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1 DOCUMENT HISTORY

Issue	Date	Reason for Issue/Changes Embodied
1	13th October 2009	First Issue.
2	24th February 2010	Addition of Appendix 7 not previously supplied
3	12th June 2012	Revised version to reflect final system delivered as at system acceptance phase

CHANGE REQUEST PROCEDURE

All changes to this document are to be authorised by the Project Manager.

Where changes are considered necessary, full details are to be submitted in writing to the Project Manager.

CHANGE RECORDING PROCEDURE

Changes to this document will be made on the basis of WHOLE DOCUMENTS, each identified by the issue number. It is vital that all interested parties refer to the current working document only.

All changes to this document will be recorded within the Document History table above. The master document will be configured with the next sequential issue number and filed within the Vix document management system.

Copies of the latest configured document will be issued in accordance with the distribution list detailed within section 2.

2 DISTRIBUTION LIST

Organisation	No. of copies	Document Format	Recipient
Vix Document Control	1 Copy	Electronic (pdf / .doc)	File
GWRC	3 Copy	Electronic (pdf / .doc)	David Lewry
Vix	1 Copy	Electronic (pdf / .doc)	Darren Schofield
Vix	1 Copy	Electronic (pdf / .doc)	Anthony Burgess

3 ABBREVIATIONS & ACRONYMS

ADSL	Advanced Digital Subscriber Line
ATCO	Association of Transport Coordinating Officers
AVL	Automatic Vehicle Location
BusNet	Product name for the Vix RTPI system
CCMS	Central Control & Monitoring System
CCTV	Closed circuit television
CJP	Cross Journey Prediction
DDA	Disability Discrimination Act
DeltaTrak	Vix On-Vehicle Computer unit
DFM	Detector Fault Monitoring
DSL	Digital Subscriber Line
EMC	Electro Magnetic Compatibility
ETM	Electronic Ticket Machine
ELCB	Earth Leakage Circuit Breaker
FAT	Factory Acceptance Test
FSS	Functional System Specification
GIS	Geographic Information System
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
GW	Greater Wellington
GWRC	Greater Wellington Regional Council
IDC	Internet Data Centre
IP	Internet Protocol
ISO	International Standards Organisation
KSCC	Korea Smart Card Corporation
KUPE	AVL System for NZ trains by ONTRACK
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode (Display)
Metlink	GW's public transport network
MRI	Master Record Index
NZ	New Zealand
OLAP	On Line Analytical Processing
ONTRACK	NZ government organisation responsible for operation the rail network
OVC	On vehicle computer
OVD	On Vehicle Display
P&R	Park and Ride
PC	Personal Computer (IBM compatible)
PID	Project Initiation Document
PMR	Private Mobile Radio
PQP	Project Quality Plan
RCB	Reduced Configuration Bus
RCD	Residual Current Device
RFID	Radio Frequency Identification
RTPI	Real Time Passenger Information
RTI	Real Time Information
RTIG	Real Time Information Group
RTZ	Route Trigger Zone
SAT	Site Acceptance Test
SCATS	Sydney Co-ordinated Adaptive Traffic System
SIM	Subscriber Identification Module (as in GPRS SIM card)
SMS	Short Message Service
SQL	Structured Query Language
TCP	Transmission Control Protocol
TDM	Time Division Multiplex

TFT	Thin Film Transistor Display
TLP	Traffic Light Priority
TSP	Traffic Signal Priority
TXC	Transxchange
TZ	Trigger Zone
UTC	Urban Traffic Control
UTMC	Urban Traffic Management Control
VA	Vehicle Actuated
VGA	Video Graphics Adapter
VHF	Very High Frequency
VID	Vehicle Identification number allocated on *BusNet*
VPN	Virtual Private Network
WAN	Wide Area Network
WLAN	Wireless Local Area Network
WAP	Wireless Application Protocol
WCC	Wellington City Council
WWW	World Wide Web (Internet)
XML	Extensible Mark-up Language

4 SUMMARY INTRODUCTION

The purpose of this document is to technically describe the system that has been provided by Vix to meet the Greater Wellington Regional Council (GWRC) Real Time Passenger Information (RTPI) system requirements, as described in the contract agreement PT0073, and associated technical specifications. The system has been installed to provide Real Time Information (RTI) for the Greater Wellington (GWRC) region, for buses and trains, and the information will be accessible to passengers, the bus and rail operators and also GWRC and other stakeholders involved with this project.

The basic requirements are, 450 off General Packet Radio Service (GPRS) based vehicle tracking kits, 250 off RTPI displays, SMS and Web applications, display of train schedule information, Horizon application software suite, hosted central servers, training, documentation, support and ongoing service delivery maintenance.

The project and the contract are also split into three key phases: -

- Planning and Design Phase (Including Project Start Up Activities)
- Pilot Phase Activities
- Full system roll out activities

The work covered by this specification is summarised as follows: -

- Design, development, test, provision, installation, configuration & commissioning of: -
  - 450 GPRS based vehicle tracking systems
  - 250 Displays at specified locations
  - Central Control & Monitoring System (CCMS) in New Zealand
  - Networks and communications infrastructure
  - SCATS Interface (Traffic Light Priority)
  - KUPE Interface (Train Information)
  - METLINK SMS And Web Interface, applications and associated services
  - Software applications, Horizon, Vehicle Viewer & Operator Reports.
  - 6 Client workstation terminals
- Importation of service schedule data supplied by GWRC and subsequent configuration
- Implementation of fault management system
- Integration, commissioning and acceptance testing of entire system.
- Supply of documentation
- Supply of training
- Warranty services & Ongoing system maintenance

The following will not be provided by Vix for this contract: -

- Power connections over 20m from the actual installation point of a display
  - It has been agreed between Vix and GWRC, that a collaborative approach is required towards provision of power over and above 20m for the first 100 locations, and also for the additional 150 locations. Costs and issues with regards to this activity has been on an 'open book' basis, and this is reflected within contract PT0073
- Local ADSL broadband connections where required

This document also clarifies both the GWRC & Vix responsibilities, and should be read in conjunction with the supporting documentation referenced in section 6.

5 PROJECT PROGRAMME & QUALITY CONTROL

The project programme and Quality Control regime are described fully in Vix document "GS3797 - Project Initiation Document" (PID), and are not repeated here.

The PID also incorporates the Project Quality Plan (PQP).

6 INTRODUCTION

6.1 Preliminaries

Vix have produced this Specification for the RTPI system elements that have been installed for the GWRC region. The system tracks both buses and trains, with Vix providing the required equipment for the buses, but taking a feed from the existing equipment and data for the train information. (No hardware has been installed by Vix onto trains). Vix will track buses on the nominated GWRC transport routes only.

This document does not supersede any contractual commitments given by Vix regarding availability of the functions listed in this Specification.

6.2 Referenced Documents

This Specification should be read in conjunction with the following documents: -

Title of Document	Reference	Comments
Greater Wellington Real Time Passenger Information (RTPI) System	PT0073	Main contractual document (Supply Agreement).
Greater Wellington Real Time Passenger Information (RTPI) System	PT0073	Main contractual document (Maintenance and Support Agreement).
Greater Wellington Real Time Passenger Information (RTPI) System – Technical Specification	18th Dec 2008	Main RFT system specification issued during the tender describing in full detail the system requirements, expectations and relevant performance criteria.
Project Initiation Document (PID)	GS3797	Overview document describing how Vix will manage, measure, control and maintain the system.
FAT – Factory Acceptance Test specifications	As required	These documents specify the Factory acceptance tests that will be carried out prior to implementation.
SAT – Site Acceptance Test specifications	As required	These documents specify the on site acceptance tests that will be carried out.
Wellington Drivers Interface Functional Specification	GS3766	This document describes the full set of features available in the Wellington drivers interface application
Vix ISO Quality Manual and Procedures.		This contains all Vix ISO approved procedures that will be followed and audited throughout this project.
Method Statements	As required	Describes how each piece of equipment is installed
Vix Health and Safety Policy Manual	Latest issue	Available to all Vix personnel to ensure that common H&S standards are understood and adhered to
British Std 17th edition – BS7671: 2008 (Reqt's for Electrical Installations)		This defines the standards to which displays will be installed and electrically certified.
Baseline Project Plan	Date stamped	This provides a GANTT chart showing key activities and their inter relationship.

6.3 General

The Wellington RTPI system is a real-time solution for managing public transport systems. This system consists of a number of key components linked by a GPRS mobile communications network, to provide a range of benefits for the transport operator, government authorities and the travelling public.

The diagram below (Figure 1) shows the general system elements of the GWRC RTPI system.

The Wellington system also has some innovative, localised solutions to address the specific circumstances existing in the Greater Wellington area, as further detailed in figure 2 below.

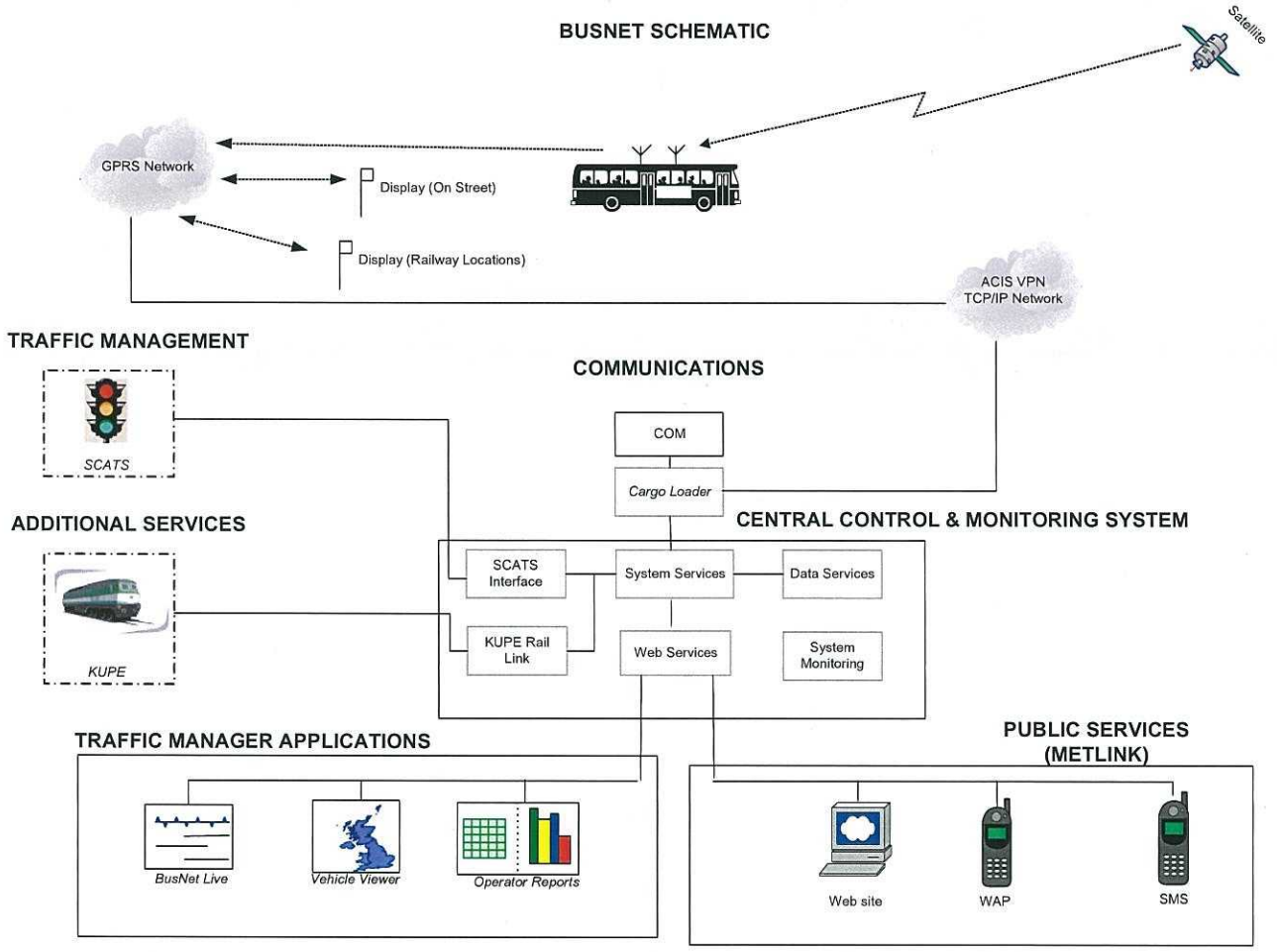


Figure 1 – GWRC RTPI System Schematic

6.4 Key Components

The key components of the Greater Wellington RTPI system, under this contract, are as follows:

a. Communications infrastructure via Vix, GWRC & Vodafone NZ
b. Central Control & Monitoring System , controlling communications and data provision
c. System management and bus operator information services
d. On vehicle equipment, to provide vehicle location and communicate other data within the system
e. Real Time Information Displays
f. Communications interface with SCATS traffic management systems
g. Communications interface with Metlink SMS and Web services
h. Communications interface with the KUPE rail information link
i. Interface with other systems as required

The main components of the overall system are shown in figure 2 below.

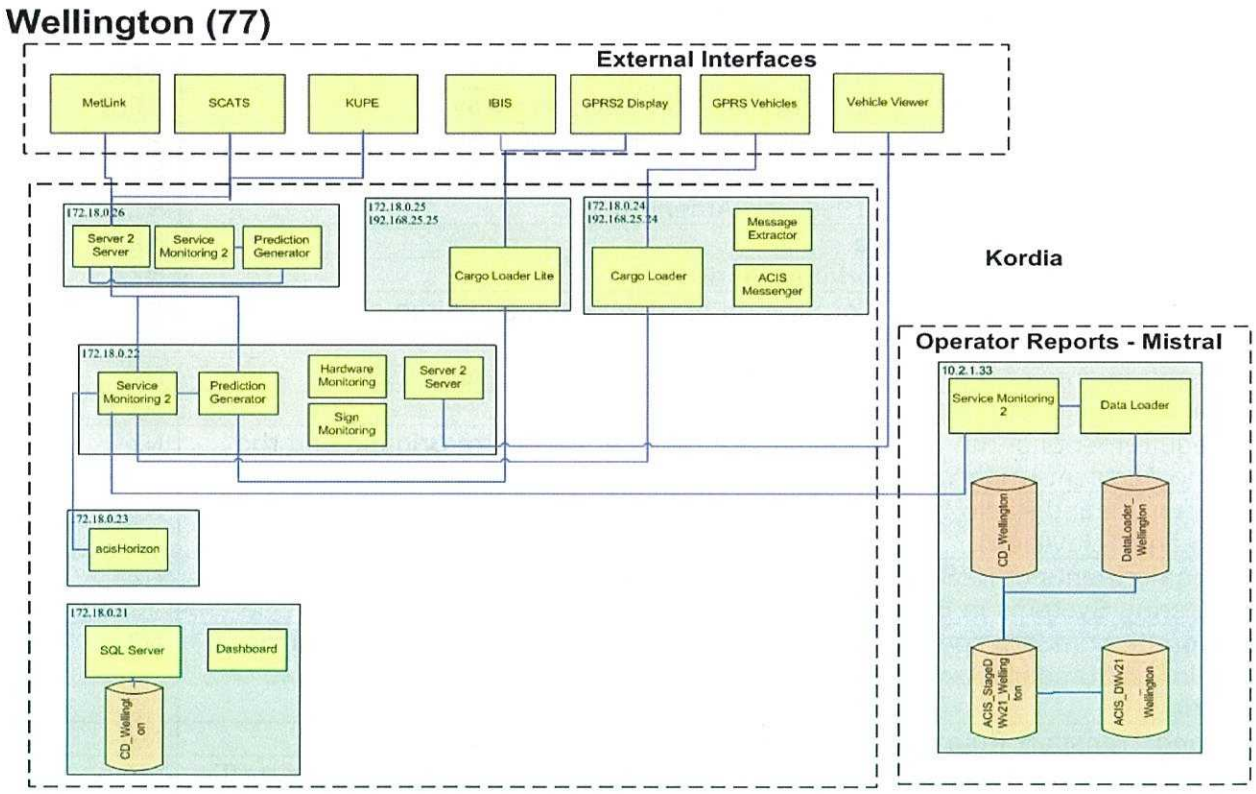


Figure 2 – Greater Wellington System Schematic (Detailed View)

6.5 Technical Standards

International, European or national standards used for the system implementation are: -

Title of Document	Issuing Body
ISO 9001 Quality Systems – model for quality assurance in design, development, production, installation and servicing	ISO
British standard BS7671 (Requirements for Electrical Installations)	British Standards
RTIG Communications position paper v 1.2 (RTIG Document RTIGS002)	RTIG
RTIG National RTI Strategy (RTIG Document RTIGS003)	RTIG
RTIG Outline Requirements specification (RTIG Document RTIGS005)	RTIG
TRIDENT Compliant XML schema v 0.98 Jan 2003 (RTIG Document RTIGS006)	RTIG
RTIG National Architecture v1.1 June 2004 (RTIG Document RTIGS011)	RTIG
RTI in shelters: Installation guidelines and specifications v1.1 Jan 2006 (RTIG Document RTIGT020)	RTIG
Meeting the needs of disabled travellers – a guide to good practice for real-time information systems providers (RTIG Document RTIGPR003-D002 – 1.1 June 2006)	RTIG
RTIG standard for Server-to-server	RTIG
RTIG Working Group 3: On-board devices. 25 bytes; one way	RTIG
All requirements of the Electricity Regulations and AS/NZS 3000	AS/NZS
The requirements of the Electrical Supply Line Company(ies).	NZ
The New Zealand Building Act 1991 and Amendments.	NZ
The New Zealand Building Code.	NZ
The requirements of the Territorial Authorities.	NZ
The requirements of Telecom Corporation of New Zealand Limited or other telecommunications companies.	NZ
The requirements of the Health and Safety in Employment Act 1992.	NZ
The requirements of the Dangerous Goods Regulations.	NZ
The requirements of the New Zealand Fire Service, Local Fire Brigade and the Fire and Accident Underwriters Association.	NZ
The New Zealand Radio Interference Regulations and Interference Notices (Radio and Television).	NZ
The requirements of NZS 4219: - Specification for Seismic Resistance of Engineering Systems in Buildings.	NZ
Appropriate standard specifications and amendments, and codes of practices listed in NZ Standard Association publications which are current at the time of tendering.	NZ
The Land Transport Rule: Traffic Control Devices 2004 (TCD Rule).	NZ
Traffic Regulations 1976 (regulations) detailing signs, markings and other traffic control devices.	NZ
Manual of traffic signs and markings (MOTSAM) - Part I: Traffic Signs.	NZ

7 BUSNET SYSTEM OVERVIEW

7.1 Introduction

The RTPI system naturally divides into a number of different modules as Shown in the schematic highlighted in figure 3 below.

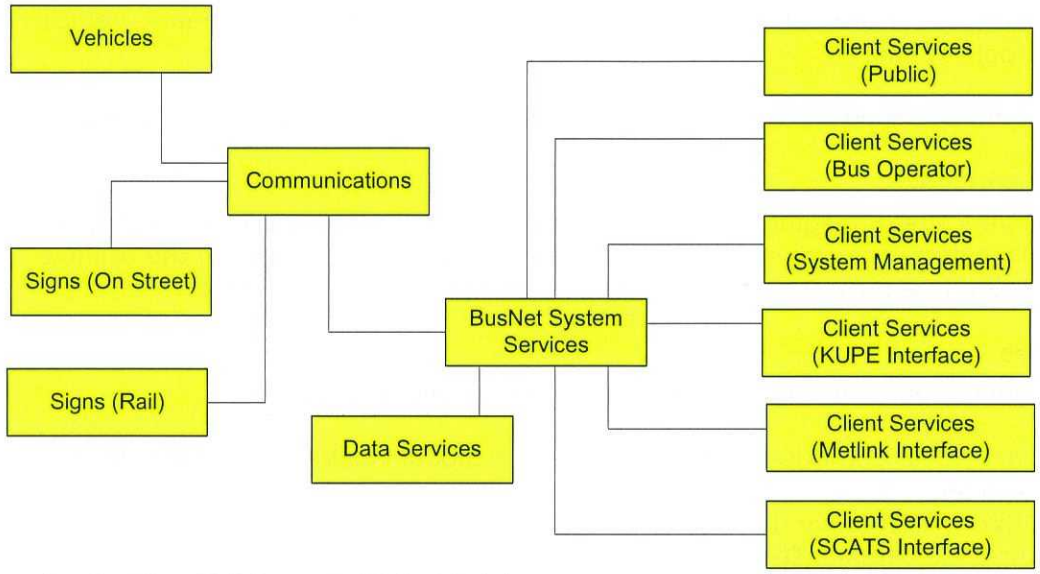


Figure 3 – BusNet RTI System Main Modules

7.2 BusNet System Services

The System Services run on a Central Server farm, located at the Central Hosting facility. This part of the system processes incoming data into meaningful information and makes it available for publication and delivery to various users and other systems.

This hosting facility is located in New Zealand within Kordia's 'Avalon' facility outside of Wellington.

The services that are provided are as follows: -

- Central System
- Data
- System management tools
- Bus operator information
- Public information

7.3 Communications

The communications system covers the data communications to and from the vehicles, and also links these systems to the central servers. The main communications infrastructure for this contract is a GPRS solution supplied by Vix.

The GPRS network is a packet switched data backbone that several mobile operators (Vodafone, O2 & Orange) have added to their existing Global System for Mobile communications (GSM) networks.

GPRS is a development of the GSM digital cellular radio standard, and GSM systems with GPRS are referred to as 2.5G. What GPRS has allowed is the easy deployment of Internet Protocol (IP) based systems using a wireless bearer. It also allows relatively fast transmission of data from capable mobiles and substitutes the need for any up-front capital outlay with call charges. There is a continuous connection, but charges are only made for data used. The revenue costs for communications using GPRS are for each bus.

Vix utilises this service for the delivery of data for some of its RTPI and Automatic Vehicle Location (AVL) applications.

Refer to GPRS product specification (Vix Document GS2346) in Appendix 1 for more details.

7.4 Data Services

Data Services covers the managing of data and supplying this information to the components that require it. This data includes schedules in Central Data, historical data in the Archive Warehouse and data in a form that can be used for reports in the Data Cubes.

7.5 Vehicles

The on-vehicle equipment comprises the following main components:

- On-Vehicle Computer that incorporates a Global Positioning System (GPS) receiver
- Drivers interactive display
- Communications Modem

7.6 Displays (On Street)

The system communicates with the on street displays via the GPRS and CCMS to display RTI predictions.

7.7 Displays (Rail)

The system communicates with the rail displays via the GPRS and CCMS to display RTI predictions.

7.8 Client Services (Public Information Services)

These deliver information to the public using a variety of information services, including Web, WAP, SMS and Voice. Public Information Services provides a suitable user interface, however the information being disseminated is supplied from the RTI System Services

7.9 Client Services (Bus Operator Information Services)

Bus Operator Information Services covers various services that deliver both real time and historical information to the bus operator.

7.10 Client Services (System Management Information Services)

System Management Information Services covers the configuration of the RTI system and the monitoring of correct operation of the RTI system.

7.11 Client Services (KUPE Information Services)

The system interfaces with the Kiwirail KUPE system provided by ONTRACK in order to provide real time predictions for when the train arrival times are going to be. The interface will be via a SIRI XML interface, and the information will be displayed on RTI displays installed by Vix at nominated locations.

7.12 Client Services (METLINK Information Services)

The system interfaces with the existing Metlink systems in order to provide the RTI on local website applications, and also via SMS services for passengers.

7.13 Client Services (SCATS Information Services)

The system interfaces with the existing SCATS traffic management systems, in order to provide bus priority requests to specific nominated traffic signal locations, to allow late running busses to proceed with safety. These requests are based on the central RTI contained within the system.

8 ON-VEHICLE EQUIPMENT

8.1 Introduction

One of the key components of any RTPI system is the tracking equipment that needs to be installed on each vehicle that requires monitoring.

This piece of equipment is known as the On-Vehicle Computer, or OVC. For this contract Vix have installed its latest OVC platform that comprises a rugged single board computer unit with fixed, upgradeable and optional modules. The unit is mounted by using a flexible and adjustable bracket which is fixed to the vehicle cab area, normally to the upper right of the driver.

The OVC holds route information and controls the processing of data received from the GPS antenna, the routing of data to and from the GPRS modem, any on-vehicle display and other peripherals that may be connected in future.

The OVC is connected into the vehicles existing electrical system for power provision. It is also connected to the vehicle Snapper Electronic Ticket Machine (ETM), and provides both GPS and GPRS communications.

The main components of the On-Vehicle Computer (OVC) unit are shown in Figure 4 below: -

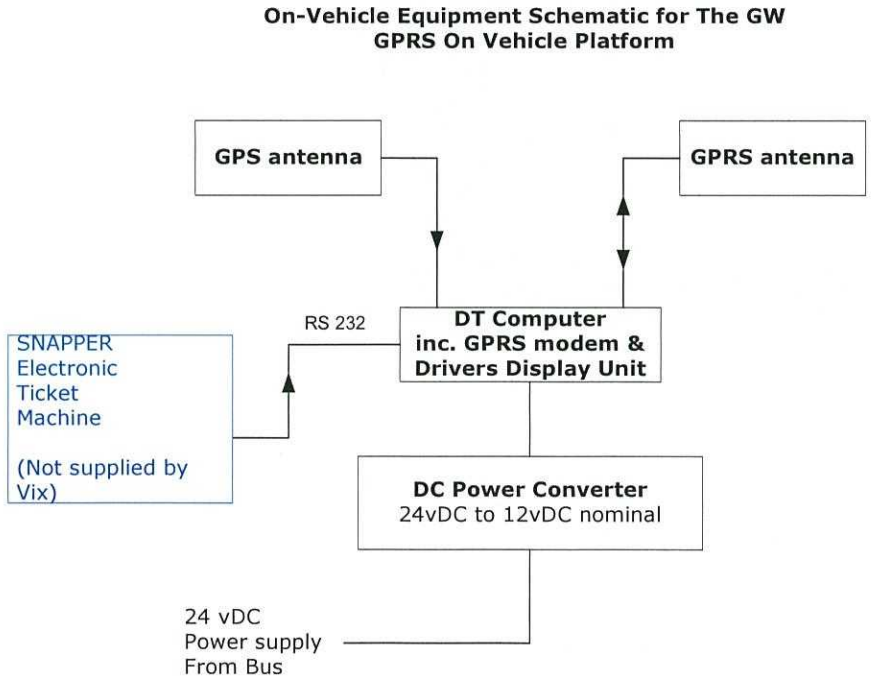


Figure 4 – Summary Schematic for OVC

8.2 Technical Detail

8.2.1 Main Components

The OVC that has been supplied for each bus comprises the following main items: -

- DT336 Computer unit with rugged single board computer
- Integrated drivers display
- ETM Interfacing
- Operating Software
- Combined GPRS/GPS antenna
- Power converter (24vDC to 12vDC nominal)
- Cable harnesses, clearly labelled with functions
- Felxible/adjustable mount brackets and Fixings with security locking system

Additional details of the OVC equipment and its functionality are given later on in this section of the document, and a detailed schematic of the OVC components can be found in figure 5 below: -

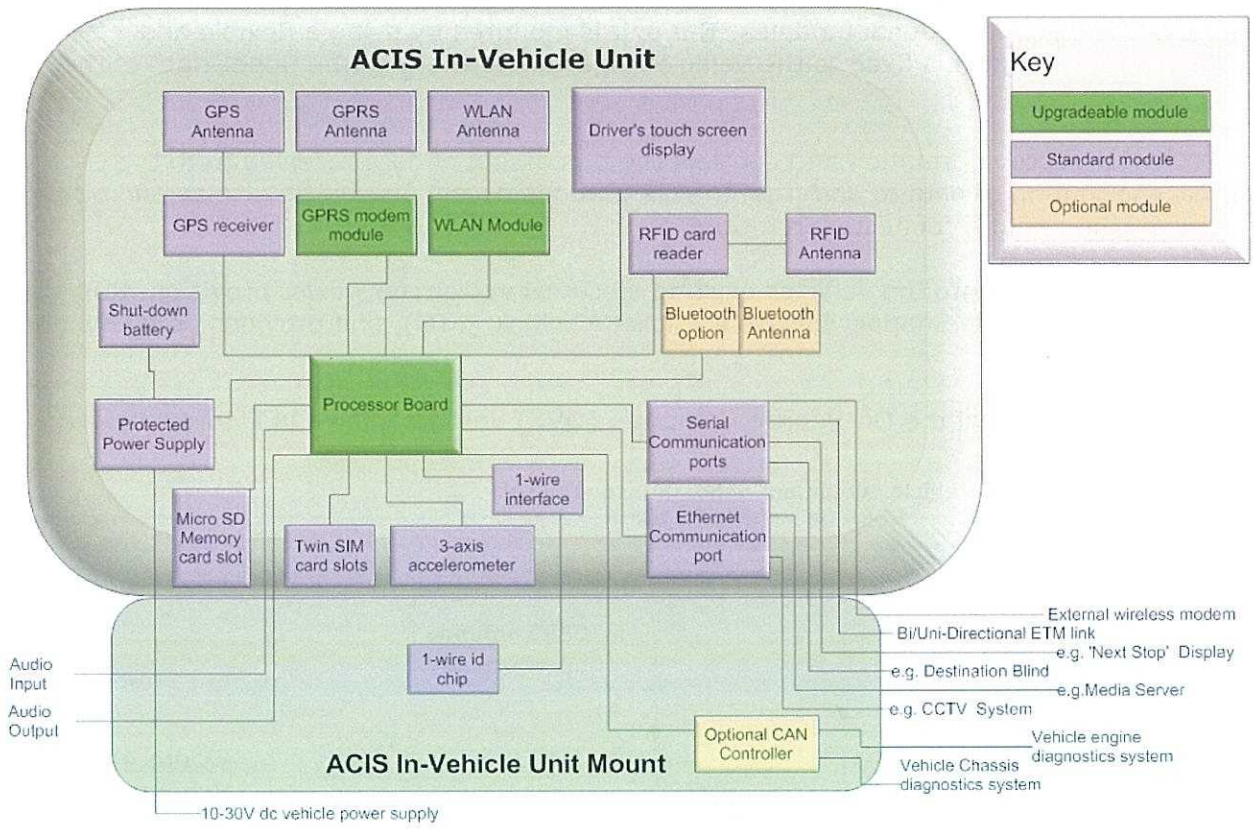


Figure 5 – Detailed Schematic for On-Vehicle Computer

8.2.2 OVC Core Functionality & Requirements for the GWRC System

The core functionality and characteristics of the GWRC OVC provided by Vix are: -

- Has been designed on a 'plug and play' basis
- Provides GPS Location information accurate to within 5 metres

- Provides event driven location updates based on entering a GPS cordon around waypoints
- Sends bus priority requests at designated locations to the RTPI server
- Has functions to enable headway management (Not within this contract scope)
- Provides a two way interface to the vehicle ETM for functions such as headway management, driver messaging and automatic fare stage updates
- Is capable of interfacing with on board 'Next Stop Displays' (Not within contract scope)
- Provides a standard interface to wireless communications device, radio or modem
- Is independent of the wireless communications solution, and able to function with an alternative
- Can function with different wireless communications solutions including Band III/VHF, GSM/GPRS, 3G and wireless broadband
- When the vehicle enters an area of no/poor communications coverage the OVC will store all location updates that cannot be transmitted. The OVC unit will automatically re-establish communications with the CCMS when it exits an area of no/poor communications coverage. This reconnection will take place within one minute. When communication is re-established the OVC unit will transmit all location updates that were missed when out of coverage
- Transmits location information to the CCMS using both period driven and event driven triggers as required
- For event driven applications the in-vehicle unit will transmit a location when it enters and/or exits a predefined zone around a way point. The size of the zone around each way point is individually configurable. The way points defined within the in-vehicle unit also include, Stops/stations, Road intersections, Tunnel entrances and exits and Other locations as required
- Will regularly report location information even when the details of the current service it is running, as received from the ETM, is missing or invalid

8.2.3 Drivers Display

There is an integral display on the unit for driver or service engineer to input required information. The functions available for the display are: -

- Service Allocation and information
- Route progression
- Next stop control
- Headway monitoring
- Schedule adherence
- Event Messages
- Driver messaging
- Diagnostic and test functions

Note: Details of the software functionality provided by the OVC will be supplied in a separate specification document (GS3766) to be provided to GWRC, and referenced in section 6 documentation.

8.2.4 Data

The OVC sends information from the vehicle as a Time Division Multiplex (TDM) message that contains the following information: -

- Unique vehicle ID code
- Operator ID code
- Service information (decoded from tables stored within the On-Vehicle Computer's configuration)
- Vehicle position
- Current heading of the vehicle
- GPS position condition status
- Trigger condition

8.2.5 Interfaces

The OVC has many interfaces with which engineers and/or equipment can interact. These are: -

- ETM (RS232)
- Diagnostics
- GPRS Radio / Wireless LAN
- GPS
- On-Vehicle displays (Not in original scope of works)
- Next Stop Announcements (Not in original scope of works)

A detailed specification of the OVC is shown in Appendix 2. An OVC User Guide provides a detailed guide to the operation of the OVC and can be found in Appendix 7.

8.2.6 SNAPPER ETM Interface

Vix have developed an interface to the existing Snapper ETM installed on the majority of the GWRC bus fleet. This interface is based around existing UK RTIG specifications, and has been developed in conjunction with KSCC and Snapper.

The interface is provided via an RS232 serial link, and is compatible with and does not impede normal operation of all bus operator legacy systems, including ticket machines, printers, cash box, CCTV cameras, smartcard or any other systems and the links between these systems. For the avoidance of doubt, should the OVC be found to interfere with any legacy on bus systems present at the time of installation, Vix have committed to rectify these issues at its cost. No such issues have been raised since initial deployments began.

8.2.7 Other Information

8.2.7.1 Communications Antennae

Vix have installed a combined GPS/GPRS antenna on each vehicle, which has been mounted on the top of the vehicle. This has a small, round profile approximately 40mm diameter by 30mm high and is mounted through a 16mm hole on the roof of the bus, on the front side of the bus at the driver's side. The antenna is designed for vehicle mounting and is robust enough to survive low hanging vegetation and bus washes without any adverse effects on the performance of the unit.

8.2.7.2 Fault Reporting

The on-vehicle unit software includes fault identification and reporting. This can identify the following potential faults: GPS failure, ETM communications failure, WLAN failure, memory card issues, including loss of card communications, memory failure and memory full, over-temperature.

8.3 Global Positioning System (GPS)

8.3.1 Overview

The RTPI system relies solely on GPS co-ordinates to provide location information to the central system. This location information is determined by the OVC using a high-sensitivity GPS receiver and built-in antenna, called the u-blox™ 5 GPS receiver system. This system is designed for use in both vehicle and hand-held GPS systems and is highly robust.

For the GWRC RTI system, Vix have installed an externally mounted antenna to ensure optimum performance due to local conditions in the Greater Wellington area. With regards to system accuracy, to achieve <5m position resolution accuracy, the system uses Differential GPS, which Vix has been utilising for over 11 years.

The software supplied with the OVC unit also has the facility for storing GPS location information, that can be used to trigger system 'events' such as RTIG Traffic Light Priority requests, RTIG Stop display prediction cleardowns and others such as message and advertising triggers.

8.3.2 Functionality

Every vehicle that is tracked is equipped with this GPS antenna system, and will receive position transmissions from the US military satellites that are part of the Global Positioning System. This antenna calculates a ground location from these positions. GPS provides a fix roughly once a second to better than 20 metres of an actual position, depending upon the number of satellites seen. The GPS derived position, along with other system data, are then transmitted at set time intervals to the Central Control System.

To produce a ground location, the GPS receiver needs to have 'locked onto' at least four transmitting satellites. For best results, the GPS antenna requires an unobstructed view of the sky. GPS coverage has found to be only a problem when the route encounters long tunnels. A GPS coverage survey of the routes was completed by Vix and any known anomalies have been corrected and adjusted for within the system configuration parameters.

8.4 Installation

8.4.1 General

Each OVC has been fitted to the buses in accordance with a method statement produced by Vix and Kordia. The method statements were created following bus surveys and detailed consultation with the Bus Operators. The fitting of equipment to the buses has only been completed after the relevant Bus Operator and the Vix or Kordia Engineer have approved the method statements.

Note that any number of vehicles can have a breakdown in RTPI equipment, without causing any adverse affect on other parts of the system (except of course that the vehicle will no longer be predicted or shown on Horizon and Vehicle Viewer etc.)

8.4.2 Power

The In Vehicle unit is connected to a power supply from the vehicle, which is controlled by the vehicle master switch. This ensures that the OVC is active whenever the vehicle is moving, whether or not the vehicle is in service. It is not necessary to leave the unit permanently powered, as the unit has a built-in shut-down mechanism that allows the system state to be retained in non-volatile memory and also vehicle data uploads are carried out at the depot during bus refueling, rather than overnight. During a layover, this means that although the vehicle may be powered down, when the vehicle is powered up the In Vehicle system software

restores the vehicle journey allocation data from non-volatile memory. This is then held until alternative journey data is passed to the system from the ETM. Similarly, if the vehicle ETM has the driver's module removed part way through a journey, this information will be held in the In Vehicle unit for a predetermined time and the vehicle will be kept allocated to that journey. If a new module is inserted and the journey log-on keyed in, the unit will continue the journey.

8.4.2 Testing

The unit has been tested to ensure that it complies with all relevant EMC regulations, including EN 55022 (Class A) emissions and EN6100. 5.5.3.1 In addition, the unit has also completed environmental testing, including temperature cycling and vibration. The unit will operate from -10°C to +70°C and relative humidity up to 90% (non-condensing).

9 PASSENGER INFORMATION POINTS (DISPLAYS)

9.1 Introduction

The RTPI system supports a variety of passenger information Signs (also known as Passenger Information Points or PIPs), including LED displays, VGA monitors, LCD panels, TFT displays etc.

For this contract Vix have provided a quantity of 250 LED/LCD RTPI displays. The breakdown of display type against quantity taken from the main contract is as follows: -

- Nine Line Interchange Signs (Out of shelter, stand-alone signs) – Qty 15
- Bann Six Line Major Stop Signs (Out of shelter, stand-alone signs) – Qty 35
- Bann Three Line Minor Stop Signs (Out of shelter sign) – Qty 180
- Shannon Three Line Major Stop Signs (In shelter sign) - 20

For the purposes of the pilot phase activities, a single 3 line LED display was installed within GWRC's Wellington office as requested and successfully tested.

9.2 Equipment (Three Line Shelter Displays)

These displays supplied are the Vix (Shannon) 3 line 'Shelter Mounted Type' LED displays.

Each display has the following characteristics:

- Amber coloured text against a black background
- 3 lines of text each with up to 32 characters (Upper and Lower case)
- Each text line able to be display different information
  - Next bus due
  - Subsequent bus due
  - Additional buses due plus clock display to show time.
- Ability to display scheduled and predicted information.
- Ability to display a custom message
- Transflective LED display screen
- Good visibility in daylight and bright conditions
- Display housings to provide minimum IP659 rating (Vix can achieve up to IP667)
- Complies with RTIG document RTIGPR003-D002-1.1 (Disability Discrimination Act (DDA) regulations)

- All equipment except radio aerials to be housed within the display unit.
- Ability to support system monitoring facility
- Ability to support remote updates from the central servers
- Ability to support sign clear down via Short Range Radio

Detailed specifications of the display, housing and mountings are given in Appendix 3.

9.3 Equipment (Three and Six Line 'Out of Shelter' Displays)

These displays supplied are the Vix (Bann) 3 and 6 line 'Flag Type' LED displays.

Each display has the following characteristics:

- Amber coloured text against a black background
- 3 or 6 lines of text each with up to 24 characters (Upper and Lower case)
- Each text line able to be display different information
  - Next bus due
  - Subsequent bus due
  - Additional buses due plus clock display to show time.
- Ability to display scheduled and predicted information.
- Ability to display a custom message
- Transflective LED display screen
- Good visibility in daylight and bright conditions
- Display housings to provide minimum IP659 rating (Vix can achieve up to IP667)
- Complies with RTIG document RTIGPR003-D002-1.1 (Disability Discrimination Act (DDA) regulations)
- All equipment except radio aerials to be housed within the display unit.
- Ability to support system monitoring facility
- Ability to support remote updates from the central servers
- Ability to support sign clear down via Short Range Radio

Detailed specifications of the display, housing and mountings are given in Appendix 4.

9.4 Equipment (Nine Line Display)

These displays will be the Vix (Wey) 9 line LED 'Summary Board Type' displays.

Each display is to have the following characteristics:

- Amber coloured text against a black background
- 9 lines of text each with up to 48 characters (Upper and Lower case)
- Each text line able to be display different information
  - Next bus due
  - Subsequent bus due
  - Additional buses due plus clock display to show time.
- Ability to display scheduled and predicted information.
- Ability to display a custom message
- Transflective LCD or LED display screen
- Good visibility in daylight and bright conditions
- Display housings to provide minimum IP659 rating (VIX can achieve up to IP667)

- Must comply with RTIG document RTIGPR003-D002-1.1 (Disability Discrimination Act (DDA) regulations)
- All equipment except radio aerials to be housed within the display unit.
- Ability to support system monitoring facility
- Ability to support remote updates from the central servers
- Ability to support sign clear down via Short Range Radio

Detailed specifications of the display, housing and mountings are given in Appendix 5.

9.5 Installation

It is the responsibility of Vix to ensure that:

- Each display installation location is supplied with mains power (230v AC, 1 Amp peak)
- The mains to each display is fitted with a separate Residual Current Device (RCD) or Earth Leakage Circuit Breaker (ELCB) for the display

It is the responsibility of GWRC to ensure that:

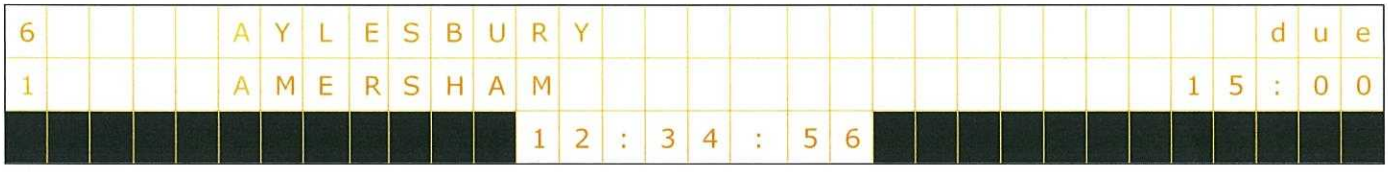
- A permanent power supply is available within 20m of each nominated site for display installation. (Please refer to the notes in section 4)

9.6 Format of Messages (Display Layout)

3 Line (In shelter)

Displays will show a maximum of 3 lines of information, two fixed lines and one rolling bottom line. The top line will provide information of the next bus, while the second will provide details of the subsequent bus. The rolling bottom line will roll when there are more than two departures due within the next hour. It will then give details of the subsequent buses. (Vix "rolling" means a line is replaced and static for "n" seconds, where "n" is configurable. Since information is updated every 30 seconds, only 3 separate departures are possible if "n" is 10 seconds).

Each line is split so that the first four characters show the service number, the next nineteen (maximum) characters show the destination and the remaining five characters show the scheduled time or predicted time (e.g. "17:45" or "15 min"). A schematic example is shown below:



3 Line (Out of Shelter)

Displays will show a maximum of 3 lines of information, two fixed lines and one rolling bottom line. The top line will provide information of the next bus, while the second will provide details of the subsequent bus. The rolling bottom line will roll when there are more than two

departures due within the next hour. It will then give details of the subsequent buses. (Vix "rolling" means a line is replaced and static for "n" seconds, where "n" is configurable. Since information is updated every 30 seconds, only 3 separate departures are possible if "n" is 10 seconds).

Each line is split so that the first four characters show the service number, the next nineteen (maximum) characters show the destination and the remaining five characters show the scheduled time or predicted time (e.g. "17:45" or "15 min"). A schematic example is shown below:

6			A	Y	L	E	S	B	U	R	Y								d	u	e
1			A	M	E	R	S	H	A	M								1	5	:	0	0
										1	2	:	3	4	:	5	6					

6 Line (Out of Shelter)

Displays will show a maximum of 6 lines of information, five fixed lines and one rolling bottom line. The top line will provide information of the next bus, while the second, third, fourth and fifth will provide details of the subsequent bus. The rolling bottom line will roll when there are more than two departures due within the next hour. It will then give details of the subsequent buses. (Vix "rolling" means a line is replaced and static for "n" seconds, where "n" is configurable. Since information is updated every 30 seconds, only 3 separate departures are possible if "n" is 10 seconds).

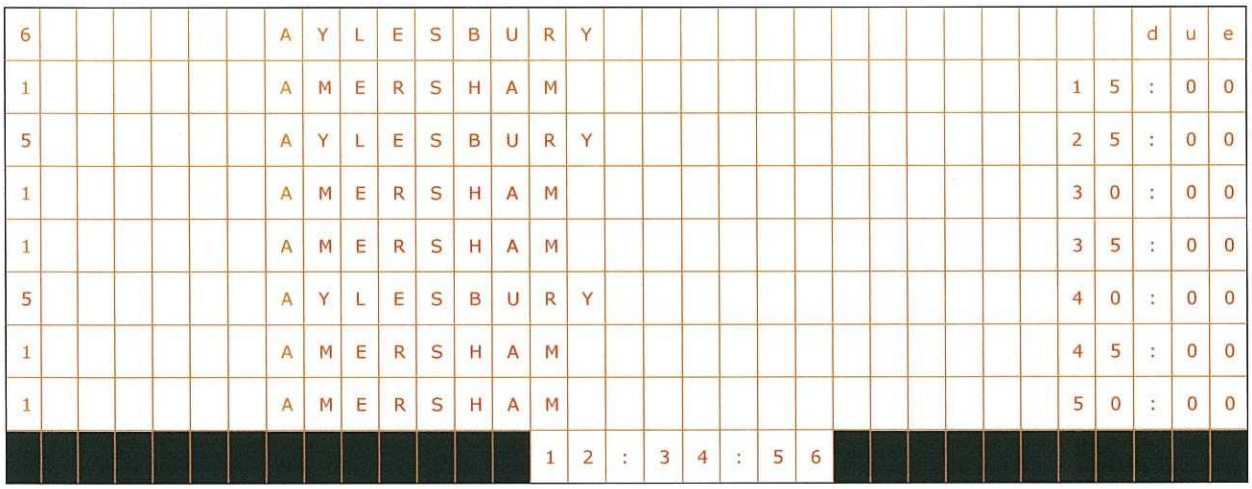
Each line is split so that the first four characters show the service number, the next nineteen (maximum) characters show the destination and the remaining five characters show the scheduled time or predicted time (e.g. "17:45" or "15 min"). A schematic example is shown below:

6			A	Y	L	E	S	B	U	R	Y								d	u	e
1			A	M	E	R	S	H	A	M								1	5	:	0	0
5			A	Y	L	E	S	B	U	R	Y							2	5	:	0	0
1			A	M	E	R	S	H	A	M								3	0	:	0	0
1			A	M	E	R	S	H	A	M								3	5	:	0	0
										1	2	:	3	4	:	5	6					

9 Line Summary Board

Displays will show a maximum of 9 lines of information, five fixed lines and one rolling bottom line. The top line will provide information of the next bus, while the next 7 lines will provide details of the subsequent bus. The rolling bottom line will roll when there are more than two departures due within the next hour. It will then give details of the subsequent buses. (Vix "rolling" means a line is replaced and static for "n" seconds, where "n" is configurable. Since information is updated every 30 seconds, only 3 separate departures are possible if "n" is 10 seconds).

Each line is split so that the first four characters show the service number, the next nineteen (maximum) characters show the destination and the remaining five characters show the scheduled time or predicted time (e.g. "17:45" or "15 min"). A schematic example is shown below:



Note: This diagram is representative only, and will be revised in accordance with specific GWRC requirements to fully utilise all 48 characters available.

Scheduled information will be displayed instead of predictions under the following conditions: -

- Faulty vehicle equipment
- Non-fitted vehicle
- Faulty antenna on Sign
- Failure of communications system
- Driver error input into ETM

Displayed information will be sorted into chronological order. Displays at layovers or termini will normally display predicted arrival times and scheduled departure times. The predictions will start within 2 minutes after the driver keys up the ETM for the journey or leaving the first stop.

Any number of displays can fail without causing any adverse affect on any part of the system.

9.7 Types of Messages

The Sign can display the following types of message:

- Predictions and or scheduled times for vehicles
- Operator messages
- Programmed custom messages automatically displayed on specified days of the week and at specified times

Predictions for vehicles are created from an algorithm on the central server.

A Bus Delayed message, which is optional, is declared when it has remained stationary for more than 5 minutes. Predictions will recommence when the vehicle begins moving again. Predictions can also be configured to continue throughout the layover. The delayed message can be removed if not required.

When the bus is coincident with the geo-coordinates supplied, within a 10metre range of coordinates, it will transmit the message in the next available slot. To a degree this depends on the accuracy of the positioning of the display on the map, which in turn depends on the accuracy of the geo-coordinates supplied in the TransXchange or ATCO.CIF data, as stored in the on-vehicle computer.

Where a vehicle cannot be tracked, scheduled timing applies. In the event that a display has reverted to displaying scheduled timing information, scheduled time will clear down automatically once that time has passed, regardless of whether the bus has arrived at the stop.

Custom messages can be sent from the Vix *Messenger* application based on the BusNet terminals to individual or groups of displays. These can be set up in advance and transmitted to displays. Messages can be programmed to appear on specific days and for specific periods or they can be unique messages. They can include inbound, outbound, route numbers, operator configurable groups etc. The system can store up to 100 custom messages. VIX allows up to 50 characters for custom messages for scrolling purposes.

Custom messages clear down by the user setting a start and end time.

9.8 Character Set Standard

Vix follows the ISO 8859-1 Character Set standard throughout all its applications. Any third party, devices, systems or applications that integrate with the Vix BusNet system must interface with this standard.

10 TRAFFIC SIGNAL PRIORITY (S.C.A.T.S)

10.1 Introduction

As part of the RTPI system Vix have provided a traffic signal priority interface to the existing SCATS traffic control system already implemented within Wellington, and owned and operated by Wellington City Council.

The purpose of the traffic signal priority system is to keep buses on schedule by providing them with priority at traffic signals.

10.1 Basic Requirements

The basic functionality provided for the GWRC TSP system are as follows: -

- Server to server interface
- Interface with existing SCATS system via the ITS Interface
- Provide and maintain all required communication links
- Configured with the signal phasing details of all traffic signals on bus routes in the WCC area linked to SCATS. The system uses this information to determine the relevant signal approach and phase to request a priority treatment

- The system will monitor the performance of buses against schedule. The system will only issue priority requests for late running vehicles, and is configurable such that the degree of lateness before a priority request is issued to the SCATS system can be adjusted.
- The degree of lateness is configurable based on Individual traffic signal, Time of day, Day of week, and Bus service
- The system will enable definition of geo-fences around traffic signals to identify the trigger points for priority requests and cancellation of priority requests. The size of the geo-fence is configurable depending upon the conditions on the approach to each signal. The geo-fences must be configured within the CCMS
- When a bus is behind schedule, and reaches a predefined point in advance of specifically configured traffic signals, the on board unit is able to initiate a bus priority call, via the RTPI central server, and the server to server interface to the SCATS UTC system
- The system will generate unique traffic signal priority requests in real time. For all vehicles running late against schedule, a priority request on approach to configured junctions will be made
- Traffic signal priority may not be provided at all SCATS controlled junctions. For junctions where SCATS may grant priority then, for all vehicles running late against schedule, a priority request on approach to the junction will be made from the RTPI central server via this interface
- All traffic signal priority requests will be logged such that they can be used to validate both the AVL system itself and for subsequent SCATS performance evaluation
- When a vehicle enters a Traffic Signal Priority request geo-fence, that message will be communicated to the SCATS server, within 2 seconds at least 97% of the time.

10.2 Detailed Specification

A detailed specification for the SCATS interface and traffic signal priority system can be found within Vix document GS4827 SCATS TLP Controller Functional Specification.

It is assumed that WCC will utilise SCATS version 6.6.2 for this system.

11 COMMUNICATIONS SYSTEM

11.1 Introduction

The communications system covers the data radio communications with vehicles and signs and also the fixed links connecting these radio systems to the central servers. The main BusNet communications system used for this contract is GPRS. A schematic of the communications system modules is shown in figure 6 below: -

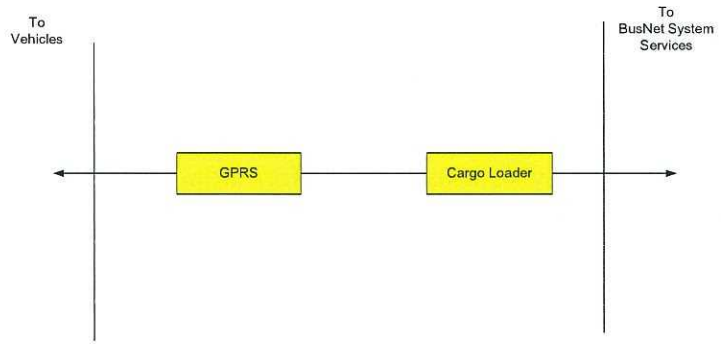


Figure 6 – Communication Systems Module Schematic

11.2 Communications Procedure

GWRC vehicles transmit and receive via this communications network. GPS derived bus positional data and service data is then received via a Virtual Private Network (VPN) Digital Subscriber Line (DSL) connection to the Vix hosted web servers within New Zealand. This bus data is then processed by various Vix applications to provide either predictions of bus arrival times or, where no bus data is received, a scheduled departure time. The predictions, schedules, schedule compliance data is then made available to web based Vix products sited at GWRC and/or the individual bus operators facilities, via Transmission Control Protocol (TCP)/Internet Protocol (IP) connections. The prediction algorithms used within the Vix web based applications are intelligent so that they quickly learn routes and compensate for delays etc fully automatically.

Every vehicle that is tracked is equipped with an onboard computer unit that includes a receiver that monitors the US military satellites that are part of the GPS. The GPS derived positions, along with other system data are then transmitted at set time intervals via the onboard GPRS modem as described above to the Vix web site.

The compacted vehicle message contains the following information:

- Unique Vehicle Identification Code
- Service Information (decoded from Tables stored within the On Vehicle Computer's configuration)
- Vehicle Position
- Current Heading of the Vehicle
- GPS Position Condition Status

The vehicles transmitting this data have a nominal transmission update rate of no more than 30 seconds. The periodic update rate is however configurable and depends on several factors.

There is sufficient information within the bus message to enable the intelligent knowledge based prediction software to compute the arrival of relevant vehicles. The prediction software is located on a server at the Kordia server hosting facility.

11.3 Central Control & Monitoring System (CCMS)

11.3.1 Introduction

The main CCMS Server provides the interface to the BusNet system. The basic functional characteristics are as follows: -

- Receipt, recording and storage of AVL data
- Processing of AVL data to produce journey time and arrival predictions
- Transmission of updates to on-street displays
- Transmission of traffic signal priority requests to the UTC system
- Transmission of updated RTPI data to the Metlink service centre
- Configuration and data management
- Data archiving
- Real time and off line report generation

Diagrams of the system architecture are shown in Figures 1 and 2 earlier in this document.

Figure 2 shows the Central System design as installed for Wellington. Essentially, schedule and static data is held in the SQL Server, AVL data comes into the system through the Data Loader and Cargo Loader Server. This is then processed by the Service monitoring 2/Prediction generator server. The subsequent Real Time Data is then distributed to the various recipients through the other servers: -

- KUPE and SCATS through the SMS/Server To Server
- Displays through the GPRS 2/IBIS Sign server
- Operator/GWRC terminals and web through the 'Horizon' server
- Finally, all data received by the system is stored on the SQL server.

Historical reporting is facilitated by converting the stored AVL data and processing it into OLAP cubes. These can then be used to create historical reports from the data in a very flexible way, using OLAP cube viewing software.

11.3.2 Hosting

Vix are using a hosting facility within New Zealand for all CCMS requirements. This facility offers the following facilities: -

- Network neutral Internet data center (IDC) with secure co-location space.
- Security and Accessibility: The location has card-controlled access, monitored alarms and video surveillance which is digitally recorded. Security notwithstanding, the SiteNET IDC is freely accessible 24x7 to allow critical operations to take place
- Uninterruptible Power and Climate Control is fundamental for co-location. The SiteNET location has redundant cooling systems and UPS and generator back-up
- Connectivity is unparalleled for this location because of its accessibility to the New Zealand domestic peering exchanges. This has allowed the solution to use diverse fibre connectivity to the Kordia network, providing guaranteed bandwidth and high reliability
- Neutral Bandwidth is available at the IDC. Because this location is carrier neutral there is the freedom to choose the bandwidth solutions that best meet the requirements.
- UPS: Room UPS
- Generator back up: Building Generator
- Environmental: Air Conditioning Dual units, 22°C ±3°,
- Fire Monitoring: Smoke Detectors
- Fire Suppression: Building Sprinklers
- Access: 24x7 Monitored card access system to building and IDC
- Rack Security: Customer provided lock
- Surveillance: Video Surveillance DVR

11.3.3 Communication Methods

The following communications systems have been deployed for the system: -

- Vehicle – Central System: AVL information which will utilise GPRS using TCP/IP and UDP communications; Configuration upload and logging downloads utilise depot based WLAN using TCP/IP protocols, with GPRS as a fall-back solution. The communications from the Central System to the GPRS system APN use a Private LAN (fibre) connection

- Central System - On-Street Displays will utilise GPRS using TCP/IP and UDP communications. The communications from the Central System to the GPRS system APN uses a Private LAN (fibre) connection
- Central System – Operator Consoles: These utilise a Central System Internet connection and an ADSL connection at the Operator depot.
- Central System to 3rd party systems: These utilise the Central System Internet connection and DSL connections at the 3rd party end to form a VPN using Vix supplied and configured VPN appliances at each end

11.3.4 Data Volumes

The anticipated data volumes from each wireless device is as follows: -

In Vehicle System: -

Message size	11 bytes (max)
Network provider message overhead	28 bytes
Messages /month approx (2 /min, 18 hours/day for 30 days (2x60x18x30)	64,800
Theoretical data sent	2.5Mb bytes
Anticipated Network provider minimum billing message size	128 bytes
Theoretical billed data sent per month	8.2Mb

The value we experience in practice is normally 7Mb, since the vehicles rarely operate continuously for 18 hour periods.

The displays are more complicated to analyse, but in practice, across the 1,500 displays working on GPRS using our GPRS2 protocol, the average data use is 5Mb per month.

11.3.5 Data Ownership

All information generated by the RTPI system including bus vehicle location data and subsequent generated at-stop predictions are considered to be the intellectual property of GWRC. GWRC reserves the right to distribute this data and information either free of charge or at cost to third parties. All generated at stop predictions and passenger information messages must be available for distribution at no extra cost via all specified stop-centric server-to-server links.

11.4 System Security and Backup Facilities

Security to the Vix Central Servers is provided by a number of different facilities:

- Firewalls are used to provide access control so that access is limited to applications and services to systems that require access
- Anti-virus protection is provided on all Windows based servers to provide protection from Trojans and virus
- Linux Systems are protected by using scanning tools to detect any programs/services that should not be running on the servers

Backups for the Central Servers are provided by Vix. These are scheduled to run at different intervals depending on the services being provided.

Monitoring software is used to make sure that systems are running and automatically alert the product support team should a failure occur on one of the services or servers.

11.5 BusNet Workstations

The BusNet workstations are located at the GWRC offices, and also at each individual bus operator's facilities. These enable users to manage, operate and monitor the vehicle tracking system.

The minimum specification for the hardware provided is:

- 2.6 GHz processor
- 2 x USB ports
- 1 GB RAM
- Dual 10GB Hard disk
- RAID 0 Controller
- CD/DVD-RW.
- 10/100Mbit/sec internal network adaptor
- 17 inch TFT three screen display & Mouse + keyboard.

The software supplied by Vix for the BusNet workstations is:

- *Horizon*
- *Vehicle Viewer*
- *Operator Reports*

11.5.1 Required Services

It is the responsibility of GWRC and/or the individual bus operators to provide and maintain the necessary mains power and communications links for these work stations.

The communications requirements are ADSL broadband connectivity, with a static IP address also required.

11.6 Cargo loader

Cargo Loader supports bi-directional connections. It allows a limited amount of back communication only when this is necessary for it to function at all. The following types of connection are supported: -

- GPRS vehicle. Multiple connections within a site and multiple sites. Sends out time sync, base ref and net ref messages once, after connection. Also bus and On Vehicle Display (OVD) messages
- GPRS sign. On connection, a time sync is sent out followed by messages containing tilde strings
- Data group products. Connection is unidirectional via Cargo Loader from the data group product.

11.7 Server-to-Server Link

The Server-to-Server Link is a Real Time Information Group (RTIG) compliant web service that provides stop centric information (stop predictions). It is a java program that runs on many platforms. Server-to-Server Link operates under Debian Linux.

Requests and responses to and from Server-to-Server Link adhere to a Trident compliant Extensible Mark Up Language (XML) protocol for the RTIG suppliers' group.

Server-to-Server Link consists of two parts: web service and application part. Web service part runs as Apache Axis service under Apache Tomcat while application part runs as a system service. The purpose of the web service part is to accept the requests and pass them to application part, which will then do the all the processing.

The XML is the universal format for structured documents (e.g. spreadsheets, configuration parameters) and data on the Web. XML is a set of rules or conventions for designing text formats that let you structure your data. It makes it easy for a computer to generate data, read data and ensure that the data structure is unambiguous.

Refer to Vix RTIG API Specification (Vix document GS0659) for details of the RTIG Server-to-Server XML schema.

12 CONFIGURATION

12.1 Introduction

The configuration process consists of gathering data from operators and local authorities, which is used to produce a Structured Query Language (SQL) database for the system. Output files are then generated to configure the components of the BusNet system as necessary.

12.2 Process

The data requirements of the Vix system are highlighted to the data supplier who will ensure that the relevant fields are correctly populated in the data source, which can be TransXchange (TXC), ATCO or ACIS 3 Spreadsheet.

Vix will import the data supplied into a SQL database, if there are no errors with the structure of the data. The network and timetable data will be filtered out across the BusNet system.

12.3 Data Responsibilities

It is the responsibility of GWRC, under the terms of the existing contract, to provide Vix with the necessary data to configure the vehicles in the required format.

The following figures 7, 8 & 9 represent pragmatic flow charts for the data:

12.4 Data Import

The data import process for the Central Data is shown in the following diagram.

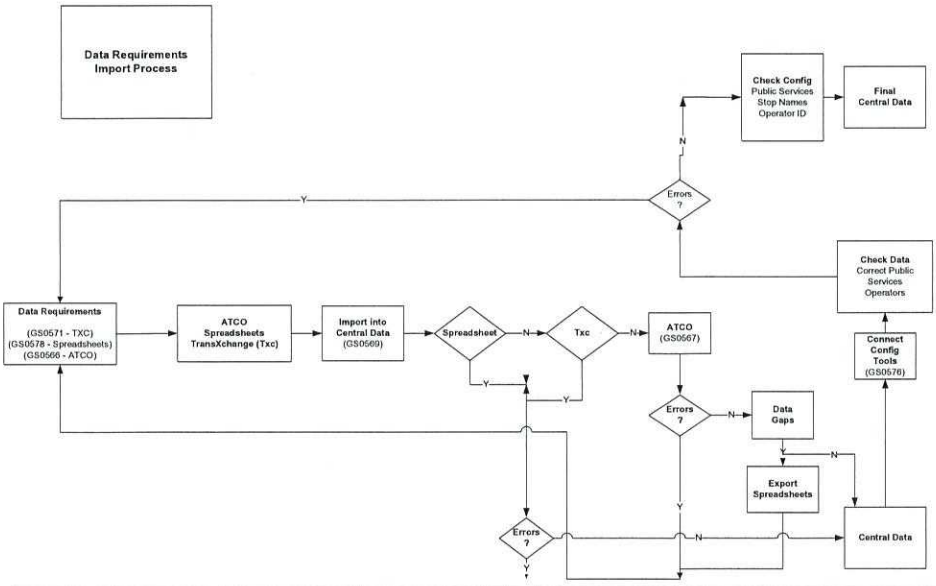


Figure 7 – Central Data Configuration Process

The data import process for each vehicle is shown in the following diagram. The GWRC – RTPI system uses RCB (Reduced Configuration Bus). The result of this will be that the vehicle only needs a new file if a new service is added to the system. Normal timetable changes will just require a central update.

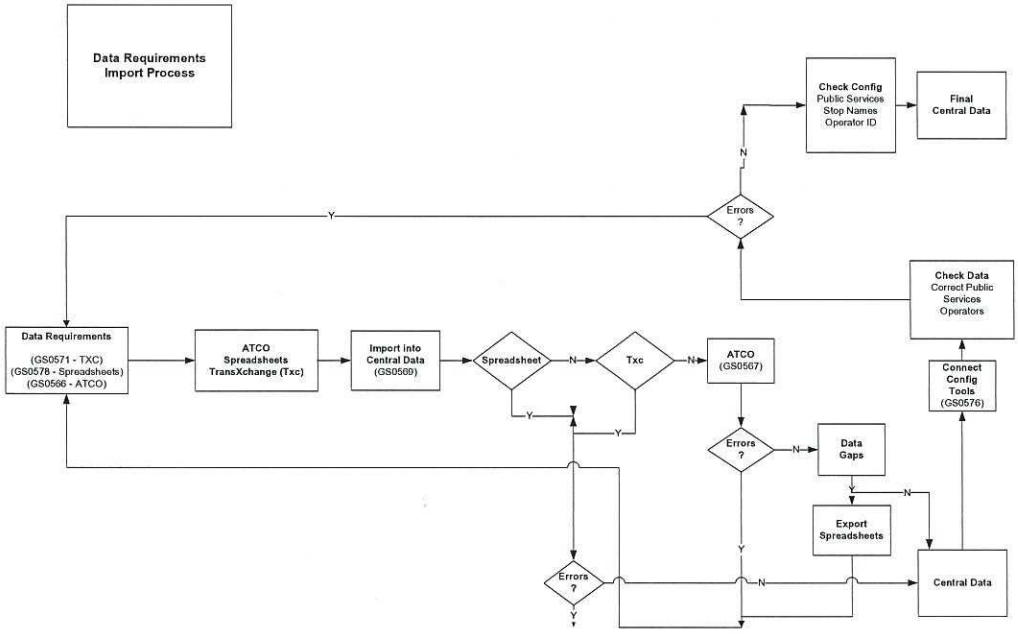


Figure 8 - Vehicle Configuration

The data import process for Vehicle Viewer configuration is shown in the following diagram.

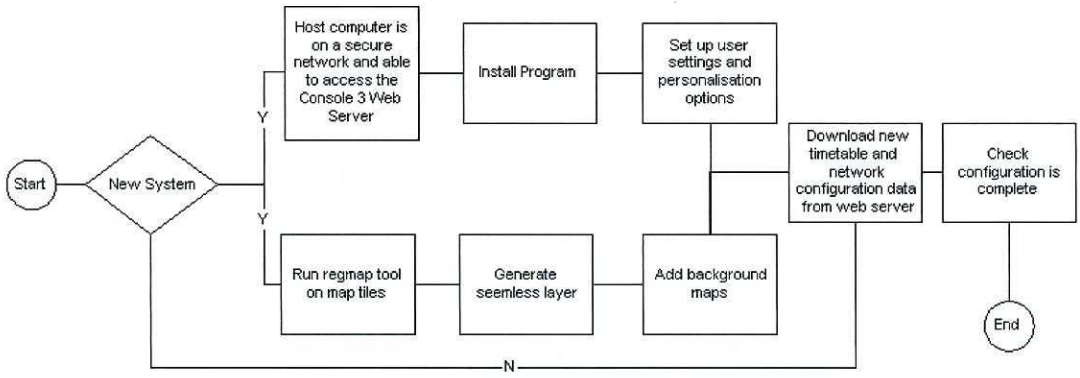


Figure 9 - Vehicle Viewer Configuration

Note: Bracketed numbers refer to Vix General Specification documents.

13 BUSNET SYSTEM SERVICES

13.1 Introduction

A schematic of the BusNet system services modules is shown below: -

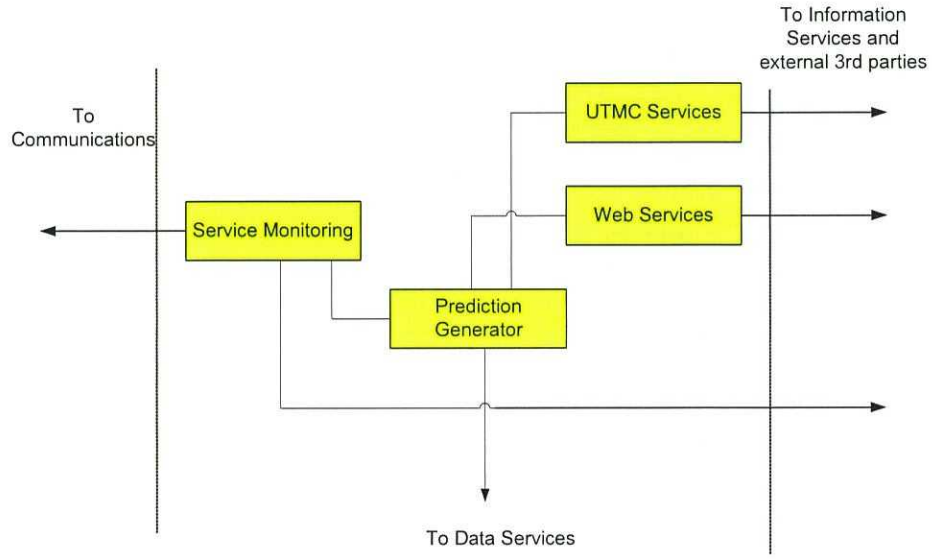


Figure 10 – BusNet System Services Schematic

13.2 Service Monitoring 2

As data flows through the BusNet system it ends up being delivered in the form of positional messages about individual vehicles. This raw information needs to be processed and turned into useful reports for local authorities and operators to view and action. Service Monitoring 2 facilitates the collection, processing and delivery of the information required.

Service Monitoring 2 keeps track of bus movements, establishes if the vehicles are on a journey, compares them to the schedule and keeps an up-to-date record of their current status. It records information on vehicles arriving and departing from stops along the journey. Service Monitoring 2 also creates an internal model of the system network to allow constant monitoring of current link times.

Service Monitoring 2 is a Windows application written in C++. The main functions are as follows:

- Create multiple connections to Cargo Loader and receive binary data feeds from each connected system
- Convert positional information from local grid based co-ordinates to latitude/longitude and national co-ordinate system positions
- Monitor vehicles and match them to scheduled journeys
- Calculate arrival and departure times from stops
- Calculate schedule deviation for each vehicle
- Calculate link time information for the system network
- Provide a standard XML output feed allowing multiple applications to connect to it

An architecture schematic is shown in Figure 11 below.

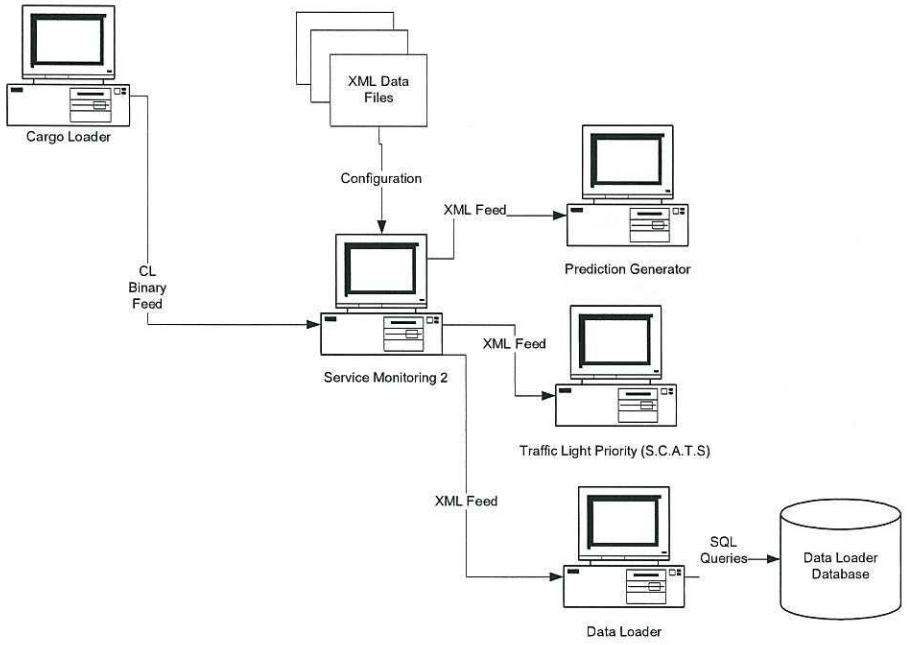


Figure 11 - Service Monitoring Architecture

Refer to XML Specification for Schedule Data (Vix document GS0564), XML Specification for the output from Service Monitoring (Vix document GS0668) and Service Monitoring 2 Installation, Configuration and User Guide (Vix document GS0680) for detailed specifications and guide.

13.3 Prediction Generator

As data flows through the BusNet system it ends up being delivered in the form of positional messages about individual vehicles. This raw information needs to be processed and turned into useful reports for local authorities and operators to view and action. Service Monitoring 2 collects the information, processes it and passes it on to Prediction Generator.

Prediction Generator is an application that makes predictions regarding when vehicles will arrive at bus stops along the route.

The main functions of Prediction Generator are as follows:

- Interfacing with data input
- Calculating vehicle arrival times
- Calculating Schedule times

13.4 Cross Journey Predictions

If provided with Running Board information the central servers can be configured to provide Cross Journey Prediction (CJP) information. At the beginning of each operating day, (3am to

3am the next day), once a vehicle is allocated to a journey it will also be allocated to that journey's associated Running Board.

When a vehicle has been allocated to a Running Board it will then be possible to predict for the vehicle's future journey based on the vehicle's progress on its current journey. These calculated predictions are then broadcast over the PMR radio system and decoded by the relevant displays, which are displayed as predictions. Once the journey, which has generated the CJP, has started, the display will then revert back to the normal mode of prediction. However, to the public, the changeover will be transparent with no noticeable difference between a CJP and a current journey prediction.

The prediction itself is calculated taking into account any layover periods between the vehicles current journey and the planned future journey (with the cross journey prediction). Therefore if the vehicle is late by a larger amount of time then the scheduled layover period it will be assumed that the vehicle will not stop for the layover and continue on to the next journey as soon as its current journey has been completed.

If at any point a vehicle moves onto a journey not on its configured Running Board the servers will lose confidence in this vehicle's Running Board and so not provide cross journey predictions for that vehicle. The servers will then try and match the vehicle to a new Running Board. By monitoring the vehicle's next few journeys the server can build confidence the vehicle has switched to a new Running Board. Once a vehicle has been seen to stay on the new Running Board for a configurable number of consecutive journeys the server will then begin to output CJP information to the displays. This helps solve the problem where a vehicle switches Running Board for an odd journey.

13.5 Vix Messenger

Vix Messenger provides a comprehensive text communication system for the entire real time system: BusNet. The Web based service allows users to send text messages to any bus stop displays or vehicle, Web, SMS via PMR, GPRS or Internet. This functionality is contained within the Horizon software application package.

14 DATA SERVICES

A schematic of the data services modules is shown below:

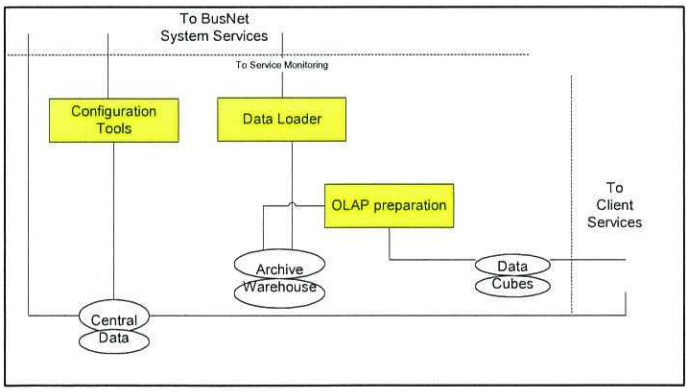


Figure 12 – Data Services Schematic

14.1. Central Data

Central Data is a database per system that contains the schedules and other data required by BusNet.

14.2 Data Management Suite

The *Data Management Suite* is split between 3 functions: importing, editing and exporting. The importer reads in the service and schedule data required by *BusNet,* checking for schema compliance and potential data issues into the *BusNet Central Data* database. The editor allows the user to amend any aspect of service data and remove duplication from the schedule data. The exporters will then provide the data to the real time aspects of *BusNet* and also to source data so that any changes can be re-used.

14.3 Configuration Tools

Configuration Tools is split between 3 functions: importing (BusNet Data Importer), editing (Busnet Data Analyser) and exporting (BusNet Data Exporter). The importer reads in the service and schedule data required by BusNet, checking for schema compliance and potential data issues into the BusNet Central Data database. The editor allows the user to amend any aspect of service data and remove duplication from the schedule data. The exporters will then provide the data to the real time aspects of BusNet and also to source data so that any changes can be re-used.
Note: It is the responsibility of Vix to maintain the process for data import/export and creating any new configuration files for uploading to the system. The initial data is to be provided by GWRC, and Vix and GWRC shall work together to ensure the required accuracy of content is achieved.

14.4 Data Loader

Data Loader connects to the XML Data Feeds from Service Monitoring 2. The application passes this information and stores data on vehicle runs and arrival/departure times in the Data Loader database. This data is processed and stored in the Archive Warehouse.

Refer to Data Loader Installation, Configuration and User Guide (VIX document GS0726) for a detailed guide.

14.5 Archive Warehouse

The Archive Warehouse is a database designed to hold archive data. This data includes the output from Service Monitoring 2 on vehicle arrivals at bus stops and on system monitoring functions.

14.6 Data Cubes

Data Cubes contain the data in a form that can be readily accessed by the reporting applications specified in Section 16, Bus Operator Information Services.

A Cube Preparation Module prepares data for use in reports, storing its output in the Data Cubes.

14.7 OLAP

OLAP or On-Line Analytical Processing refers to the set of hardware, software and tools that are used to store data in a multidimensional environment. It gives users the opportunity to slice and dice the data and also drill down and up to respectively move from high levels of consolidations to lower details and vice versa.

OLAP systems provide information that is timely, accurate, complete and easily understood. Like the Dimensional Model, an OLAP system also contains Measures (numeric facts) and Dimensions (textural attributes).

15. SYSTEM MANAGEMENT INFORMATION SERVICES

15.1 Introduction

A system management information service continually monitors the performance of the Vix BusNet installed equipment.

Vix System Monitoring provides engineers with reports and alerts for when one of the Vix products is faulty. The System Monitoring provides fault reporting for vehicles, communications, network infrastructure, servers and applications.

15.2 System Monitoring

The Vix products consist of remote items located street side, equipment fitted to buses, network links and phone lines and servers with component applications running. To make the fault reporting system simple to understand it has been split down into five basic components:

- Vehicles
- Passenger information Signs
- Communications
- Network & infrastructure
- Servers & applications

The following is a diagrammatic representation of the System Monitoring system:

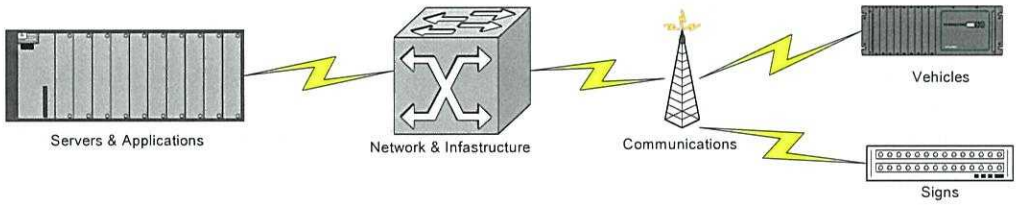


Figure 13 – System Monitoring Schematic

The reliability of the communications system will be monitored by the system monitoring application on the Central System. This involves both sending 'heartbeat' messages to the central system to check that communications are active and also by devices reporting in their configuration and software status so that the central System can check that schedule file and other configuration data has been received successfully by individual devices.

Below is a short description of the reporting capabilities.

15.3 Vehicles

System Monitoring will detect failures for the vital links and hardware on the vehicle that would have a detrimental effect on the availability of real time information.

15.4 Passenger Information Signs

System Monitoring detects failures in the Sign computer and radio modem that is used in generating real time information regarding the predicted departure information of forthcoming vehicles.

15.5 Communications

The Vix communications infrastructure provides a mechanism for the Vix Central System to communicate with Vehicles and Signs.

15.6 Network & Infrastructure

The Vix network and infrastructure provides the servers and workstations with the necessary links to communicate effectively. System Monitoring continually monitors the links that are in place and reports to the Vix engineers of any failures.

15.7 Servers & Applications

The Vix servers and applications provide the data, business and client logic required to deliver the Vix product range. System Monitoring continually monitors the servers & applications that are in place and reports to the Vix engineers of any failures.

Refer to the System Monitoring 3 Product Specification contained within Appendix 6 for a detailed specification.

16. BUS OPERATOR INFORMATION SERVICES

16.1 Introduction

Bus Operator Information Services covers various services that deliver both real time and historical information to the bus operator. The three main applications functions are:

- Vehicle Viewer. This Console is suitable for use with GPRS and is able to operate with large systems
- Horizon. Provides traffic managers with a view of the current status of their services
- Operator Reports. These allow the operator to analyse data over a period of time, in a variety of ways.

A schematic of the bus operator information services modules is shown below:

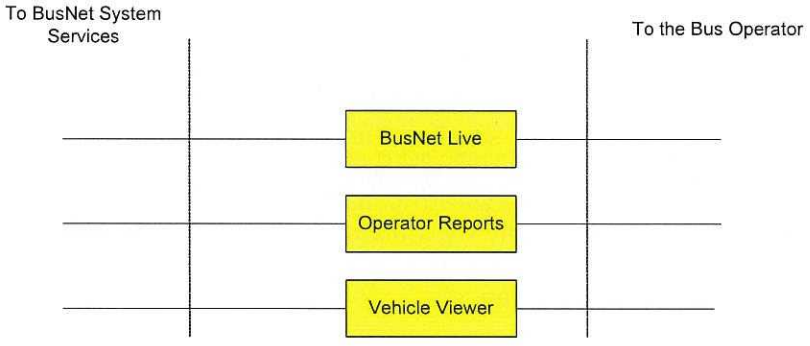


Figure 14 – BusNet System Services Schematic

16.2 Vehicle Viewer

Vehicle Viewer is the Vix primary application to display information about bus location, provide remote configuration and control of on-vehicle equipment and on street displays and facilitate text messaging to the on-vehicle units.

Vehicle Viewer displays BusNet information in a graphical friendly way. The main functions are as follows:

- Display vehicle icons based on their real time position
- Display virtual stop real time predictions and scheduled data
- Provide views into static data
- Provide real time event based management
- Replay historical data

Vehicle Viewer is a locally installed tool, requiring Internet access through which Vix servers send data. This data is then processed locally on Vehicle Viewer. As part of the Horizon suite of products an ADSL line is to be installed at each terminal location. The Vehicle Viewer product is a web based application accessed from the workstations and will use the Internet data to display buses on a GIS console.

Refer to the Vehicle Viewer Product Specification contained within Appendix 7 for additional information.

16.3 Horizon

Horizon is a web-based application used to monitor bus services in real time. It works on the basis that each bus is constantly reporting its position and that the system will update at least every 30 seconds. The system operates through a number of interlinking screens or sets of data that can be analysed individually or at the same time. Links enable the user to navigate through the system.

Horizon is primarily a tool to assist supervisors who have responsibility for service supervision, often away from the point of service.

Horizon provides the following information:

- Bus positions can be automatically viewed on the workstation
- The information associated with each bus icon shows the fleet number and service the bus is currently running
- A bus operator will only be able to see his own buses

The above information can be configured by the operator to provide:

- Vehicle Schedule Variations-Vehicle Lateness
- Vehicle Schedule Variations-Vehicle Earliness
- Public Service Overview
- Service Compliance
- Vehicle Not On Service
- Diagrammatic Map
- Public Service (Day View)
- Vehicle window
- Journeys Not Being Monitored
- Journey On Running Board

Refer to the BusNet Live Product Specification contained within Appendix 8 for additional information.

16.4 Operator Reports

Operator Reports allow the operator to analyse total service performance over a period of time, in a variety of ways. This is done through a series of easy to understand reports. The server application of Operator Reports is a centrally deployed module that allows many clients to connect to it. Once a client has connected, the server will send back information about features that can be displayed on a series of web pages.

A real time data flow diagram is shown below.

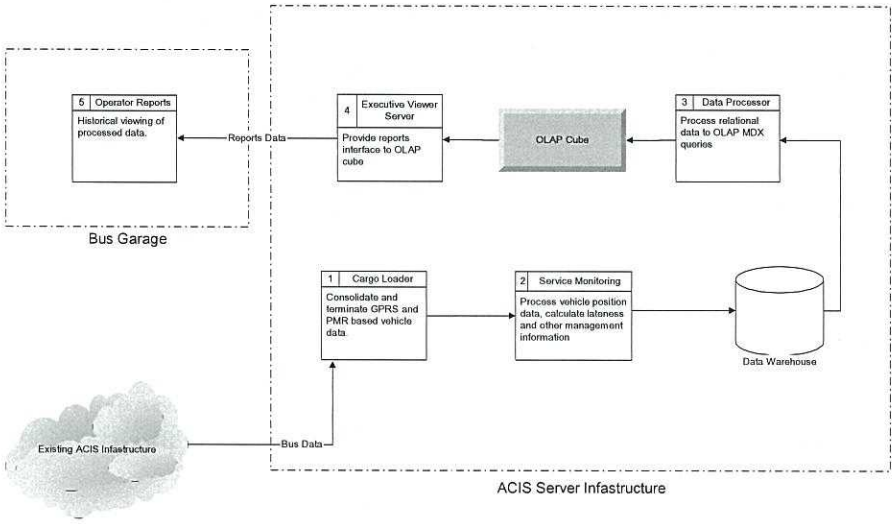


Figure 15 – Real Time Data Flow Diagram

The application comprises single web browser windows with the report viewer application embedded in the browser. The windows contain information about a specific feature in tabular or diagrammatic format. Screens include geographical information, an information feature table, an event viewer and other smaller widows.

The data dimensions for reporting on are as follows:

- Clock
- Running Board
- Variation Category
- Journey Ref
- Service Stop
- Direction
- Stop Category
- Vehicle
- Period 1, 2 & 3
- Day
- Driver
- Stop Sequence
- Stop Type
- Operator
- Stops Matched
- Journey
- Time Category
- Stop
- Service
- Calendar

Any dimension can be filtered to show one, some or all the data. The data will be available for at least one year.

The Vix system monitors processes and captures service data in real time. This data is further processed and stored in to a MS SQL Server Analysis Services OLAP database. Vix will create an additional system export component for the export of data. This component will then export the data from the Vix OLAP database in to the Trapeze system on a snapshot basis.

Refer to the Operator Reports Product Specification contained within Appendix 9 for additional information.

17. BUS OPERATOR INFORMATION SERVICES

17.1 Metlink

17.1.1 Introduction

Metlink is a functional part of GWRC that provides service schedule and journey planning services to the public through Metlink (www.metlink.co.nz). These services are delivered through call centre, Internet and SMS channels, and are provided and supported by Trapeze systems.

The RTPI system provides updated arrival time estimates to the Metlink systems via a SIRI XML interface.

17.2 KUPE

17.2.1 Introduction

KUPE is the AVL system developed for New Zealand Trains by ONTRACK. GWRC require an interface between this system and the RTI system in order to display train arrival and departure information on the RTI displays being procured by GWRC.

17.1.1 System Design

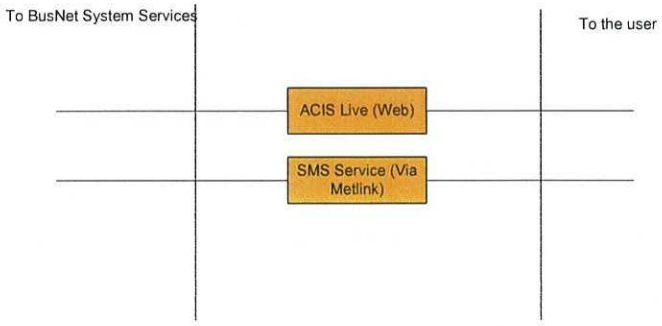
Vix will provide a detailed specification for this interface once all requirements are agreed with GWRC and ONTRACK. Summary details of how this interface links into the overall system can be found in earlier sections of this document.

It is expected that the required interface will be SIRI XML compliant.

18 PUBLIC INFORMATION SERVICES

18.1 Introduction

A schematic of the bus operator information services modules is shown below:



18.2 Customised Web Site

Vix have provided a S2S interface to the existing GWRC Metlink Website to provide all required RTPI prediction information.

18.3 SMS

Vix have provided a S2S interface to the existing GWRC Metlink SMS service to provide all required RTPI prediction information.

19 WARRANTY

Vix will provide a 12-month warranty from the SAT or System Takeover date detailed within the project plan or a 12-month warranty from the date of installation which ever is reached first.

During the warranty Vix will rectify all faults that are attributable to the quality of our product and workmanship. The warranty excludes faults that are outside of our control, for example due to vandalism etc.

20. DOCUMENTATION

Vix will supply the following documents to Greater Wellington Regional Council: -

Description	Deliverable
Project Inception Meeting Notes	Y
Project Initiation Document (PID)	Y
Project Highlight Reports	Y
Minutes of regular project meetings	Y
Functional System Specification (FSS)	Y
Final Work Programme (FWP)	Y
Risk Management Plan (RMP)	
Configuration Data Specification (CDS)	Y
Factory Acceptance Test (FAT) Specifications	Y
Site Acceptance Test (SAT) Specifications	Y
Factory Acceptance Test (FAT) Results	Y
Site Acceptance Test (SAT) Results	Y
Notes of technical meetings	Y
System Operation Manual –Incorporating Fleet Management System Manual	Y
Maintenance and Service Manual	Y
Operator web interface fleet management tool – Operation and Software Manual	Y
Fleet Management System - Hardware Manual	Y
Fleet Management System- Software Manual	Y
System Hardware Manual (incorporating Fleet Management Hardware manual)	Y
System Software Manual (incorporating Fleet Management Hardware manual)	Y
Project Plan, reviewed and updated regularly	Y
Fault Reporting System Manual	Y
Vehicle Method Statements	Y
Safety Management Plan Material	Y
Depot Site Files	Y
As Built Drawings	Y
Master Record Index (MRI)	Y
User Manuals	Y

21. TESTING AND COMMISSIONING PROCEDURES

The completion and acceptance testing of a BusNet System is both complex and time-consuming. In order to ensure that all the testing is carried out within the timescale required, the testing is carried out at various test points throughout the contract. The key stages and test points are highlighted below:

1. Agreement of the Final System Specification. This is important as all the subsequent testing is designed to test to this specification
2. Pre-Factory Acceptance Testing (PFAT). This can take place for all the defined task divisions simultaneously, or there may be a PFAT for individual tasks. The PFAT may be or may not be witnessed by the Client. It is expected that the client will not witness the PFAT tests.
3. Factory Acceptance Testing (FAT). This can take place for all the defined task divisions simultaneously, or there may be a FAT for individual tasks. The FAT may be or may not be witnessed by the Client. It is expected that the client will witness the FAT tests.
4. Individual commissioning tests. All equipment when installed must be accompanied by the requisite equipment test and commissioning sheet. These are collated and logged into the Master Record Index by the project engineer
5. Site Acceptance testing (SAT). This is the final global project testing which tests the operation of the whole system, with all the individual tests having been completed for all the individual pieces of equipment earlier in the project. Key final test at this stage is a test of the Contract Document Handover Pack to ensure that all the relevant documentation is provided. The SAT will be witnessed by the client.
6. Vix Master Record Index (MRI). The MRI is updated with every order. It will be issued to the Client at the end of the contract

Of the above items 1 to 5, although they following common methodologies, they are specific to the contract to which they will apply. These are carried out during the project in accordance with agreed test schedules which are deliverable documents agreed with the customer and as such form part of this quality plan as and when they are produced, and the issue recorded in this quality plan.

All the equipment covered under item 4 above has a defined procedure for the completion of each commissioning exercise. This documentation is defined in the Vix quality manual and all forms are controlled forms.

Note: The agreed Acceptance Testing plan is defined within contract PT0073, Schedule 10.

22. DOCUMENT ACCEPTANCE

The above document clearly represents the required contracted work completed by Vix.

Signed: ..... GWRC

Print: David Gunham

Date: 26 June 2012

Job Title: CEO

Signed: VIX

Print: ANTHONY BURGESS

Date: 27TH June 2012

Job Title: Head of Project Management

APPENDIX 1 – GPRS PRODUCT SPECIFICATION GS2346

APPENDIX 2 – PRODUCT SPECIFICATION FOR DT330 ON-VEHICLE COMPUTER

APPENDIX 3 – SHANNON ON STREET DISPLAY PRODUCT SPECIFICATION

APPENDIX 4 – BANN ON STREET DISPLAY PRODUCT SPECIFICATION

APPENDIX 5 – WEY 9 LINE SUMMARY BOARD DISPLAY PRODUCT SPECIFICATION

APPENDIX 6 – SYSTEM MONITORING 3 PRODUCT SPECIFICATION

APPENDIX 7 – VEHICLE VIEWER PRODUCT SPECIFICATION

APPENDIX 8 – HORIZON PRODUCT SPECIFICATION

GPRS Communications

ACIS BusNet systems can use commercially available GPRS communications systems to convey BusNet data between the central computers, vehicles and displays. The General Packet Radio Service (GPRS) is a proven means for packet data transmission across digital cellular GSM networks, having been developed by the European Telecommunications Standards Institute (ETSI) as an integral part of the GSM specifications and is widely adopted worldwide.

Features

- Up to 48 kbps data transfer capability
- Uses commercially available cellular network
- ACIS developed improved compression algorithms
- Configuration is set as part of system set-up
- Quad-band radio operation
- Uses long established standards
- Optional voice calls

Benefits

- ✓ Faster download speed than PMR systems
- ✓ No dedicated PMR system that has to be set up
- ✓ Over 50% lower monthly costs with GPRS2 compared to GPRS1
- ✓ Fast system set-up
- ✓ Worldwide operation
- ✓ Low-risk, proven technology
- ✓ Make and receive voice calls via GSM system

User features

There is no need for direct user interaction with the GPRS service. The system acts as a channel over which packet data transfers are made in real time.

Configuration

The vehicles and displays are fitted with GPRS radio modules. In order for the radio modules to operate on the commercial GSM network they are fitted with Subscriber Identity Module (SIM) cards for the operator's network. The SIM cards contain the necessary information to allow the operator to identify the GPRS module; this is the same function that a SIM card performs within a cellular telephone.

The SIM requires the correct information to ensure that the data from the GPRS module is sent to the ACIS servers. This is achieved by setting the Access Point Name (APN). The APN needs to be set for the system; each vehicle and display with a GPRS module has a configuration file that contains the GPRS settings including the APN.

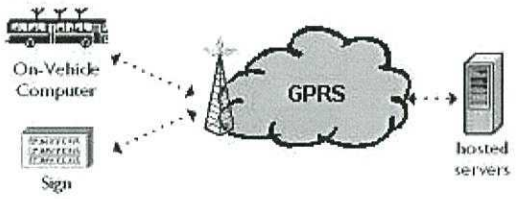
Monthly Billing

Unlike PMR systems there is no dedicated radio network that has to be set up; the GPRS system is a public service made available by the cellular operators. The service is charged for as a subscription, with the exact cost per month being determined by the amount of data that is transmitted.

GPRS has the advantage of lower set-up costs and can be deployed quicker than a PMR system, but has a per month operational cost.

Operational Features

Architecture: The GPRS radio system is used to pass data between the different components of the BusNet system. It provides the wireless communications between the vehicles and displays and the central servers



Outline Architecture for GPRS Systems

The data that is transferred between the vehicles and displays and the central servers is primarily the real time information related to the vehicle journey tracking and the associated predictions. The volume of this data is small and thus the associated running costs are low.

The GPRS radio system is also used for system updates, such as downloading new schedule information to the displays. Whilst this data is more volumous than the real time updates, the frequency of such downloads is low, thus the associated running cost is low.

Being sensitive to the issue of running costs, ACIS have introduced an upgrade from GPRS1 by means of compressing data for its newer displays, thus reducing the running costs further. This system is called GPRS2 and requires a greater processing power in the display.

Product Specification

BUSNET

Detailed system specification

Description: GPRS Radio Communications

Product Code: GPRS 1 & GPRS2

Data Transfer Rates

GPRS Class 10 modules on vehicles and in displays:

Configurable between 8 – 12 kbps uplink and 32 – 48 kbps downlink

or 16 – 24 kbps uplink and 24 – 36 kbps downlink

Radio Frequency Operation

Worldwide operation

Quad band, GSM 850/900 MHz power class 4 (33dBm)

GSM 1800/1900 MHz power class 1 (30 dBm)

Mobile class B operation; can receive text messaging whilst operating in GPRS mode.

3GPP release 99 protocol operation

Antennas

Combined GPRS and GPS for vehicles,

Separate GPRS and GPS for vehicles (if required)

GPRS only antennas for displays

Other Products part of the GPRS system

See DT126 GPRS On-Board computer product specification

See displays: Alphatrak-GPRS1 or Linux GPRS2 display processors

See Hosting Product Specification.

System requirements

The GPRS radio system must be installed as part of an ACIS BusNet system that provides real time passenger transport information. The hardware and software components are delivered complete, ready for on-site installation.

Sales details

Product options: The ACIS Communications Team selects the actual components and configurations to deliver a system that is suitable for a customer's needs.

Installation: ACIS uses specially trained staff to install the radio modules as part of the on-vehicle and display installation. The installation includes the correct locating of the antennas in order to ensure that the radio coverage requirements are met.

Licensing: There are no specific licencing requirements for this product. The radio frequency licences are owned by the network operator, to whom subscription fees are payable. Licences for the intellectual property used within the GPRS radio modules are paid for in the purchase cost of those radio modules. Licences for third-party software used in the radio system components are included in the purchase of the product.

Documentation packs: The documentation covering the installation and configuration of the GPRS radio modules is included within the user documentation that is provided for each of the products or components that use the GPRS radio modules, e.g. DT126 On-Vehicle Computer and Rivelin display.

Training modules: Full user training for non-technical users is available.

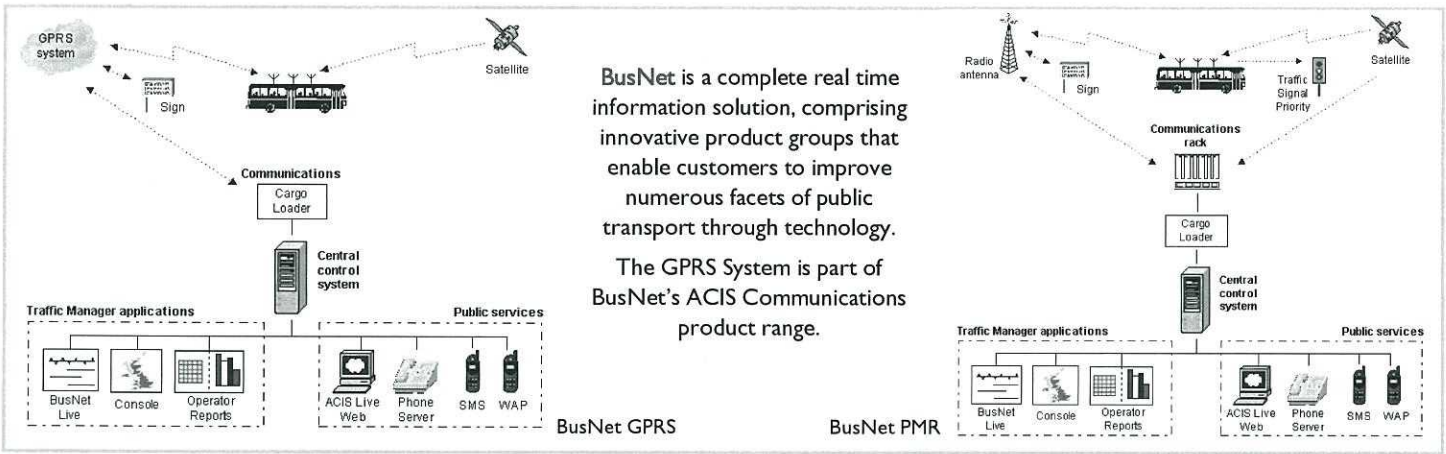
Client responsibilities: The client is responsible for the purchase of and useage costs of GPRS SIM modules, APN and voice calls.

Where required the client is also responsible for the set-up and running costs of SMS text numbers and aggregator costs as they occur.

Post-sales support

Warranty: All licenced BusNet installations come with a 12-month ACIS Support warranty.

Maintenance: At the end of the warranty period, an optional ACIS maintenance contract is available for purchase.



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Fax +44 (0)1223 641678

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Netherlands
Tel +31 3562 81515
Fax +31 3577 0962

Registered in England & Wales No: 3030951

DT330 SERIES ON VEHICLE COMPUTER

KEY FEATURES

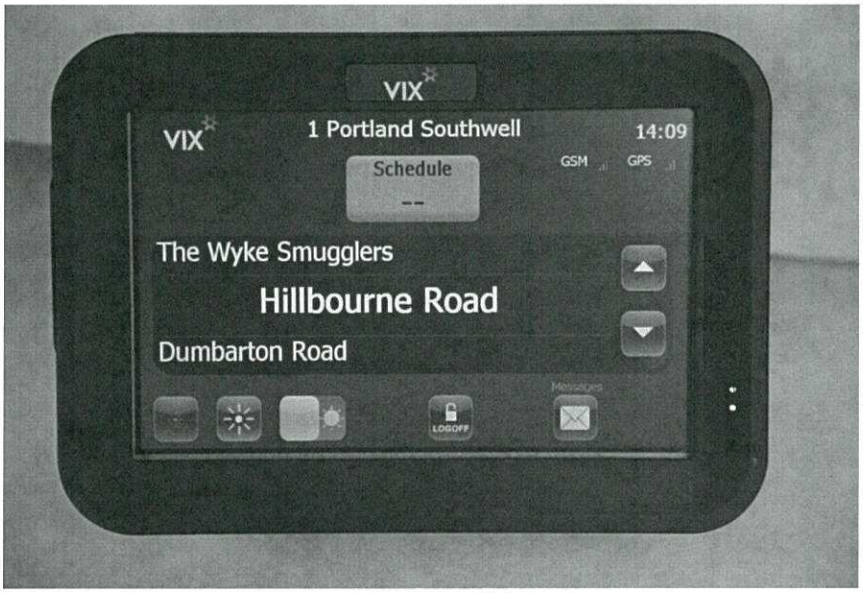
Effective vehicle tracking with integrated driver display

Integrated 7" TFT colour touch screen

Electronic ticket machine interface

Extensive local I/O capabilities for connection to other on vehicle devices

PMR/GPRS/3G versions

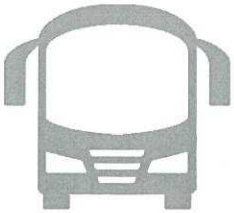


VIX MOBILITY

Vix Mobility is a global provider of integrated transit and mobility systems making it easy for people to use and pay for urban transport.

We design, manufacture, deliver and operate intelligent transport, fare collection and passenger information systems for transit operators around the world, serving over 140 million users in 25 countries.

Vix Mobility products and services encompass a wide range of transport and transit solutions including Automated Fare Collection (AFC), Intelligent Transport System (ITS), Real-Time Passenger Information (RTPI) and Central Clearing House (CCH) services.



OVERVIEW

The DT330 series provides robust on vehicle GPS positioning computers for real time vehicle tracking which have been specifically designed for the requirements of bus and coach operators. With PMR, GPRS and 3G versions, the DT330 series is perfectly placed to make use of your existing radio network or exploit the GPRS cellular infrastructure.

With an integrated colour touchscreen and user-friendly interface, the DT330 series provides simple devices for drivers to use. Additionally, it incorporates connectivity to standard vehicle peripherals, with expansion ports for future enhancements.

This high specification computer provides the performance needed for the most demanding applications in harsh on-vehicle environments. Whether it is for vehicle tracking, vehicle status, driver communication, passenger announcements or rich media passenger displays, the DT330 series of on-vehicle computers provides the ideal solution for real time AVL (Automatic Vehicle Location) fleet management.

BENEFITS

- DT335 PMR with external radio
- DT336 GPRS with integrated modem
- DT337 3G with integrated modem
- Simple uncluttered installation providing high visibility driver display
- Single point driver service logon
- Robust design for vehicle use with no external voltage conditioning
- Simple connection to existing peripherals and future expansion.

TECHNICAL SPECIFICATIONS

Product code	DT335 PMR On Vehicle Computer DT336 GPRS On Vehicle Computer DT337 3G On Vehicle Computer	
Detailed System Specification	• Intel PXA270 520MHz processor system (128MB Ram, 64MB Flash, 1GB Micro SD) • 8 K EEPROM, RTC and watchdog • Built in 7" Colour TFT Touch screen • High performance 50 channel GPS engine • USB, 3x RS232, 1x RS485, 1 wire, 5x Digital Inputs, 2x Digital Outputs, 2x 12V 100mA	• Supply voltage: 7 to 60V dc • Power requirement: 12 W typical • Operating temperature: -15°C to +55°C • Relative humidity: 10% to 95% noncondensing • Certification: EMC: 2004/108/EC.
Electronic Ticket Machine Interface	Uses RS485 to support: • Vix TP4000, TP5000 and TP5700 • Almex A90 and Optima • Wayfarer 3, TGX150, TGX250 • ETMSS, Ticketer. Uses RS232 to support: • Snapper	If you need support for any other ETM, please contact Vix as we add to the list regularly
Dimensions	Dimensions: (w) 200mm x (h) 140mm x (d) 45mm	Weight: 500g
Expansion Capabilities and Options	• Next stop display • Media server and TFT passenger display • Traffic Signal Priority (RTIG and Strategic) • Local street display cleardown (RTIG)	• Passenger PA system • Next stop audio announcements • External antenna for GPS (if required).
Data Connection	Communication between the On Vehicle system and the Vix server is via PMR or GPRS, depending on model selected. The customer may require a licence for RTIG traffic signal priority.	
Configuration	Initial configuration of vehicles and routes is managed by Vix. Vix assists the client in setting up an end to end process, so that correct data is always available on the vehicle. The data standards currently supported are TransXchange and ATCO.	
System Requirements	The DT330 series is part of the Vix BusNet™ server system for receiving and processing vehicle data. Horizon, Operator Reports and other packages as required.	
Ordering (typical configurations)	Part number 950-00335 for PMR On Vehicle Computer Part number 950-00336 for GPRS On Vehicle Computer Part number 950-00348 for 3G On Vehicle Computer	

Stringent reliability testing is performed on all equipment.
To ensure the highest quality, specifications may change without notice.

FM 52494 EMS 531796

Vix operates a Quality Management System and is certified to be compliant with ISO 9001:2008 and EMS ISO 14001:2004

AD190 SHANNON SHELTER DISPLAY

KEY FEATURES

Shelter mounting GPRS LED bus stop display

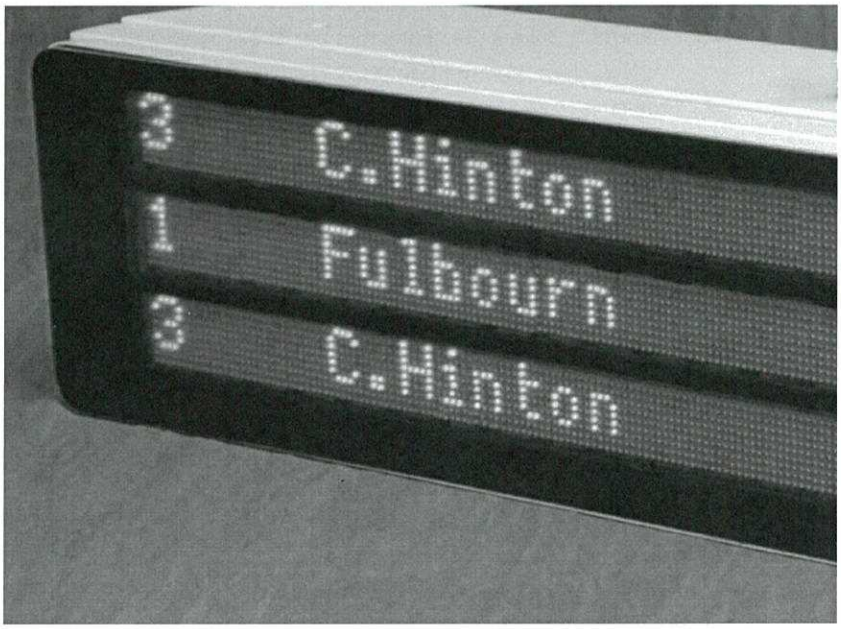
Three line display

32 characters per line with true descenders

Effective journey cancellation and delay display

Configurable display content

High contrast LEDs with a wide viewing angle



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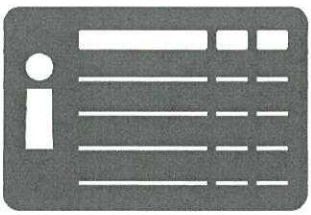

REAL TIME PASSENGER INFORMATION

The AD190 Shannon Shelter Display is designed for top mounting into bus shelters. It has three lines of 32 characters with true descenders. The display shows service numbers, destinations with via points and due times. When predictions are not available, scheduled departure times can be shown. The amber-on-black LED display provides a high contrast that is fully compliant with the Disability Discrimination Act of 1995 (UK) for legibility.

Communication is by either GPRS or an Ethernet connection. Vix uses an optimised protocol to reduce the message overhead sent to signs, minimising data costs when running on cellular networks.

CONFIGURABLE CONTENT

The actual data columns displayed can be defined. Alternating entries can show intermediate stops, cancellations, delayed journeys and when scheduled times are shown rather than real time predictions. Dual language entries can also be alternated. A predetermined message can be shown if contact is lost or no predictions are available. An information line can be configured to show items such as the stop name and time.

As a vehicle approaches the stop, the predicted arrival time can be configured to show "Due" when the predicted arrival time drops below a preset value. As a vehicle leaves the stop, entries on the display can be cleared either centrally, through the BusNet system, or directly from the vehicle (an option to give quicker cleardown).

SECURITY AND RESILIENCE

The display features a vandal resistant polycarbonate front screen and fixings with anti-tamper locks.

On board diagnostics monitor LED faults, communications, temperature and software.

AUDIO INFORMATION

Optional audio announcements giving the stop name and imminent departures can be triggered with RNIB React3 key fobs.

TECHNICAL SPECIFICATIONS

Product code	AD190 Range	
Case	Material: Aluminium with tough powder coated paint finish Environmental IP65. (to BS EN 60529) Environmental: IP65 (to BS EN 60529) Impact resistance: IK09 (to BS EN 62262) Front screen: 5mm anti-reflective polycarbonate and scratch resist coating	Operating temperature: -25°C to +50° C Humidity: 5% to 95% non condensing Dimensions (approx): (w) 910mm, (h) 200mm, (d) 200mm excluding power and external connections Weight: 12kg
Display	Display technology: LED Colour: Amber LED on black background Format: 3 lines, 32 characters per line Characters: 30mm high, 9 x 5 pixels per character LED module life: >150,000 hours to half brightness	Luminous Intensity(Iv): 600cd/m^2 MTBF: 50,000 hours Viewing distance: 15m Viewing angle: $\pm$ 60° horizontal, $\pm$ 60° vertical.
Electrical	Power supply: 100-240V ac, 50/60Hz linear supply	Power consumption: 82W typical, 120W max UMSG charge code: 811 0072 000 100 (72W)
Audio	Key fob type: RNIB React3 Text-to-speech engine: English as standard.	Please check with Vix for alternative language options.
Standard Mounting	Top mount into shelter: Two M10 bolts at 700mm centres to any RTIG compliant shelter	
Certification	This product complies with the appropriate European Directives: • EN55022 (Radiated Emissions) • EN60950-1 (General safety)	• EN60590-22 (Outdoor safety) • EN55024 (Immunity) • EN61000-3-2 (Harmonics) • EN61000-3-3 (Voltage Fluctuations & Flicker).
Finish	The display is available in three standard colours: • RAL 9016 smooth white • RAL 9005 smooth black • RAL 7040 smooth grey.	(Other colours from the RAL colour range are available as an optional cost extra).
Optional Fittings	Pole and Visor: Gallows style Heater: For low temperature areas to -40°C	
System Requirements	Vix displays are designed to be installed as part of an BusNet™ system or as part of the Vix Unified Display System. Mains power must be available at the location installation point.	
Options	• RNIB React3 operated announcements - audio announcement of stop name and next services to RNIB standard • Impact sensor - blanks the display for preset time (possum mode) then reverts to normal operation • RTIG T0008 compliant Local Cleardown - prompt removal of predictions from displays on departure.	
Ordering (typical configurations)	Part number 960-00362 for an AD190 Shannon Display, GPRS with React3 Part number 960-00363 for an AD190 Shannon Display, GPRS For information about other configurations, please contact Vix Sales.	

Stringent reliability testing is performed on all equipment.
To ensure the highest quality, specifications may change without notice.

FM 52494 EMS 531796

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AD225 BANN FLAG DISPLAY

KEY FEATURES

Pole mounting GPRS LED bus stop display with true descenders

Available in 3-line or 6-line options, 24 characters per line

Space for corporate branding

Effective journey cancellation and delay display

Configurable display content

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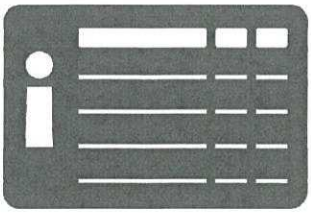

REAL TIME PASSENGER INFORMATION

The AD225 Bann Flag Display is designed for bus stop pole mountings in a 3-line or 6-line, 24 character option. The display shows service numbers, destinations with via points and due times. When predictions are not available, scheduled departure times can be shown.. The amber-on-black LED display provides a high contrast that is fully compliant with the Disability Discrimination Act of 1995 (UK) for legibility.

Communication is by either GPRS or an Ethernet connection. Vix uses an optimised protocol to reduce the message overhead sent to signs, minimising data costs when running on cellular networks.

CONFIGURABLE CONTENT

The actual data columns displayed can be defined. Alternating entries can show intermediate stops, cancellations, delayed journeys and when scheduled times are shown rather than real time predictions. Dual language entries can also be alternated. A predetermined message can be shown if contact is lost or no predictions are available. An information line can be configured to show items such as the stop name and time.

As a vehicle approaches the stop, the predicted arrival time can be configured to show "Due" when the predicted arrival time drops below a preset value. As a vehicle leaves the stop, entries on the display can be cleared either centrally, through the BusNet system, or directly from the vehicle (an option to give quicker cleardown).

SECURITY AND RESILIENCE

The display features a vandal resistant polycarbonate front screen and fixings with anti-tamper locks.

On board diagnostics monitor LED faults, communications, temperature and software.

AUDIO INFORMATION

Optional audio announcements giving the stop name and imminent departures can be triggered with RNIB React3 key fobs.

TECHNICAL SPECIFICATIONS

Product code	AD225 Range	
Case	Material: Aluminium with tough powder coated paint finish Environmental: IP65 (to BS EN 60529) Impact resistance: IK09 (to BS EN 62262) Front screen: Anti-reflective polycarbonate and scratch resist coating	Operating temperature: -20°C to +50° C Humidity: 10% to 90% non condensing Dimensions (approx): (w) 700mm, (h) 416mm, (d) 205mm excluding antennae Weight: 18kg.
Display	Display technology: LED Colour: Amber LED on black background Format: 3 or 6 lines, 24 characters per line Characters: 30mm high 9 x 5 pixels per character LED module life: >150,000 hours to half brightness	Luminous Intensity(lv): 600cd/m^2 MTBF: 50,000 hours Viewing distance: 15m Viewing angle: $\pm$ 60° horizontal, $\pm$ 60° vertical.
Electrical	Power supply: 100-240V ac, 50/60Hz linear supply Power consumption: 27W typical, 80W max	
Audio	Key fob type: RNIB React3 Text-to-speech engine: English as standard	Please check with Vix for alternative language options.
Standard Mounting	Side mount by either edge onto a pole: M8 bolts at 700mm centres	
Certification	Complies with the appropriate European Directives: • EN55022 (Class A Radiated Emissions) • EN60950-1 (General safety)	• EN60590-22 (Outdoor safety) • EN55024 (Immunity) • EN61000-3-2 (Harmonics) • EN61000-3-3 (Voltage Fluctuations & Flicker).
Finish	The display is available in three standard colours: • RAL 9016 smooth white • RAL 9005 stippled black • RAL 7040 stippled grey.	(Other colours from the RAL colour range are available as an optional cost extra). An area of (w) 665mm x (h) 395mm is available on the reverse side for corporate branding. The 3 line variant also has an area of (w) 725 x (h) 200 on the front for corporate branding.
Optional Fittings	Heater: For low temperature areas to -40°C	
System Requirements	Vix displays are designed to be installed as part of an BusNet™ system or as part of the Vix Unified Display System. Mains power must be available at the location installation point.	
Options	• RNIB React3 operated announcements - audio announcement of stop name and next services to RNIB standard • Impact sensor - blanks the display for preset time (possum mode) then reverts to normal operation • RTIG T0008 compliant Local Cleardown - prompt removal of predictions from displays on departure.	
Ordering (typical configurations)	Part number 960-00364 for 3 line AD225 Bann Flag Display, GPRS with React3 and Local Cleardown Part number 960-00365 for 3 line AD225 Bann Flag Display, GPRS with React3 Part number 960-00366 for 3 line AD225 Bann Flag Display, GPRS Part number 960-00368 for 6 line AD225 Bann Flag Display, GPRS with React3 and Local Cleardown Part number 960-00369 for 6 line AD225 Bann Flag Display, GPRS with React3 Part number 960-00370 for 6 line AD225 Bann Flag Display, GPRS	

Stringent reliability testing is performed on all equipment.
To ensure the highest quality, specifications may change without notice.

FM 52494 EMS 531796

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AD370 WEY DISPLAY

KEY FEATURES

Frame or pole assembly mounting GPRS LED display with true descenders

6, 9 and 12-line options, 48 characters per line

Current time clock display

Effective journey cancellation and delay display

Configurable display content

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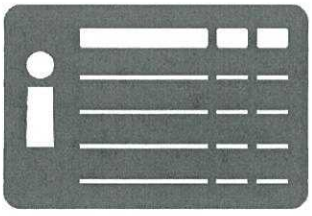

REAL TIME PASSENGER INFORMATION

The AD370 Wey Display is designed for wall or free-standing frame mountings in a 6-line, 9-line or12-line, 48 character option. The display shows service numbers, destinations with via points and due times. When predictions are not available, scheduled departure times can be shown. The amber-on-black LED display provides a high contrast that is fully compliant with the Disability Discrimination Act of 1995 (UK) for legibility.

Communication is by either GPRS or an Ethernet connection. Vix uses an optimised protocol to reduce the message overhead sent to signs, minimising data costs when running on cellular networks.

CONFIGURABLE CONTENT

The actual data columns displayed can be defined. Alternating entries can show intermediate stops, cancellations, delayed journeys and when scheduled times are shown rather than real time predictions. Dual language entries can also be alternated. A predetermined message can be shown if contact is lost or no predictions are available. An information line can be configured to show items such as the stop name and time.

As a vehicle approaches the stop, the predicted arrival time can be configured to show "Due" when the predicted arrival time drops below a preset value. As a vehicle leaves the stop, entries on the display can be cleared either centrally, through the BusNet system, or directly from the vehicle (an option to give quicker cleardown).

SECURITY AND RESILIENCE

The display features a vandal resistant polycarbonate front screen and fixings with anti-tamper locks.

On board diagnostics monitor LED faults, communications, temperature and software.

AUDIO INFORMATION

Optional audio announcements giving the stop name and imminent departures can be triggered with RNIB React3 key fobs.

TECHNICAL SPECIFICATIONS

Product code	AD370 Wey Summary Display range	
Case	Material: Aluminium with tough powder coated paint finish Environmental: IP65 (to BS EN 60529) Impact resistance: IK09 (to BS EN 62262) Front screen: Anti-reflective polycarbonate and scratch resist coating Operating temperature: -20°C to +70° C Humidity: 10% to 90% non condensing	Dimensions (approx): 6-line: (w) 1355mm, (h) 900mm, (d) 191mm 9-line: (w) 1355mm, (h) 920mm, (d) 191mm 12-line: (w) 1355mm, (h) 940mm, (d) 191mm excluding antennae Weight: 90kg max.
Display	Display technology: LED Colour: Amber LED on black background Format: 6, 9 or 12 lines, 48 characters per line Characters: 32mm high 9 x 6 pixels per character LED module life: >150,000 hours to half brightness	Luminous Intensity(Iv): 600cd/m^2 MTBF: 50,000 hours Viewing distance: 15m Viewing angle: ± 25° horizontal, ± 25° vertical.
Electrical	Power supply: 100-240V ac, 50/60Hz linear supply Power consumption: 650W max	
Audio	Key fob type: RNIB React3 Text-to-speech engine: English as standard	Please check with Vix for alternative language options.
Standard Mounting	Mounted to a frame or pole assembly using channel clips into channels on the rear of the display.	
Certification	Complies with the appropriate European Directives: • EN55022 (Class A Radiated Emissions) • EN60950-1 (General safety)	• EN60590-22 (Outdoor safety) • EN55024 (Immunity) • EN61000-3-2 (Harmonics) • EN61000-3-3 (Voltage Fluctuations & Flicker).
Finish	The display is available in three standard colours: • RAL 9016 smooth white • RAL 9005 stippled black • RAL 7040 stippled grey.	(Other colours from the RAL colour range are available as an optional cost extra).
Optional Fittings	Heater: For low temperature areas to -40°C	
System Requirements	Vix displays are designed to be installed as part of an BusNet™ system or as part of the Vix Unified Display System. Mains power must be available at the location installation point.	
Options	• RNIB React3 operated announcements - audio announcement of stop name and next services to RNIB standard • RTIG T0008 compliant Local Cleardown - prompt removal of predictions from displays on departure.	
Ordering (typical configurations)	Part number 960-00371 for 12 line AD370 Wey Display with React3 and Local Cleardown For information about other configurations, please contact Vix Sales.	

Stringent reliability testing is performed on all equipment.
To ensure the highest quality, specifications may change without notice.

FM 52494 EMS 531796

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SYSTEM MONITORING DASHBOARD

KEY FEATURES

Web based application showing KPIs as percentages

Display and vehicle hardware performance

Driver, journey and communication performance indicators

Daily, weekly, monthly and detailed reports

Data can be exported to CSV files for further analysis

Date	Journey KPI	Driver KPI	Vehicle KPI	Prediction KPI	Sign KPI	Communication KPI	Overall KPI
Today	N/A	0%	100%	N/A	0%	100%	50%
28/02/2012	75%	90%	99%	N/A	69%	100%	86%
27/02/2012	82%	97%	78%	N/A	68%	100%	85%
26/02/2012	82%	97%	41%	N/A	68%	100%	77%
25/02/2012	82%	97%	18%	N/A	69%	100%	73%
24/02/2012	79%	95%	79%	N/A	69%	100%	84%
23/02/2012	81%	97%	79%	N/A	68%	100%	85%
22/02/2012	84%	92%	31%	N/A	69%	100%	75%
21/02/2012	80%	93%	99%	N/A	69%	100%	88%
20/02/2012	80%	96%	32%	N/A	69%	100%	75%
19/02/2012	88%	95%	48%	N/A	68%	100%	80%
18/02/2012	79%	96%	76%	N/A	69%	100%	84%
17/02/2012	57%	96%	75%	N/A	67%	100%	79%
16/02/2012	55%	96%	15%	N/A	69%	100%	67%
15/02/2012	55%	94%	72%	N/A	69%	100%	78%
14/02/2012	55%	95%	22%	N/A	68%	100%	68%
13/02/2012	57%	94%	75%	N/A	69%	100%	79%
12/02/2012	78%	95%	40%	N/A	68%	100%	76%
11/02/2012	71%	97%	71%	N/A	68%	100%	81%
10/02/2012	71%	97%	70%	N/A	68%	100%	81%

‹ 1 2 3 4 5 6 7 8 9 10 ...

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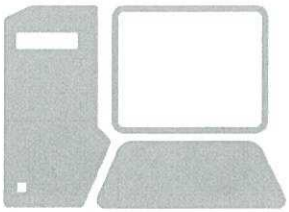

OVERVIEW

System Monitoring Dashboard is a web based application that measures and monitors the performance of the Vix BusNet™ real time information system. System data is collected and stored in a dedicated database which is accessed using System Monitoring Dashboard on an Internet enabled workstation. Data is updated at an interval of typically 30 seconds to ensure constant system status analysis.

A simple menu structure allows users to view headline reports and drill down for detailed performance information. System Monitoring Dashboard gives access to:

- Driver performance KPI, measuring the quality of drivers' input
- Vehicle communication KPI, showing vehicle operational status
- Vehicle journey KPI, showing accuracy of tracked journeys
- Display communication KPI, showing display operational status
- Communication KPI for PMR systems, measuring PMR status.

Multiple views can be configured for the reports, with each user able to configure their own view of data. Reports can be exported as CSV files for more in depth analysis within spreadsheets.

BENEFITS

- Reliable, accurate measurement of system performance through predefined indicators
- Performance is measured against clear targets
- Simple analysis of data against Service Level Agreements
- Instant reports and alerts on possible system faults
- Web based application is accessible worldwide through a password protected portal.

TECHNICAL SPECIFICATIONS

General	Vehicles per system: up to 3,500 Position processes per hour: up to 420,000	Position processes per weekday: up to 8,400,000
Latency	For displayed data: <= 0.5 seconds for 95% of position reports <=2 seconds for 99% of position reports <=5 seconds for 99.9% of position reports	For data that is written to the database: <=2 seconds for 95% of position reports <=5 seconds for 99% of position reports <=15 seconds for 99.9% of position reports
Events	Number of events logged: up to 10,000 Event histories logged: up to 100 for each event	Event codes: 16 (15 with voice communications)
Languages	Maximum languages supported at any time: 2	Menus and window text can be shown in any European language
Security	Maximum number of users: 50	Administrators: 2
	All data on hosted servers is protected by multiple layers of security including firewalls, hardened servers and access assigned per system. Regular backups are taken to protect data. All access to Vix BusNet™ is password controlled at three levels (Administrator, System and Operator).	
Configuration limits	Number of stops: up to 30,000 Number of public services: up to 500	Journeys per day: up to 100,000
Architecture	The System Monitoring database is a centrally deployed module that can connect to multiple client installations. After connection, the server sends processed data for display through the System Monitoring Dashboard.	
Data connection	System Monitoring Dashboard components communicate via TCP/IP. Bandwidth requirements are kept low by message streamlining, sending partial messages and sending only new data. Data is refreshed every 30 seconds by default (this is configurable).	
Installation and configuration	System Monitoring Dashboard is implemented as a Vix hosted service, accessed over the Internet.	
Diagnostics	Vix System Monitoring Dashboard provides full built-in fault diagnostics with secondary failover capabilities. If it detects a fault either within itself or in the environment within which it is operating, it takes proactive action. Debug feeds are accessible to Vix engineers, allowing effective remote and unobtrusive monitoring and diagnosis. Fault information is also written into error files for later analysis.	

System requirements

Installation	System Monitoring Dashboard must be installed as part of a Vix BusNet™ system. All installation and configuration is performed by Vix.
Bandwidth	System Monitoring Dashboard requires a bandwidth of at least 64kB/s per user.

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VEHICLE VIEWER

KEY FEATURES

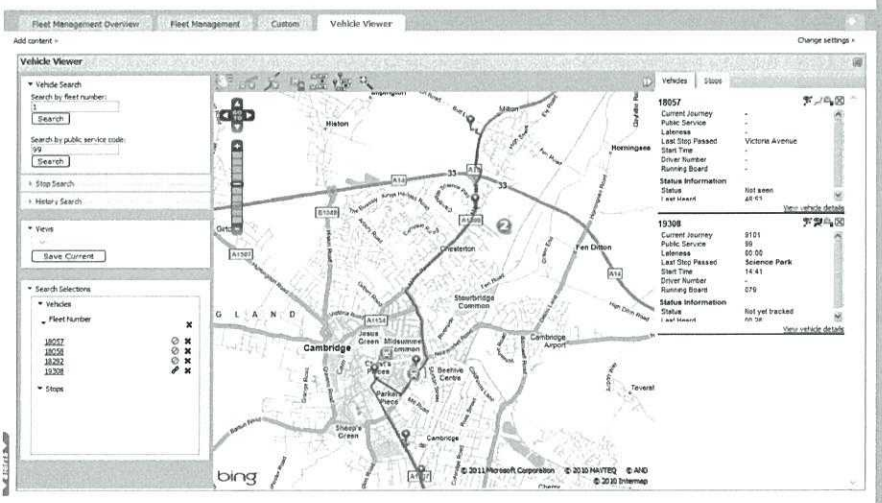
Intuitive map based display of a vehicle fleet

Real time and historical replay feature

Web browser access to all features

User programmable alarm and notification features

Display vehicles, signs and routes on a single map view



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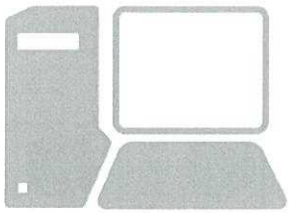

OVERVIEW

Vehicle Viewer is a full screen widget for Horizon which delivers a real time view of a vehicle fleet. This solution allows an operator to dynamically manage the fleet to ensure compliance and provide enhanced customer service; the information can also be stored for replay and analysis at a later date.

Vehicle Viewer provides an intuitive, real time, map-based display of an operator's vehicle fleet as well as a dynamic view of bus stop display information. Separate map layers are available for each item including vehicles, routes and stops, and users can easily turn them on and off as required. With a powerful integrated search facility, each user can quickly locate any resource under their control, and also identify any routes, stops or signs that are associated with a specific vehicle or service.

Alerts can be set within Vehicle Viewer to automatically highlight any vehicles or routes that may be a cause of concern. This is particularly useful to alert when a vehicle is operating outside of given parameters eg early/late/off route, or to identify a vehicle that has activated its panic button. It is also possible to activate a "vapour trail" to instantly highlight the path a vehicle has taken to reach its current location.

Using an innovative replay feature that analyses historical data, users can select any given period of time to review activity. It is also possible to pause, fast forward or rewind the replay as required to analyse events.

BENEFITS

- Improves an operators ability to measure and therefore manage their compliance to performance requirements
- Ensures the most effective use of resources
- Allows comprehensive historical analysis of an incident, to allow confident responses to complaints or enquiries
- Intuitive interface ensures no requirement for expensive training
- Easy to deploy to end users as no additional software required on the client PC.


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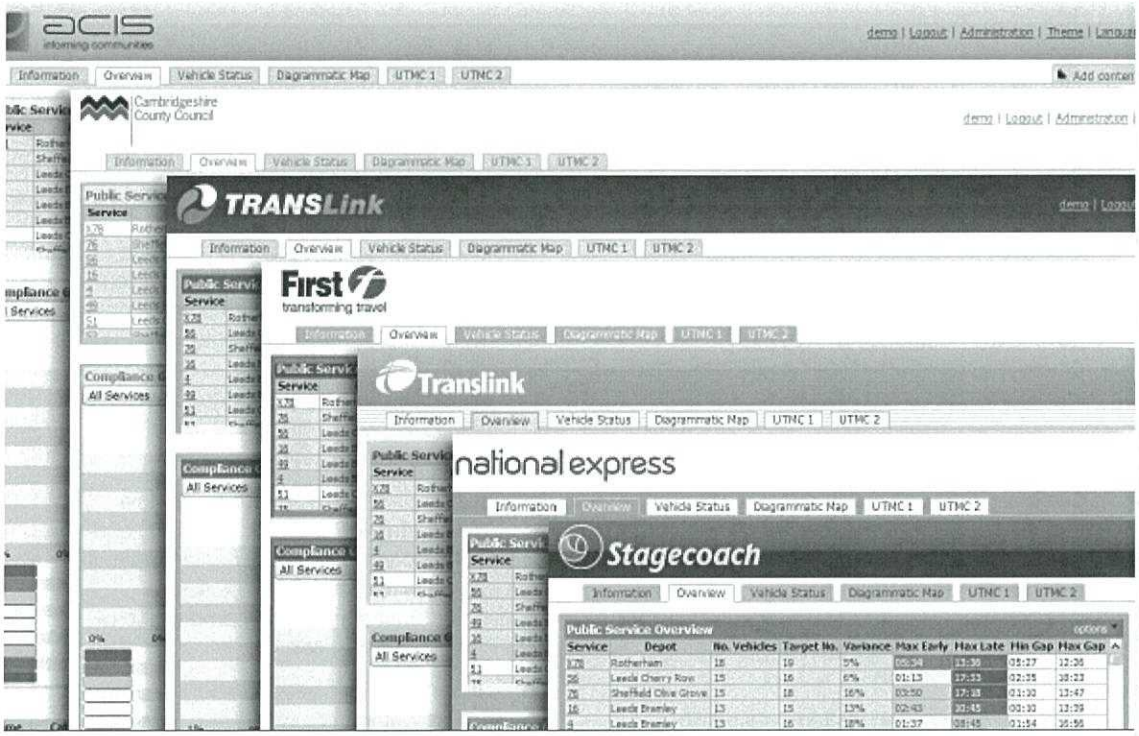
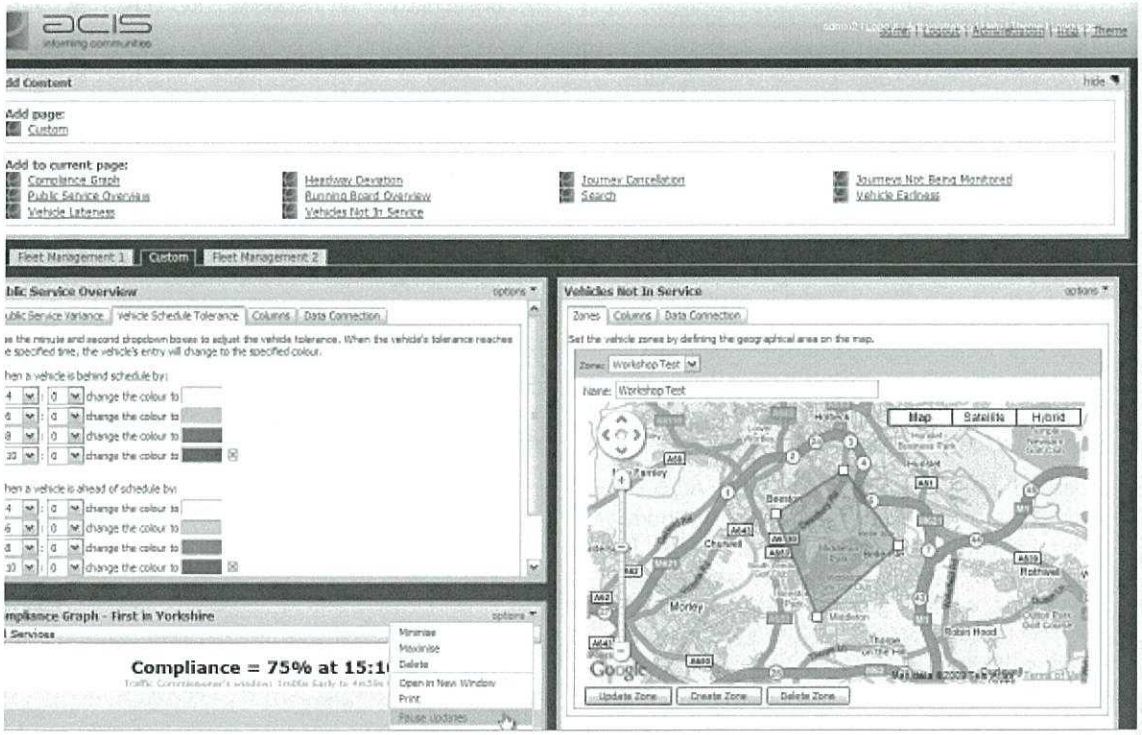
acisHorizon™

Live web-based portal providing the user with complete control of their working environment.





ACIS

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www.acis.uk.com

acisHorizon™

About ACIS

Since 1995, ACIS, has been providing unique, innovative technology solutions to improve public transport.

Dedicated to the improvement of transport intelligence within the community, ACIS has now developed the ability to provide real time passenger information across the full range of communication media.

Visual displays on bus and on street, travel alerts via mobile phone and PC as well as detailed bus service information via digital television and unique displays in the home have all been developed to ensure that passengers have the very latest transport information at their fingertips.

The Market

Until recently, Government funding has been channelled towards urban centres and prime bus routes where the highest number of public transport users could benefit from the investment into real time enabled transport solutions.

However, Local Government guidelines now demand environmental sustainability in all areas of new development by reducing the need to travel and in particular by making the best use of existing transport infrastructure enhanced by intelligent transport solutions.

In addition to modal shift targets, social inclusion, energy reduction, DDA (Disability Discrimination Act) compliance and energy reduction are now major factors when making decisions relating to the provision of travel and journey related information.

About acisHorizon

acisHorizon is a web platform based on the latest web technologies such as .NET Framework 3.5 with AJAX and Silverlight. It will give each user complete control of the working environment using small plug-and-play applications called widgets. Each user can add, configure and remove widgets within the password protected web portal, and arrange these widgets to customise their own workspace to match their working practises.

The concept of plug-and-play widgets future-proofs acisHorizon, as ACIS will continue to develop new widgets. As new widgets become available for use, they will simply appear in the users' lists of content that can be incorporated into their acisHorizon workspace. Users can then add these new widgets at any time without affecting their previous workspace performance.

Using the latest Microsoft technology ACIS will also provide users with widgets to perform comprehensive graphical and data analysis. For example, widgets can display live graphs using Silverlight or define geographical zones for vehicle tracking using Google Maps and SQL Server 2008.

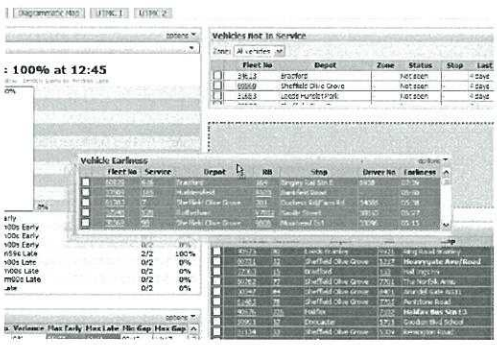
acisHorizon has a dedicated Data Access Layer for quick and easy data access over secured SOAP/XML protocol using Web Services. The web portal can access data through the same single data channel that runs it, without having to connect to and query multiple data sources.

The acisHorizon user interface is designed to cater for both technical and non-technical users, allowing simple access to data combined with more complex analytical capabilities. The functionality that can be accessed by each user is controlled by the widgets that the user's log-on role has permission to view. This is defined by the system administrator.

A series of tabs in the acisHorizon window contain widgets that access functionality and reporting features. Both tabular and graphical data can be displayed, allowing users to choose the most appropriate combination of data views for their needs.

Context-sensitive help is supplied for the acisHorizon system as a whole and for each widget, explaining principles of operation and how to perform tasks.

The functionality of an installation depends entirely on the widgets installed. The following is a sample of the functions available.



acisDFM (Dynamic Fleet Management)

A constantly updated overview of public services gives users a real-time view of vehicle movements, with colour-coded display of variance from timetables.

Fleet operators can use acisHorizon to manage both their services and their vehicle fleet from a single application. In addition to the live map showing vehicle and stop locations, Operators have access to:

- Real time service information
- Full vehicle monitoring
- Replay of historical data
- Instant alerts from vehicles
- Full reporting.

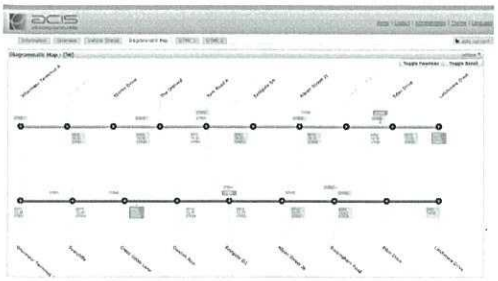
Colour-coded service displays instantly highlights variance of vehicle numbers, maximum lateness/earliness and gaps between vehicles currently running on a route.

A day view of individual services can be displayed, showing a snapshot of the operation of the service with colour-coded highlighting of variances from timetable. Users can also view a diagrammatic map of any route, showing actual and scheduled positions of vehicles updated in real time.

Vehicle monitoring covers a wide range of facilities, including:

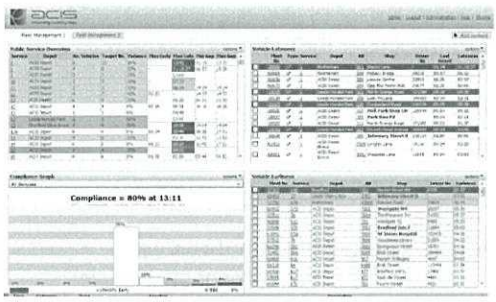
- Lateness and earliness
- Running boards overview and detail levels
- Vehicles not in service
- Detailed status view of vehicle.

All data is stored and can be replayed graphically on a dedicated map display, allowing simultaneous management of real time data and historical replay. Historical data can be replayed at up to 20 times real speed to identify trends and problems.



An alerts area displays items that could potentially cause operational and security:

- A driver pushes the panic button
- A vehicle leaves a timing point early
- A vehicle deviates from its serviced route
- A vehicle begins a journey for which it is not scheduled
- A vehicle logs off before a scheduled journey has been completed.



The following capabilities will be delivered in future versions of acisHorizon:

acisAMS (Asset Management System)

Local authorities can view infrastructure and service information across all the operators using their facilities. Typical uses would be:

- Interactive mapping showing stop messaging and vehicle movements
- Service overview display
- Transmission of messages to displays
- System monitoring
- Historical and live reporting.

acisHorizon uses web-powered map engines like Google Maps and MS Virtual Earth, and superimposes information about transport services.

Bus stops and vehicle locations are displayed in real time, giving a picture of the current situation. Users can show the current display at any selected stop simply by clicking the stop's icon on the map.

Users can send messages directly to either individual displays or groups of displays to maintain current data at all stops in the transport system. Effective monitoring also generates an alert if a display becomes inactive or disconnected from the network.

acisReports

acisHorizon allows reporting through both a set of proven, preconfigured report templates and ad-hoc custom reporting facilities.

An intuitive interface allows users to construct reports interactively, by clicking and dragging elements into a matrix. Charts and graphs can be created "on the fly", and these are updated as new data and elements are dragged onto the report.

When a report has been created, it can be saved as a template so that it can be run on new data whenever required.

acisConnect

acisHorizon opens up real time service and journey information to the travelling public, allowing them to monitor and plan journeys effectively. Typically, members of the public will have:

- Limited access to the live map to see an overview of vehicle locations and live stop data
- Live access to service timetables
- Journey planning facilities
- Service alerts for registered users.

The security access of acisHorizon allows the system administrator to give public access commercially insensitive data held on the system. Typically, members of the public will see a limited version of the live map from which they can view stop information to monitor arrivals and departures for their journey.

Full service timetables can be made available, and registered users can access these to log journey plans on the system. They can then receive live updates for services within their plan.

Service alerts can be sent automatically to registered users either through the web, e-mail or by SMS message to their mobile phone. These messages can be to inform the user that a bus arrival is imminent, or to give details of potential delays. This ensures that travellers have the latest service information for their planned journeys.

acisHorizon at a glance

Features

- Multi-layer Graphical User Interface (GUI)
- Low configuration overhead with simple, rapid deployment at user sites
- Customisable workspace for each individual user, allowing combinations of data to be displayed together
- Incorporation of new widgets extends system functionality with no practical limit
- "Drill-down" functionality between widgets gives easy access to more detailed information on vehicles and services
- Administrator controlled functionality
- Overview of service operation, showing vehicles on each service, lateness/earliness and gaps between vehicles
- Vehicle locations and progress on maps, with real-time updates
- Customisable, colour-coded views of vehicle early and late running
- Visibility of data from individual vehicles
- Constant real-time alerts on all aspect of the RTI system, split into categories and event types
- Diagrammatic view of individual routes, showing most recent vehicle timings
- Graphical view of compliance, updated in real time
- Urban traffic management centre updates.
- Messaging to displays and vehicles
- Configurable for single operator/depot or multiple operator/depot data display
- Based on the latest .NET Framework 3.5 and using cutting edge Web 2.0 AJAX portals
- Single click branding with selection of themes and languages.

Benefits

- Fleet and asset management, full reporting and public website functionality
- The widget implementation allows you to tailor the system to meet your needs, into a single system
- Real time views of maps, vehicles, displays, routes and stops
- Stop-based real time information allows effective passenger journey planning
- Customisable user interface allows each user to view precise information
- Live view of vehicle locations on real maps and diagrammatic route views
- Rapid identification of incidents enables fast responses to changing conditions
- Vehicle paths are constantly visible, allowing effective monitoring of service operation
- Data is shared between all widgets, ensuring complete consistency across applications
- Administrator control means that individual operators can see only their own services
- Minimises user training requirements
- Simple application of themes and languages allows easy branding of the interface
- Web service interface and preconfigured reports give comprehensive access to RTI data
- Role-based user accounts control data access for individual users
- Each user's personal homepage gives one-stop access to information from all over the web.

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