nestrans

The Transport Partnership for Aberdeen City and Shire

Real Time Passenger Information

Study Report

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1 Introduction

1.1 JMP Consultants Ltd was appointed by Aberdeenshire Council on behalf of Nestrans to undertake a study into the potential options for a regional Real Time Passenger Information (RTPI) system covering the Nestrans area (Aberdeen City and Shire).

1.2 The study is designed to identify the best option for providing real time information across the region. It considers options for expanding or replacing the current Aberdeen system as well as the implication of running two parallel systems.

1.3 The study also considers various technologies for providing information to travellers, from conventional bus stop signs and audio announcements to internet and mobile phone based information sources.

1.4 Of prime importance in the development of any regional RTPI system is the buy-in of all local authorities and bus operators. For this reason, the study has included consultation with key stakeholders across the region.

1.5 It has also included discussions with neighbouring authorities and transport partnerships regarding the sharing of information on cross boundary services.

2 Background

Current System

2.1 Aberdeen City has had a RTPI system in place since 1998. This was initially installed by First Aberdeen for fleet management purposes, although there are now over 140 signs principally 'on-street' as well as a number of Thin Film Transistor (TFT) displays in Council buildings, the Universities, the Aberdeen Royal Infirmary, Aberdeen Airport and the Vue Cinema. Approximately 20 of these signs have recently been renewed. The new signs are yellow Light Emitting Diode (LED) against a black background, whereas the older signs are all red LED against black, and hence do not meet the latest guidance on 'Meeting the needs of disabled travellers'[1].

2.2 In recent years, First Aberdeen has undertaken a 'technology refresh' exercise to replace on-vehicle equipment on all 165 buses with the latest incarnation of the ACIS Deltatrak on-board computer. This is capable of using a variety of communications methods, and can even auto-switch between them as required.

2.3 First Aberdeen has recently entered into a 3 year maintenance contract with ACIS. The partners have regular operational meetings where key performance indicators such as vehicle tracking percentage are discussed and efforts are made to ensure continuous improvement.

2.4 Over the last couple of years, there has also been a push by Aberdeen City Council to provide public information in a wider range of locations. This has resulted in new TFT displays being installed at the Universities, Aberdeen Royal Infirmary (ARI) and the Vue cinema. The screens at the universities provide real time information via a web link to the ACIS hosted servers, whilst the screens at ARI and the Vue are linked to the Private Mobile Radio (PMR) system.

2.5 Communications to buses, bus stops and the remaining TFTs are via PMR radio, with the main antenna mast mounted on St Nicholas House. This system was originally purchased by First, but is maintained by Aberdeen City Council.

2.6 The PMR system is currently operating at capacity and any further system expansion would require an application for a further licence or a reconfiguration of all radio equipment to increase the time between communications. In addition, the ongoing OFCOM frequency reallocation will mean that the existing licence will need to migrate to a new frequency. Depending on the frequency awarded, this may require new radio equipment and/or antennae on buses and signs.

2.7 In the next few years the current location of the main antenna mast will have to be altered as St Nicholas House is scheduled for demolition.

2.8 A recent addition to the current system has been Traffic Signal Priority. This is achieved via a server to server link to the Urban Traffic Control (UTC) system, with no direct communications from the bus to the on-street traffic signals.

Other Systems

2.9 There are also a number of TFT screens in Aberdeen Bus Station which it is intended will be used to provide scheduled and/or real time departure information, although these are currently used only as general information/advertising displays.

[1] Meeting the needs of disabled travellers - A guide to good practice for real-time information systems providers, RTIG Document: PR003-D002-1.2, March 2007

2.10 In addition, there are scheduled departure displays in Peterhead Bus Station and at Ellon Park and Ride site driven via Asymmetric Digital Subscriber Line (ADSL) links from the Aberdeenshire Council scheduling system at Woodhill House in Aberdeen.

2.11 As part of the National Concessionary Fares scheme, all bus depots have had wireless local area networks (LAN) installed for upload/download of data to ETMs, and this network could be made available for use by any RTPI system. This would allow timetable and other database changes to be downloaded to buses more efficiently and quicker than is possible using the normal bus communications system.

Future Expansion

2.12 The existing Aberdeen City RTPI system has a number of forthcoming issues relating to communications (see Clause 2.6 above) which will require significant alterations to the system over the coming years.

2.13 Consideration of the benefits of further real time information provision across the Nestrans area is included in the emerging Aberdeenshire Bus Information Strategy and Nestrans Bus Action Plan and is compatible with the aims and objectives of the regional transport strategy and both Councils local transport strategies.

2.14 The result of these issues is the decision by Nestrans to investigate, in partnership with key stakeholders, the potential for region-wide RTPI coverage

2.15 There are three primary options for a regional RTPI system. This report will discuss these and make recommendations on the way the scheme should be taken forward. The three options are:

- Extend the existing Aberdeen City RTPI system across the region.
- Provide a complete new regional RTPI system to replace the existing.
- Provide a new RTPI system in Aberdeenshire to link with and work alongside the existing, expanding the coverage across the region.

3 Bus Operator Requirements

First Aberdeen

3.1 A telephone discussion was held with John Birtwistle of First Group on 16 March to discuss the aims of the project, and it's interaction with their existing system.

3.2 First's primary requirements of any RTPI system are the need to be able to track any vehicle in real time, either by corridor, route or individually; and the need to be able to analyse historic data for scheduling purposes and to identify delays. The third requirement is the need for real time communications with vehicles, either by text message or voice.

3.3 First Aberdeen has all its vehicles equipped with ACIS equipment, and has a maintenance agreement in place until at least December 2010. The current system provides all the functionality First requires from a system, so they would not wish to change it. It would, therefore, be a case of any region wide system being either an extension of the current Aberdeen RTPI system, or a parallel system linked with SIRI protocols.

3.4 Whichever option is pursued, First would not want to incur any additional capital or revenue costs and will need to be convinced that their current system will not suffer.

Stagecoach Bluebird

3.5 A meeting was held with Roy Jeffries and George Devine of Stagecoach on 20 February to discuss their requirements for any RTPI system.

3.6 In principle Stagecoach is keen to participate in any regional RTPI system. Stagecoach recognises that high quality, accurate Automatic Vehicle Location (AVL) equipment on their vehicles can provide significant benefits in terms of fleet management.

3.7 The Stagecoach Bluebird fleet operating in the Nestrans region is now fully equipped with the latest ERG Electronic Ticket Machine (ETM). Not only does this have a built in Global Positioning System (GPS) receiver, but it also has the option of adding a Subscriber Identity Module (SIM) card to provide General Packet Radio Service (GPRS) or Wideband Code Division Multiple Access (WCDMA) connections. It runs a Windows CE™ Operating System and would therefore be capable of having additional RTPI software added.

3.8 Stagecoach has Trapeze software for scheduling and will be providing full TransXChange exports for Electronic Bus Service Registration (ESBR) by autumn 2009. They would be happy to provide this data to either a Local Authority or RTPI provider subject to appropriate Data Sharing/Confidentiality Agreements being in place.

3.9 Stagecoach will be happy to participate in the RTPI system as long as there is no additional hardware required on their buses. Additional software that would run on the ETM might be acceptable so long as it caused no operational problems.

3.10 Stagecoach has not yet been convinced that there is a demonstrable benefit to be gained from Traffic Signal Priority. They are therefore not concerned that this feature is unlikely to be available without additional on-vehicle hardware. If it were to be available, then they would consider it once they had been convinced of its benefit.

3.11 If their fleet were to be equipped for RTPI, they would seek assistance with provision of any hardware, software and communications costs over and above those required for their own internal fleet management use. In particular, the use of GPRS for bus location messages is not required for their fleet management purposes, and the provision of 290 SIM cards and their ongoing revenue costs would be seen as an additional cost that would need to be met by the project unless commercial benefit for Stagecoach could be proven.

Others

Bains Coaches, Deveron Coaches and Nicoll's Coach Hire

3.12 In addition to the major operators of First Glasgow and Stagecoach Bluebird, Bains Coaches, Deveron Coaches and Nicoll's Coach Hire operate services in the City and Shire area but unlike the potential the larger subsidiaries these smaller operators are not currently partners to the project. However, as part of the National Concessionary Fares scheme, all buses have or will be equipped with ETMs for use by RTPI system.

Aberdeenshire Council

3.13 Aberdeenshire Council operates a large number of supported bus services in rural areas. All their vehicles are equipped with the latest Almex ETMs, and are capable of being enhanced to provide GPS and GPRS/WCDMA communications.

3.14 These vehicles should therefore be considered within the main RTPI system implementation. The system will need to be flexible enough to cater for any demand responsive services operated by these vehicles either now or in the future.

Express Coach Services

Megabus

3.15 No Megabus services stop anywhere in Aberdeen City or Shire apart from Aberdeen Bus Station. There is therefore little benefit in adding them to any RTPI system initially.

Scottish Citylink

3.16 The only Citylink services operating in Aberdeen City or Shire run south from Aberdeen. This is a twice daily service that only stops in Stonehaven. There is therefore little benefit in these coaches being added to a RTPI system initially.

National Express

3.17 As with both Megabus and Citylink services National Express only stop at Aberdeen Bus Station. There is, therefore, little benefit in these coaches being added to a RTPI system initially.

4 Local Authority Requirements

General

4.1 The purpose of this study is to identify the best means of providing real time information across the Nestrans region, taking into account experience and best practice from across the UK.

4.2 For this reason, the local authorities do not wish to influence the study by specifying too many specific requirements.

4.3 There are, however, a number of general points regarding the provision of real time information.

Aberdeen City Council

4.4 Aberdeen City Council already has a RTPI system in place, so is looking to this project to expand on their means of disseminating information, in line with their LTS objectives. In particular they are interested in providing information via SMS and web based portals. This would expand their information provision beyond the bus stops with signs, allowing access to information at all stops.

Aberdeenshire Council

4.5 Aberdeenshire Council, as a large rural authority, procures a significant number of supported services. Vehicles operating Aberdeenshire DRT services are fitted with Blueport MDTs capable of GSM/GPRS voice and data communication. In the case of those contracted services that are currently operated on behalf of the Council by companies other than Stagecoach Bluebird and Stagecoach Strathtay, all vehicles are equipped with Almex Optima or Almex mobile ETMs which are understood to be capable of being enhanced to provide GPS and GPRS communications. For the majority of these bus companies Aberdeenshire Council provides the relevant 'back-office' facility.

4.6 These vehicles must be considered within the main RTPI system implementation. Similarly commercial services operated by other operators must also be included in any RTPI system and ideally the RTPI system should also be flexible enough to cater for any demand responsive services which are open to members of the general public.

4.7 Whilst there are a number of principal bus stops across Aberdeenshire, for example those designated Aberdeenshire Interchange points, which would benefit from 'conventional' RTPI displays, the Council see that the delivery of RTPI in a rural context will require other means of information dissemination such as SMS and web based applications. Any RTPI developments should, where feasible and cost-effective, build upon existing information initiatives such as the recently introduced interactive journey planning facilities and the extensive promotion of the Traveline SMS text messaging service.

4.8 Aberdeenshire Council considers it important that RTPI be provided at Peterhead Interchange, Ellon Park and Ride and the proposed Banchory Park and Ride.

4.9 The Nestrans Regional Transport Strategy (RTS) recognises that accurate and accessible travel information is a vital part of a high quality bus network and a key ingredient in attracting people to use the bus. It also recognises that Real Time Information has a key role to play in achieving this. Following publication of the RTS, Nestrans has developed a Bus Action Plan which sets out in

more detail how the RTS policies on bus can be achieved and identifies development of Real Time Information as a key part of this.

Cross Boundary Links

4.10 Traditionally, RTPI systems have been installed within an authority's region, and cease to operate outside of that defined area. This is fine for services operating entirely within the authority, but causes problems for cross boundary services.

4.11 From a public perspective, these artificial boundaries for an information system make no sense. Why should a passenger be able to get information for the first half of a bus journey but not for the second half? Is it sensible that the public can get real time information for a bus heading into town, but not for the return journey because the town is in a different local authority to where they live?

4.12 It is important, therefore, for continuity of information to the travelling public that RTPI systems operate efficiently irrespective of local authority boundaries.

4.13 With the development of the RTIG server to server Extensible Markup Language (XML) standards, which have now been incorporated into the European Service Interface for Real Time Information (SIRI) standard, the interchange of information between systems has become better defined. Consequently, the linking of different RTPI systems to provide continuity of information across boundaries is easier.

4.14 Whilst the number of systems with cross boundary links is still low, the SIRI links are in use between RTPI systems and UTC or Urban Traffic Management and Control (UTMC) and to Kizoom (Traveline's Short Message Service (SMS) information provider) to provide real time SMS information.

4.15 The Nestrans region potentially has links to existing RTPI systems operated by the Highlands and Islands Transport Partnership (HITRANS) and Angus Council, and to any future system in Perth and Kinross.

4.16 Initial discussions regarding cross boundary links have been held with Lesley Millar at Angus Council, Ranald Robertson at HITRANS, Scott Denyer at Perth and Kinross Council and Niall Gardiner at Tayside and Central Scotland Transport Partnership (TACTRAN).

HITRANS

4.17 HITRANS currently has a small scale RTPI system operating in Inverness. This was originally a Tandata system, although with the takeover of Tandata by ACIS, the equipment was all replaced with the latest ACIS system. HITRANS is in the process of tendering for an expansion of the system. Whoever wins this expansion, the resulting system is required to offer SIRI compliant data feeds.

4.18 HITRANS has confirmed that it would be keen to link to any system operating across the border in Aberdeenshire, to provide improved information for the public.

Angus

4.19 Angus Council has an ACIS RTPI system. This was originally installed as an extension of the Dundee City Council system, and already shares data and radio transmitters with Dundee.

4.20 Angus Council would be keen to link with any system in Aberdeenshire to provide improved information to travellers on cross boundary services.

Moray

4.21 There is currently no RTPI in Moray; however, there are a number of cross border services which need to be considered when adopting any system in the Nestrans area.

Perth and Kinross

4.22 There is currently no RTPI in Perth and Kinross. Discussions with Niall Gardiner at TACTRAN have indicated that this situation will not change until at least 2012-13. In principle, however, they would be keen to encourage links with any future system they may implement.

5 UK Experience

General

5.1 In the United Kingdom (UK), the history of RTPI and Automatic Vehicle Location (AVL) systems has been largely driven by local/public authorities looking to provide real time information, usually via signs, for the travelling public.

5.2 This has resulted in systems being primarily funded through public money, with bus operators allowing equipment to be fitted to their vehicles, but only rarely taking an active role in the development of the system.

5.3 One of the few occasions where the approach was different is in Aberdeen. Here the system was originally promoted and installed as a fleet management tool by First Aberdeen, with Aberdeen City providing real time information signs within bus shelters.

5.4 This is more in line with the model in continental Europe where systems are generally implemented by the (often publicly owned) public transport operators as a fleet management tool, with real time information for passengers being an add on.

5.5 One key impact of this local authority ownership of RTPI systems is the reluctance of bus operators to put any money into a system that is seen as not belonging to them and is not fully under their control.

5.6 The reason for this is a lack of evidence that RTPI has a commercial benefit for bus operators. Without a demonstrable business case for RTPI, operators are generally happy to participate in schemes, but are unwilling to risk their own money.

5.7 Research into the effect of a bus location information system on the demand for buses found that real-time bus stop information enables passengers to schedule their arrival at the bus stop more closely, reducing waiting time and frustration and encouraging greater bus use. It is suggested that passenger growth is increased by up to 10% without any change to services[1].

5.8 This level of participation is demonstrated by some operators allowing equipment to be fitted to their vehicles, and by the increasing willingness of operators to provide operational data for use in RTPI systems.

[1] Traveller Information Systems Research: A Review and Recommendations for Transport Direct - Glenn Lyons, Reg Harman, John Austin and Alastair Duff, Aug 2001.

6 Technical Background

Vehicle Tracking (Automatic Vehicle Location)

General

6.1 RTPI systems have been in use across the UK since the early to mid 1990's. Early systems were based around tags or roadside beacons identifying buses at key locations on the network, and hence tended to be used on specific corridors with dedicated vehicles. Park and Ride routes were frequently targeted.

6.2 In the mid 1990's, systems based on GPS started to appear.

Global Positioning System (GPS)

6.3 GPS is a system that uses the principles of triangulation to provide a location based on the time taken to receive radio signals from a number of orbiting satellites. The huge benefit of using GPS over a tag or beacon based system for RTPI is that there is no need for roadside infrastructure for vehicle tracking purposes. Thus, once a vehicle was fitted with GPS equipment and a means of communicating its location back to a central server, it could be tracked anywhere within the range of its communications equipment.

6.4 The GPS system was originally developed by the United States (US) military. It offers two radio systems: one for military and one for civilian use.

6.5 Due to an inbuilt inaccuracy in the civilian GPS signal, called the 'Selective Availability' (SA), the location accuracy could only be guaranteed to ±100m. This was not really sufficient for a real time information system. The only way to get an acceptable tolerance over vehicle location was therefore to provide a differential GPS (dGPS) system. This relied on the inaccuracy being consistent over a local area, and hence by having a GPS receiver at a known, fixed location, the current SA inaccuracy could be calculated and a correction factor broadcast to all mobile units.

6.6 In 2000, the US effectively turned off the SA feature of civilian GPS. This improved the accuracy of a GPS position from approximately ±100m to ±10m or better. In 2007, the decision was made that this feature would never be re-enabled, and replacement satellites do not apparently have this facility. The principal effect of this on RTPI systems is that dGPS is no longer necessary for basic real time predictions, and can probably be omitted even for systems with traffic signal priority. This removes the cost of a GPS base station, but more importantly, it reduces the communications overhead since there is no longer a need to continually broadcast SA corrections.

On-Vehicle Equipment

6.7 RTPI systems have historically required some form of on-vehicle computer to provide interaction with the driver (either directly or via a cable link to the ETM) and to undertake the vehicle tracking and communications functions.

6.8 Recent developments in ETMs mean that the potential now exists for the on-vehicle computer to be dispensed with under certain circumstances. The most recent incarnation of ETMs offer a Windows CE™ operating system and standard Information and Communications Technology (ICT) interfaces (Ethernet, RS232, RS485, USB 2.0, 802.11b/g, etc) allowing AVL software to be run directly on the ETM and GPS receivers to be connected. All scheduled service buses in the Nestrans area have this latest generation of ETM.

6.9 The installation of AVL software on the ETM, rather than an on-bus RTPI computer, reduces the potential for incorrect driver input to the AVL computer, and removes the opportunity for a failure of the cabled connection between the ETM and AVL computer. It can, however, reduce the overall functionality of the system somewhat.

6.10 In particular, the capability for any local communications between the bus and the roadside are lost. This means that automatic cleardown of signs on departure from a bus stop, and local traffic signal priority request are not available.

6.11 It may potentially be possible for this to be provided, but would require some additional hardware to be fitted to buses to interface with te ETM and send radio transmissions to the roadside.

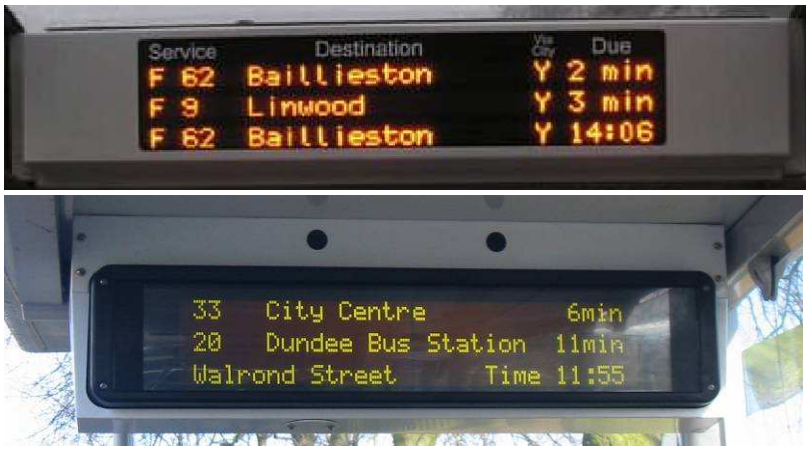
6.12 The decision therefore has to be made whether the reduced potential for driver error and the lowered maintenance requirements of loading the software onto the ETM outweigh the resulting reduction in functionality of the system.

Information Provision

Passenger Information

6.13 Information can be provided to the travelling public via a number of media. Historically, the usual way to provide information has been via LED or Liquid Crystal Display (LCD) signs, such as those one shown in Figure 6.1, at bus stops and public locations where potential bus passengers may be found.

Figure 6.1 Bus Shelter Information Sign



6.14 Whilst these types of sign can be very effective at providing information, they are expensive, and therefore only tend to be used at locations where large numbers of passengers board the bus. In particular, they are often used at city centre stops with frequent bus services and a high throughput of passengers.

6.15 An even larger version of these signs is used in bus stations or interchanges where service frequencies require more information to be displayed.

Figure 6.2 Bus Station Information Signs

6.16 It could be argued that the locations where there is a greater need for information are the stops where buses are far less frequent. At these locations, fewer individuals would benefit from the information, but the value of accurate information on an hourly service is far higher to each individual than on a five minute service frequency. Unfortunately, the cost of providing conventional information signs at this large number of locations is likely to be prohibitive.

6.17 Fortunately there are now a number of alternative ways of providing information to the travelling public.

Alternative Display Types

6.18 Rather than a full 2 or 3 line 30 character display, RTPI suppliers are now offering smaller alternative display formats that can be fitted to poles rather than having to be mounted within a shelter.

6.19 These range from bus stop flag displays, such as the one shown in Figure 6.3, to the interactive display units shown in Figure 6.4.

Figure 6.3 Bus Stop Flag Information Sign

Figure 6.4 Pole or Kiosk Mounted Information Displays

6.20 Whilst none of these gives a huge cost saving, they do have the benefit of being able to be provided at locations without bus shelters. The information displays in Figure 6.4 also have the benefit of being able to provide a greater range of information than purely the next bus. The display on the left can provide full timetable information whilst the display on the right can be configured to provide any public information or advertising that may be required.

6.21 A further alternative is a totem style display. These are becoming more common in public areas close to bus stops, such as town centre pedestrian areas and on-street interchanges. They can have the benefit of being visible from a greater distance than signs within shelters, and thus a single totem is able to serve a number of stops. They also allow the types of enhanced information provision shown in Figure 6.4 to be given in addition to standard signs.

6.22 A new feature of some of these is the ability to use Bluetooth and 'hypertags' to allow the public to download information from the totem onto their mobile phone or PDA enabling the information to be taken away for later use. These are in use in Norwich where they provide general tourist and visitor information, but in principle the same technology could be used to provide targeted public transport information.

6.23 Figure 6.5 below shows examples of totem displays.

Figure 6.5 Totem Displays

Audio Messages

6.24 Whilst audio information can be annoying to those working or living nearby, it can be a valuable information source for the visually impaired and those with reading difficulties.

6.25 Audio information can be split into two categories:

- Information that is provided automatically
- Information that has been provided on demand

6.26 Automatically provided information is typically given at large interchange points and within bus/rail stations. It can either be general travel information (eg. all buses are subject to delay due to extreme weather) or can be more specific (eg. the train now standing at platform 4 is the 14:10 to Edinburgh). In all cases, however, the information is intended to be of benefit to large numbers of passengers.

6.27 Information on-demand is likely to be more personalised. It can be triggered by a number of methods, including push buttons, radio keyfob, and proximity cards (Smartcard reader).

6.28 Push button information now tends not to be installed due to problems with ‘abuse’ by individuals repeatedly pressing the button with resultant annoyance to other travellers. It can, however, occasionally be installed along with a ‘panic’ button for emergency assistance,

Figure 6.6 Push Button Information Point

6.29 A radio keyfob trigger system is commonly used, with keyfobs being available through the local authority and/or the local Royal National Institute of Blind People (RNIB) branch. The main problem with this is that there has not been universal standardisation, so visitors from outside the region and irregular travellers are unlikely to have a suitable keyfob.

6.30 Recent discussions have indicated that the latest RNIB 'REACT' keyfob system is being promoted as a national standard, with implementations being introduced across the UK. If this proves successful, then its use in the Nestrans region would allow visually impaired users from England and Wales to obtain audio information in addition to those using the National Entitlement Card in Scotland (see clause 6.32 below).

6.31 The 'REACT' system is being developed as a full wayfinding system for the visually impaired. The keyfob is permanently powered, and when within range of a transmitter it triggers an audible message giving details of location, and an indication of whether further information is available. The keyfob has two buttons, one that is used for triggering general wayfinding information, and one that is reserved for triggering public transport information.

Figure 6.7 REACT keyfob and transmitter

6.32 In Scotland, the National Entitlement Card (NEC) offers an opportunity for providing information on-demand to either all card holders or those with specific identifiers on the card (eg. visually impaired, people with disabilities, over 60's, young persons etc.). Information can be triggered by placing the card against a clearly identifiable reader located at a bus stop.

Figure 6.8 Smartcard Information Point

6.33 There would be a benefit in providing audio information that could be triggered by both systems. This would offer the widest possible usage opportunity, with the NEC allowing those Scottish users who may benefit from audio information but are not registered visually impaired to access information, whilst the keyfob would allow visually impaired users from elsewhere in the UK to obtain information.

6.34 This dual system option allows information to be provided to the widest possible audience, whilst also enabling some control over who can use the system. It also offers scope for inhibiting the

same card/fob from continually triggering the announcement. This has been done elsewhere by only allowing one card/fob to trigger an announcement twice. After this, that individual card/fob is prevented from triggering a further announcement for a set period.

6.35 The National Entitlement Card, which is currently hosted on the Accord Card in Aberdeen and the 'Access Aberdeenshire' card across the shire, is a Scottish public services smartcard. Since implementation of the scheme in 2006 over 1.4 million cards have been issued to Scottish citizens. As well as supporting the national concessionary travel schemes, some councils also use the card to support their local library and leisure services.

6.36 Cards issued to young people are able to support cashless catering, school libraries, registration, controlled access, and show and go services (e.g. Young Scot discounts) and the nationally accredited Proof of Age Scheme.

6.37 The new national Card Management System went live on Monday 23 March 2009. The OneScotland Card Management System replaces the interim system that was put in place to support the national concessionary fare scheme. As well as supporting concessionary travel, the new system will allow commercial travel ticketing and other applications, and will allow councils to add products and services to cards that have already been issued.

Mobile Phone

6.38 An increasingly useful means of providing information to travellers is via their mobile phone. Surveys undertaken in Northern Ireland[1] have shown that mobile phone ownership had increased to 84% of the adult population in 2007-8. Whilst similar surveys could not be found for the UK in general or Scotland in particular, it is unlikely that mobile phone ownership will differ significantly from that in Northern Ireland.

Table 6.1 Percentage mobile phone ownership in Northern Ireland

Sex and age	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	Sample Size
All										
16-19	26	62	81	80	92	94	96	98	97	**230**
20-29	39	66	83	89	91	94	94	97	98	**626**
30-39	35	59	73	78	85	88	93	95	98	**773**
40-49	32	50	65	69	80	83	87	91	92	**776**
50-59	24	35	55	61	70	76	80	83	88	**632**
60+	6	13	22	31	39	42	50	53	58	**1,235**
All	26	44	59	64	72	75	79	82	84	**4,272**
Males										
16-19	26	58	79	79	88	92	93	98	96	**123**
20-29	44	68	82	87	91	94	94	96	97	**261**
30-39	43	65	78	79	87	91	93	95	96	**361**
40-49	40	57	71	72	85	83	87	92	94	**373**
50-59	30	41	59	63	74	76	78	82	88	**298**
60+	8	16	25	33	45	45	54	56	62	**559**
All Males	31	49	62	66	76	76	80	83	85	**1,975**
Females										
16-19	26	67	82	82	95	95	98	98	99	**107**
20-29	35	65	84	91	90	94	95	97	98	**365**

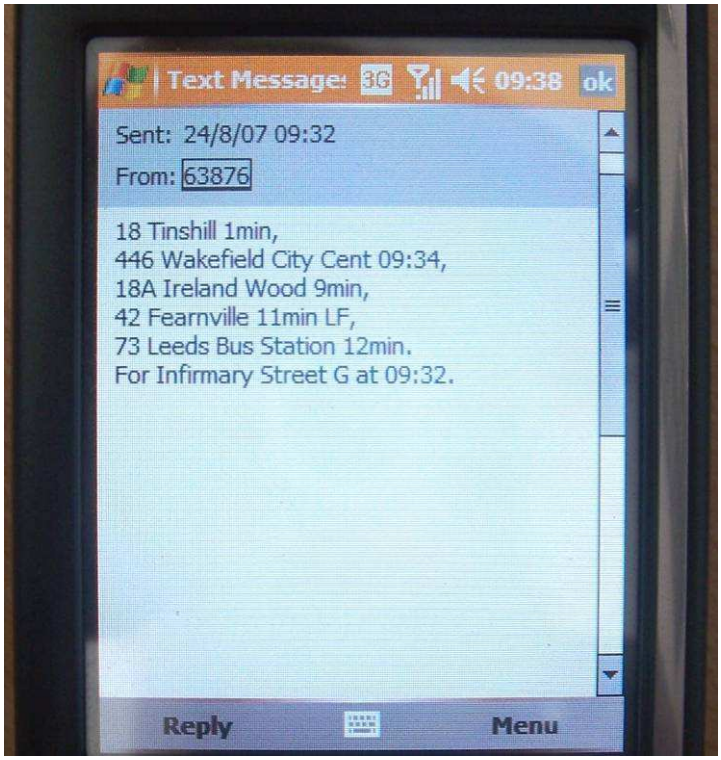
[1] Central Survey Unit (CSU) of the Northern Ireland Statistics and Research Agency, Continuous Household Survey 2008

Sex and age	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	Sample Size
30-39	28	54	69	78	82	86	93	96	99	**412**
40-49	25	44	60	66	76	83	87	89	91	**403**
50-59	18	30	52	60	67	77	81	84	88	**334**
60+	4	11	20	29	35	40	47	50	55	**676**
All Females	21	41	56	63	68	74	78	81	83	**2,297**

6.39 With these levels of mobile phone ownership, there are obvious opportunities for the provision of information via a call centre, SMS messaging and Wireless Application Protocol (WAP), particularly to the under 40's, where mobile phone ownership is almost universal.

6.40 Figure 6.9 shows the sort of information available via SMS message in West Yorkshire. This allows differentiation between real time and scheduled information by the format of data. Real time predictions are given as a number of minutes whereas scheduled arrivals (for vehicles not being tracked) are given as a time.

Figure 6.9 Real Time SMS Information



6.41 Similar information can be provided in Scotland via a link between the real time server and the Traveline Scotland SMS messaging service operated by JourneyPlan. The service offered in Scotland is slightly more sophisticated than that in the rest of the UK, allowing future timetables, and next buses on particular services or to specified destinations to be requested.

6.42 Edinburgh City Council provides easy access to real time bus information in and around Edinburgh. The 'Bustracker' system can quickly check your bus times at home, at work or on the move. The system can:

- Search by street name or post code – Click on a stop displayed on a map to see which "BusTracker" services stop there, display departures and find the Bus Stop Code.

- Search by bus service number then select a service to get details of the bus route.
- "Map Display" – see the route on Google Maps. Click on a stop for more information on services and departure times.
- "Service Diagram" - see the route with lots of information about destinations and key points along it.
- Search by bus stop code - quick and easy option, especially when on the move.
- You can also connect to the BusTracker mobile site: http://mobile.mybustracker.co.uk/ and bookmark it in your wap browser for quicker access.
- Enter the unique Bus Stop Code to quickly get real-time information updates for that stop on your phone – anytime, anywhere.
- Use BusTracker "Search by street name or post code" OR find it on the service information at the bus stop. Note down the Stop Code and use it later.
- Advanced options / My Sign – make life easy. Create and bookmark your own BusTracker signs.
- You can combine your favourite bus services from up to 5 different stops.
- Bookmark your favourite stops to go straight to the real-time information you need.

6.43 A similar system can be provided direct from ACIS, and in theory from other RTPI providers, although we are not aware of anyone other than ACIS actually operating this at the moment. This would allow alternative charging regimes to be used, but would have the large disadvantage of requiring a new telephone number to be promoted. In addition to the significant cost of updating all bus stop information and any publicity, it would mean that the Nestrans area would have a different SMS information telephone number to the rest of Scotland.

6.44 It is believed that WAP information will also soon be available from Traveline Scotland through a contract being set up with Kizoom. A real time feed to this would allow users to access more detailed journey planning information than could be provided by SMS alone, as well as being able to plan revised trips if delays occur en-route.

6.45 A further benefit of WAP over SMS is the cost to the user. SMS information from Traveline Scotland currently costs a normal text cost for the outgoing message and 25p for the reply. The cost for the equivalent WAP inquiry is likely to be significantly lower.

Other Media

Internet

6.46 An obvious source of information to many is the internet. This may be accessed via the latest 'smartphones', but is more likely to be from a home or office computer. The Scottish Household Survey 2007 reported that:

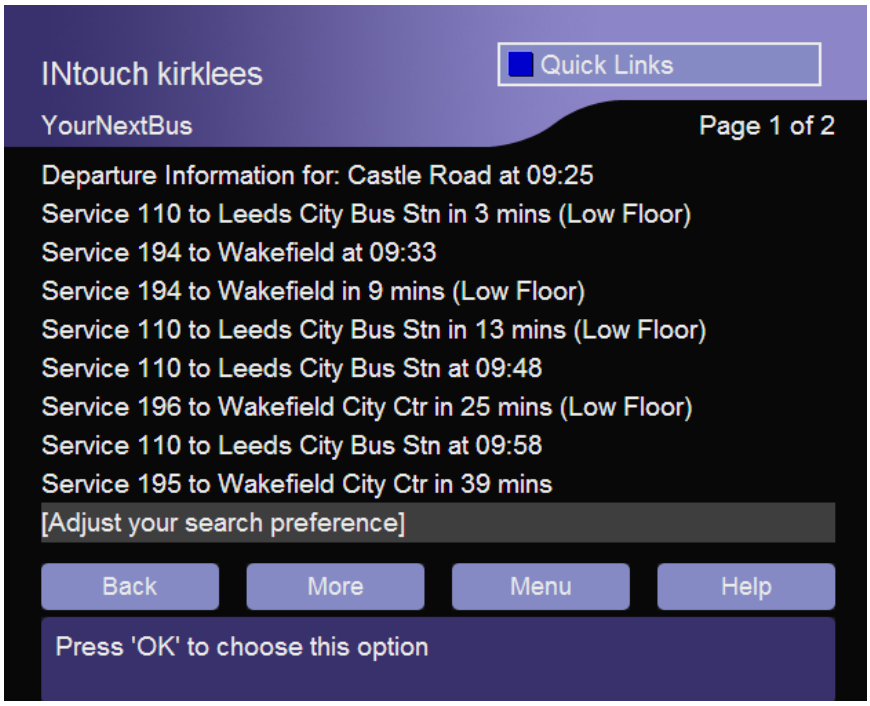
- 57 per cent of households have home internet access: 64 per cent in remote rural areas compared to 54 per cent in large urban areas
- 36 per cent of households in the 15 per cent most deprived areas of Scotland have home Internet access compared to 61 per cent in the rest of Scotland
- 49 per cent of households have a broadband Internet connection: 22 per cent in the lowest earning households and 86 per cent in the highest

6.47 Many examples exist across the UK of real time information being available via the internet. These include national systems such as 'Transport Direct' and the regional 'Traveline' sites as well as local authority websites and facilities offered by private companies such as the 'ACISLive' feature on their website.

Digital Television

6.48 Another potential source of information is local digital television. DigiTV is a service created by Kirklees Council and available to all local authorities for the dissemination of local information. It is used in some locations to provide real time bus information (eg. in West Yorkshire it uses a link to the ACISLive site).

Figure 6.10 Next Bus departures on DigiTV



6.49 DigiTV can be accessed and interacted with for no additional fee by those who subscribe to Sky or Virgin Digital. More recently, some of the freeview boxes have the ability to connect to a network to access an internet connection. Interactive DigiTV can also be used on these. Currently details of bus and train arrivals and departures in the City and Shire as well as limited travel information can be viewed.

Application to Nestrans

6.50 Whilst all the alternative information provision methods described above can play a role in informing the public, it must be recognised that those most dependent on the bus service (ie. those unable to use an alternative form of transport) are frequently also those without access to a mobile phone or internet.

6.51 It is important, therefore, that information is provided to these 'captive audience' users wherever possible to maintain their confidence in the public transport system. In many cases, the alternative to using the bus is to not travel at all.

6.52 Conversely, those most likely to have access to the alternative information sources described above (ie. young, employed) are those where it is most important to encourage the use of public

transport in preference to the private car. These alternative information sources can therefore play an important role in encouraging the *Smarter Choices* agenda.

Meeting the needs of disabled travellers

6.53 In 2006, the Real Time Information Group (RTIG) published a document titled 'Meeting the needs of disabled travellers - A guide to good practice for real-time information systems providers'. This was then revised and reissued in March 2007.

6.54 The document provides guidance on display, audio, tactile and website information sources to facilitate compliance with the Disability Discrimination Act.

6.55 Whilst any signs and audio announcement equipment purchased are likely to comply with these guidelines, Nestrans should be aware of this document, particularly in relation to the positioning of any information sources, and in the design of any web based information that they may provide.

Fleet Management Information

6.56 Fleet management information is often overlooked by transport authorities when seeking to purchase a RTPI system.

6.57 From their perspective the important thing is the provision of information to the travelling public. Without good fleet management facilities, however, it will be impossible to get full buy-in from the bus operators, since this is the only area where they see a business case for any investment.

6.58 High quality fleet management information is the key to helping bus operators improve their scheduling, identify recurrent delays, operate in accordance with traffic commissioner standards, and ultimately run their operations more efficiently.

6.59 It will also assist with monitoring of conformity with the requirements of any Bus Priority Improvement Partnership (BPIP), both in terms of identifying buses that don't run, or deviate from schedule, and in terms of identifying where the local authority needs to investigate measures to assist buses.

6.60 It is important therefore that whatever system is purchased, the fleet management information is suitable for the bus operators. Whilst it is unlikely that any operator will be using vehicles on both the current and any future system simultaneously (assuming a parallel system is installed – see section 7.16), this eventuality should be catered for. It is therefore essential that if two parallel systems are installed, all fleet management data is combined on one of the servers to allow easy analysis.

6.61 Whilst the precise fleet management requirements would need to be agreed with the bus operators at the time of detailed system specification, a number of general features will be essential:

- The ability to plot journey times between stops at all times of day and days of week.
- Comparisons of actual running times with scheduled for services by time of day and day of week.
- Highlighting of locations where buses are not being tracked on a service.

6.62 The ability to view and print off summary charts and reports is important, but it must also be easy to extract the raw vehicle location and journey data from the system to allow operators to use external tools to analyse it for any purpose they require.

Communications

General

6.63 Communications for RTPI can generally be considered as having two requirements:

- Communications with fixed equipment (eg. bus stop signs)
- Communications with mobile equipment (eg. buses)

6.64 Whilst the same communications system can be used for all equipment, there are a number of additional choices for fixed equipment that it would be beneficial to consider.

Communications Options

6.65 Communications with fixed and mobile equipment can be via two broad categories of technology:

- Mobile phone (GSM, GPRS, WCDMA)
- Private Radio (Licensed or license free)

6.66 Communications with fixed equipment can additionally use the following technologies:

- Dial up Public Switched Telephone Network (PSTN) phone line
- Broadband ADSL or Single-pair High Speed Digital Subscriber Line (SHDSL) connection
- Private cable connection

6.67 A brief discussion of the relative merits of these technologies for each application is given below.

Communications with Mobile Equipment (Buses)

6.68 Communications with buses can either use the mobile phone network or a private radio system with transmitters sited at key locations to provide acceptable coverage across the region.

Mobile Phone

6.69 The benefit of using the mobile phone network is primarily the pre-existing infrastructure, allowing easy provision of communications with buses across the majority of the region. For those buses where the AVL software is running on the ETM, this process is simplified by the design of the ETMs with mobile phone communications in mind. This can be as simple as the addition of a SIM card into a slot on the ETM. All buses in the Nestrans area have these modern ETMs.

6.70 Use of the mobile phone network does come at a cost. GPRS or Third Generation (3G) alternatives are charged by the network operators according to the volume of data sent. Whilst the amount of data to be sent would be relatively small, to provide accurate predictions it will be necessary to provide location updates 2 or 3 times per minute. Section 9 provides details of likely data transmission costs for a range of communications media, but assuming a message size of 100 bytes in each direction, and an average usage of each bus of 12 hours per day, this equates to approximately 10MB per bus per month. It may be that careful design of the system allows message sizes to be reduced, and Stagecoach has indicated that they anticipate data volumes of approximately 4-6MB per bus per month. For robustness, and because actual data volumes will vary between system suppliers, 10MB has been used in the cost estimates (see section 9).

6.71 Mobile phone coverage across the region is extremely variable across operators. Appendix C includes screenshots of the coverage plots from each of the mobile operator's websites. It is clear from these a number of the operators would be unlikely to be able to provide suitable coverage across the entire region. The most comprehensive coverage appears to be available on the '3' and

'O2' networks, although it is important that detailed surveys are undertaken to assess the quality of reception for each network operator prior to signing contracts.

6.72 Indications from Aberdeenshire Council, however, are that previous work on this subject has shown Vodaphone to offer the best coverage and network capacity across the region. This is not reflected in the available coverage plots. It may be the case that some mobile providers class a lower signal level as being acceptable than the others, and the coverage plots should be read as a guide only.

6.73 A survey of current mobile phone tariffs indicates that O2 can offer a data only SIM for £3.50 a month for up to 5MB and £5 a month for 10MB. It may be that bulk deals could be negotiated with providers at a better rate than this, but this figure has been used in the cost estimates in section 9 to provide a robust estimate. Information from Aberdeenshire Council indicates that they are currently paying £1 per MB on Vodaphone for the Demand Responsive Transport (DRT) vehicles.

Private Radio

6.74 If private radio were to be used, then there would be no data transmission costs other than an annual license cost for use of the radio channel(s). There would, however, be significant costs involved in providing radio transmitters and linking these together to operate in parallel, to give an appropriate level of coverage across the region.

6.75 Whilst final details of the number and location of transmitter sites cannot be gauged without a full radio survey, it is felt likely that at least six transmitters would be needed to get reasonable coverage across the region. This estimate is based on coverage predictions obtained using a free on-line coverage prediction tool. It has assumed 10W unidirectional transmitters in the 186MHz band sited on existing masts across Aberdeenshire. Screen prints from each of these predictions are included in Appendix B.

6.76 It should be noted that even with these six transmitters there are likely to be significant holes in the coverage and until detailed surveys are undertaken it will be impossible to know how great an impact these will cause to system operation.

6.77 The existing RTPI system in Aberdeen operates on PMR with a single transmitter mounted on St Nicholas House. Most equipment is connected via this, although a number of newer information screens use a broadband connection direct to the ACIS server.

6.78 The PMR system will require a major update within the next couple of years because of the anticipated demolition of St Nicholas House in 2012, and a cross Europe realignment of frequency usage, that is likely to result in OFCOM requiring the current system to migrate to a new frequency by the end of 2011.

6.79 Depending on the new frequency allocated by OFCOM, it is possible that all radio antennae on buses and signs may need replacing.

6.80 A study into this was undertaken by ACIS in 2007. Their conclusions indicated that a migration of the existing system to a new Band 3, sub-band 1 PMR system with a new base station would cost almost £300,000, with a further £30,000 to enhance the signs to provide cross journey predictions and provide the latest vehicle viewer software.

Communications with Fixed Equipment (Information Displays)

6.81 Whilst communication to fixed equipment can be via mobile phone or private radio, it can also be via fixed line technologies.

Dial up PSTN line

6.82 Dial up PSTN phone lines are conventional voice phone lines. They are charged according to the number of times used and duration of calls. They also suffer from relatively slow communication rates, although their speed is likely to be as good as or slightly better than mobile phone connections.

6.83 These lines could potentially be used for connecting on-demand information displays at remote sites with low predicted usage, although there would be a noticeable delay in providing information whilst the connection was made.

Broadband ADSL/SHDSL Connections

6.84 These connections provide fast data communication over standard copper phone lines. They require a PSTN phone line to be installed initially. ADSL lines offer fast download speeds over lines that can be shared with voice communications. SHDSL offer fast up and download speeds but require a high quality dedicated phone connection, with a maximum distance from the exchange of approximately 3Km.

6.85 Whilst ADSL lines are available throughout Aberdeenshire, SHDSL is only likely to be available in Aberdeen City[1]. Even where it is available, it is likely to prove significantly more expensive than ADSL.

6.86 These types of connection are likely to be the most suitable for information sources with a large data loading, such as interactive screens offering online mapping.

Private Cable Connections

6.87 Whilst being the lowest cost in revenue terms, the capital cost of installing private communications cables will be prohibitive for anything except short local links. In practice this means that private cable links will only be worth considering where there is a nearby communication 'hub' such as a council building with access to the corporate WAN.

[1] http://www.samknows.com/broadband/

7 Technical Options

System Options

7.1 As described in section 2.15 there are three options for providing a regional RTPI system:

- Option 1 - expand the existing Aberdeen City system
- Option 2 - provide a new regional system to replace the existing Aberdeen system
- Option 3 - provide a new regional system to link to and work in parallel with the existing system.

7.2 In addition to these 3 options, there is the 'Do nothing' option of keeping the existing Aberdeen City system, but migrating the communications to a new PMR base station and frequency.

7.3 The benefits or otherwise of each of these options are described below.

Option 1 – Expand the existing system

7.4 As described in section 2.1 onwards, the existing system has recently undergone a technology refresh with all new on-vehicle equipment and a number of new and replacement information displays.

7.5 The existing PMR communication system will need replacing in the coming years to comply with the OFCOM frequency reassignment, and the transmitter mast needs relocating since St Nicholas House is due for demolition.

7.6 So long as the communications issues can be resolved satisfactorily, an expansion of the existing system would provide the benefit of allowing continuity of service, with additional buses/information signs coming on stream as they are installed.

7.7 This option would provide the smoothest transition as far as the travelling public are concerned since existing equipment will be able to remain, although the communications transition will have to be carefully handled to ensure a minimum downtime of the system.

7.8 ACIS undertook a study in 2007 investigating the switch over to a new PMR system. This looked at changeover issues, and priced up alternatives depending on whether a new frequency was required or just a transmitter move. On the basis that frequency realignment is highly likely to affect Aberdeen sometime within the operational life of any new system, it appears prudent to assume that a new frequency in Band 3 sub-band 1 will be required.

7.9 Stagecoach Bluebird has stated that they will only be happy to participate in the project on the basis that their vehicles will have the RTPI software loaded on the ETMs and communications will be by mobile phone technology. This will mean that they will not be affected by the issues arising from the PMR radio move.

7.10 Option 1, therefore, appears to comprise a switch of all existing Aberdeen equipment to the new PMR channel, with Stagecoach buses being fitted with GPRS communications. This would allow improved communications whilst 'roaming' across the Nestrans area and out into neighbouring authorities.

7.11 It is unclear at the moment the extent to which Aberdeenshire Council will provide physical signage at stops, although information via SMS/WAP/internet/etc should be universal. A reasonable initial

assumption is that one or two locations in each major settlement will have an electronic display with audio facilities. For costing purposes, a figure or 60 displays has been assumed.

Table 7.1 Option 1 Summary

Strengths	Weaknesses
Expansion of the existing system would provide the benefit of allowing continuity of service.	Appears to be a comprise with a switch of all existing Aberdeen equipment to the new PMR channel, with Stagecoach buses being fitted with GPRS communications
This option would provide the smoothest transition as far as the travelling public are concerned	The existing PMR communication system will need replacing in the coming years to comply with the OFCOM frequency reassignment, and the transmitter mast needs relocating since St Nicholas House is due for demolition.
Stagecoach Bluebird preference for RTPI software loaded on the ETMs and communications by mobile phone technology. Can be accommodated by this option	
Opportunities	**Threats**
Additional bus/information signs can be phased to come on stream	Reliant on communication issues being sorted satisfactorily
The replacement of the existing PMR communication system will provide an opportunity to relocate to improve coverage	ACIS units reaching the end of their useful life, and do not meet the latest guidance on DDA compliance.

Option 2 – Replace the existing system

7.12 To replace the existing system with an all new RTPI system would, depending on the system supplier, mean a large cost element of the project would be spent replacing perfectly serviceable signs and almost new on-vehicle equipment. It would also raise contractual issues with the recently signed maintenance contract in place between First Aberdeen and ACIS.

7.13 The benefit would obviously be seen in uniformity of equipment across the region, but unless funding is limitless, it would probably be a better idea to spend the money on providing RTPI information at additional sites rather than on replacing all existing signs to ensure uniformity.

7.14 There is the possibility, however, that if ACIS were to win an open tender for a complete replacement system, then Option 2 could be varied to provide Option 1. This would allow the newer RTPI signs to be kept and only the older red LED signs, which do not meet DDA guidance, to be replaced.

7.15 For costing purposes, an assumption has been made of a complete system replacement with all buses and shelter mounted signs in Aberdeen using GPRS communications, and 60 pole mounted displays in Aberdeenshire using ADSL.

Table 7.2 Option 2 Summary

Strengths	Weaknesses
Uniformity of equipment across the region.	Large cost element of the project would be spent replacing perfectly serviceable signs and almost new on-vehicle equipment.
	Large cost of the project would mean that equipment would require to be phased in, meaning potential mixed systems
	The existing PMR communication system will need replacing in the coming years to comply with the OFCOM frequency reassignment, and the transmitter mast needs relocating since St Nicholas House is due for demolition.
Opportunities	**Threats**
There is the possibility that if ACIS were to win an open tender for a complete replacement system, then Option 2 could be varied to provide Option 1	Raise contractual issues with the recently signed maintenance contract in place between First Aberdeen and ACIS.
ACIS units reaching the end of their useful life, and do not meet the latest guidance on DDA compliance.	Large cost of the project would mean that equipment would require to be phased in, meaning potential mixed systems

Option 3 – Provide a parallel system

7.16 This option would ensure no disruption to the existing RTPI system from the expansion (although there would still need to be careful planning of the existing PMR communications change).

7.17 A new system could be installed independently with the buses equipped and server operational before any link to the current system is made. Once confidence is achieved in the operation of the new system, particularly the data, then a SIRI compliant server to server link between the existing ACIS system and the new system can be 'switched on'. This will allow the existing RTPI signs to display information obtained from new system.

7.18 At this point, new signs/information sources can be provided across the region, and they should be able to immediately start giving combined information from both systems.

7.19 Again, if ACIS were to win the tender for a parallel system, it would make more sense for the new system to be built on top of the current one, using a single server for the entire system. This would reduce costs and remove any potential for problems with a SIRI link between servers.

7.20 The main potential issue with a parallel system is any increased latency within the system caused by data having to pass through two servers and the links between them. Although in theory any delays should be minimal, the potential exists for this to be an issue.

7.21 This is unlikely to be a serious concern for RTPI at bus stops, since a few seconds inaccuracy will not be noticed in the general background 'noise' and the refresh rate of the signs. Where it may be an issue is if traffic signal priority requests are being sent across the SIRI link and from there into the UTC system. It should be possible to avoid this, however, by careful design of the system so that it has a direct SIRI link to the UTC computer.

7.22 For costing purposes, it has been assumed that all newly equipped buses will communicate by GPRS, and 60 pole mounted information displays will be provided communicating by ADSL.

Table 7.3 Option 3 Summary

Strengths	**Weaknesses**
No disruption to the existing RTPI system from the expansion	Potential slowing of data having to pass through two servers and the links between them. May be an issue with traffic signal priority. Careful design of the system so that it has a direct SIRI link to the UTC computer should limit this.
A new system could be installed independently with the buses equipped and server operational before any link to the current system is made.	The existing PMR communication system will need replacing in the coming years to comply with the OFCOM frequency reassignment, and the transmitter mast needs relocating since St Nicholas House is due for demolition.
Combined information from both systems can be given on signs	
No contractual issues over current maintenance agreements	
Opportunities	**Threats**
If ACIS were to win an open tender for a parallel system, then a single server could be used for the entire system. This would reduce costs and remove any potential for problems with a SIRI link between servers.	Reliant on communication issues being sorted satisfactorily
	ACIS units reaching the end of their useful life, and do not meet the latest guidance on DDA compliance.

'Do Nothing'

7.23 Even a 'Do nothing' option will require significant work and expense to migrate the current PMR radio system to allow continuity of service after the frequency migration and with the demolition of St Nicholas House.

7.24 A study commissioned by Aberdeen City Council and undertaken by ACIS investigated this, and in March 2007 reported anticipated costs for this of almost £300,000 just for migrating to a new Band 3 sub-band 1 radio on a new antenna, and reconfiguring the buses and signs to use this. When minor system upgrades to provide cross journey prediction of buses and improved bus tracking management were added in this gave a total 'Do nothing' cost of approximately £330,000.

8 Funding Options

Links to National & Local Initiatives

8.1 Creating a greener Scotland is one of the strategic objectives of the Scottish Government. This involves improving the natural and built environment and ensuring the sustainable use and enjoyment of it.

8.2 Local government can have a significant impact on whether Scotland achieves its aims. Councils are pioneering much good practice in reducing carbon footprints and creating a more sustainable environment.

8.3 In 2007, all Scottish local authorities signed Scotland's Climate Change Declaration[1].

8.4 This is a commitment to prepare and publicly declare a plan, including timescales and targets, to significantly reduce greenhouse gas emissions from all local authority operations.

8.5 Aberdeen and Aberdeenshire Councils' Local transport Strategy (LTS) outlines their aims. It includes a specific objective to support initiatives to reduce harmful emissions, greenhouse gases, light and noise pollution.

8.6 NESTRAN's Bus Action Plan (published in February 2009) sets out clear and ambitious targets and core interventions that will see bus based transport contributing to these national and local initiatives.

8.7 The Improvement Service is supporting councils and their partners in promoting sustainable methods of delivering services and in reducing their carbon footprints. Their activities include:

- Developing guidance, in partnership with the Sustainable Development Commission, on the selection and use of appropriate tools for assessment of council-related and area-wide carbon emissions;
- Assessing councils' understanding of, and capacity to use, appropriate tools and techniques for the reduction of carbon emissions;
- Proving guidance on the Carbon Reduction Commitment and supporting councils in developing their capacity for effective operation of the carbon trading scheme in 2010;
- Working with councils and stakeholders to strengthen their capacity for assessing and addressing their carbon and ecological footprints, including the use of PSIF, guidance on building sustainability into Single Outcome Agreements and continued support for the Local Footprints project;
- Working with councils and stakeholders to strengthen their capacity to assess and address the impacts of climate change on services and communities.

Funding Streams

8.8 Aberdeenshire Council has been allocated in its Capital Plan for 2009/10 the sum of £200,000 for RTPI, with a further £50,000 allocated to each subsequent financial year up to 2023.

[1] http://www.improvementservice.org.uk/library/download-document/742-scotland-s-climate-change-declaration

8.9 There are no specifically identified budgets for the implementation of a RTPI system from the other key stakeholders, although Nestrans does have money set aside in this year's budget to implement elements of the Bus Action Plan. This could be spent on RTPI. Nestrans funding and budgets have not been confirmed for future years, but a similar situation may be the case in the future.

8.10 It is unlikely that private sector funding (bus operators) will be in a position to financially contribute other than by ‘payment in kind’.

8.11 National and local initiatives such as linking the RTPI project directly with Scottish Government targets such as displayed above by the Improvement Service and with the agreed Single Outcome Agreements are seen as a way of prioritising the need for a RTPI system in contributing to meeting the targets set at both a National and Local level.

9 Cost Estimates

Item Costs

9.1 At this stage, when the scale of any system is not yet defined, precise costs cannot be given. However, it is possible to identify approximate costs for each aspect of a potential system, and provide example costs for a couple of possible schemes.

9.2 Table 9.1 below gives approximate item costs for the major components of a RTPI system, and Table 9.2 gives likely ongoing revenue costs. These item costs are then carried forward into the cost estimates for different potential implementation schemes.

Table 9.1 RTPI system capital costs

Item	Description	Unit Cost (£)
1	Central server + software	17,000
2	Replacement PMR Radio Base Station + changes to buses/signs (ACIS report)	330,000
3	GPRS Instation/comms server	2,000
4	Operator Terminal Licences	2,500
5	Website Mapping Information	10-20,000
6	On-bus hardware + software	2,500
7	On-bus software for ETM	250
8	On-bus next stop signs	1,000
9	GPRS SIM card	5
10	RTPI shelter sign	3,500
11	RTPI flag sign	4,000
12	Audio announcement in sign	700
13	RTPI 20” TFT display	3,500
14	RTPI 42” TFT display	6,000
15	Pole mounted information display	3,000
16	Audio within a sign	400
17	Provide new ADSL phone connection	250
18	Provide new power connection	800*
19	System tests	15,000
20	Training	5,000
21	Documentation	3,000
22	System Configuration	5% of capital cost
23	Project Management	10% of capital cost
24	Contingency	10% of capital cost

* *May vary hugely depending on ducting requirements. Assumption has been made of clean supply within 5m.*

Table 9.2 RTPI system annual (revenue) costs

Item	Description	Unit Cost (£)
1	System Maintenance	10% of capital
2	GPRS costs (£5 for 10MB pcm)	60
3	ADSL costs (£30 pcm)	360
4	Radio Base Antenna rental	7,000
5	Radio Licence (3 channels)	800
6	Replace life expired shelter sign	3,500
7	Existing Aberdeen System Maintenance	100,000

9.3 The following sections give possible indicative costs for 3 schemes, broadly correlating to the expansion options defined in section 7. The assumption has been made that ADSL will be used for new signs/displays, and GPRS for new buses and replacement communications on existing buses and signs.

Scheme 1 – Extend Existing System (incl. new Band 3 sub-band 1 radio)

9.4 This scheme assumes 60 new pole mounted information displays in Aberdeenshire communicating by ADSL and all Stagecoach buses fitted with ACIS software communicating over GPRS back to the existing servers. ADSL has been assumed for the pole mount displays due to the amount of user requested data that may be transferred if they prove popular. It also replaces the current PMR with a new Band 3, sub-band 1 radio system with consequent equipment alterations to accommodate this.

9.5 In the revenue costs there is an assumption that 10% of existing signs will need replacing each year due to them being life expired.

9.6 It should be noted that revenue cost estimates are additional to the current revenue costs.

Table 9.3 Scheme 1: Extend Existing System – Capital Costs

Item	Description	Unit Cost (£)	Quantity	Cost (£)
3	GPRS Instation	2,000	1	2,000
4	Operator Terminal Licences	2,500	3	7,500
5	Website Mapping Information	10-20,000	1	15,000
7	On-bus software for ETM	250	290	72,500
9	GPRS SIM card	5	290	1,450
15	Pole mounted information display	3,000	60	180,000
16	Audio within a sign	400	60	24,000
17	Provide ADSL for pole mount displays	250	60	15,000
18	Provide power to pole mount displays	800	60	48,000
20	Training	5,000	1	5,000
21	Documentation	3,000	1	3,000
			SubTotal	*373,450*
22	System Configuration	5% of capital cost	1	18,673
			SubTotal	*392,123*
23	Project Management	10% of total cost	1	39,212
			SubTotal	*431,335*
24	Contingency	10% of total cost	1	43,134
2	Replacement PMR Radio Base Station + changes to buses/signs (ACIS report)	330,000	1	330,000
			Total	**804,469**

Table 9.4 Scheme 1: Extend Existing System – Additional Revenue Costs

Item	Description	Unit Cost (£)	Quantity	Cost (£)
1	System Maintenance	10% of capital	1	80,447
2	GPRS costs (£5 pcm)	60	290	17,400
3	ADSL costs	360	60	21,600
4	Radio Base Antenna rental	7,000	1	7,000
6	Replace life expired signs	3,500	14	49,000
7	Existing Aberdeen System Maintenance	100,000	1	100,000
			Total	**275,447**

Scheme 2 – Replacement System using GPRS

9.7 This scheme removes the existing system replacing it with new equipment using GPRS communications to all buses and signs. It assumes 60 new pole mounted information displays in Aberdeenshire communicating by ADSL and all Stagecoach and First Aberdeen buses fitted with ETM software communicating over GPRS.

Table 9.5 Scheme 2: Replace Existing System using GPRS throughout – Capital Costs

Item	Description	Unit Cost (£)	Quantity	Cost (£)
1	Central server + software	17,000	1	17,000
3	GPRS Instation	2,000	1	2,000
4	Operator Terminal Licences	2,500	5	12,500
5	Website Mapping Information	10-20,000	1	15,000
7	On-bus software for ETM	250	455	113,750
9	GPRS SIM card	5	595	2,975
10	RTPI shelter sign	3,500	140	595,000
13	RTPI 20” TFT display	3,500	6	21,000
15	Pole mounted information display	3,000	60	180,000
16	Audio within a sign	400	60	24,000
17	Provide ADSL for pole mount displays	250	60	15,000
18	Provide power to pole mount displays	800	60	48,000
19	System tests	15,000	1	15,000
20	Training	5,000	1	5,000
21	Documentation	3,000	1	3,000
			SubTotal	*1,069,225*
22	System Configuration	5% of capital cost	1	53,461.25
			SubTotal	*1,122,686.25*
23	Project Management	10% of total cost	1	112,269
			SubTotal	*1,234,955*
24	Contingency	10% of total cost	1	123,496
			Total	**1,358,451**

Table 9.6 Scheme 2: Replace Existing System using GPRS throughout – Revenue Costs

Item	Description	Unit Cost (£)	Quantity	Cost (£)
1	System Maintenance	10% of capital	1	135,845
2	GPRS costs (£5 pcm)	60	595	35,700
3	ADSL costs	360	60	21,600
			Total	**193,145**

Scheme 3 – Parallel System using GPRS

9.8 This scheme keeps the existing system, replacing the current PMR with a new Band 3, sub-band 1 radio system with consequent equipment alterations to accommodate this. It then provides a new system for Aberdeenshire with 60 new pole mounted information displays and all Stagecoach buses fitted with ETM software communicating over GPRS back to a new server. It then provides a server to server link between systems to allow information for both systems to be displayed on all signs.

9.9 In the revenue costs there is an assumption that 10% of existing signs in Aberdeen will need replacing each year due to them being life expired.

9.10 It should be noted that revenue cost estimates are additional to the current revenue costs.

Table 9.7 Scheme 3: Parallel System – Capital Costs

Item	Description	Unit Cost (£)	Quantity	Cost (£)
1	Central server + software	17,000	1	17,000
3	GPRS Instation	2,000	1	2,000
4	Operator Terminal Licences	2,500	3	7,500
5	Website Mapping Information	10-20,000	1	15,000
7	On-bus software for ETM	250	290	72,500
9	GPRS SIM card	5	290	1,450
15	Pole mounted information display	3,000	60	180,000
16	Audio within a sign	400	60	24,000
17	Provide ADSL for pole mount displays	250	60	15,000
18	Provide power to pole mount displays	800	60	48,000
19	System tests	15,000	1	15,000
20	Training	5,000	1	5,000
21	Documentation	3,000	1	3,000
			SubTotal	*405,450*
22	System Configuration	5% of capital cost	1	20,273
			SubTotal	*425,723*
23	Project Management	10% of total cost	1	42,572
			SubTotal	*468,295*
24	Contingency	10% of total cost	1	46,830
2	Replacement PMR Radio Base Station + changes to buses/signs (ACIS report)	330,000	1	330,000
			Total	**845,125**

Table 9.8 Scheme 3: Parallel System – Revenue Costs

Item	Description	Unit Cost (£)	Quantity	Cost (£)
1	System Maintenance	10% of capital	1	84,513
2	GPRS costs (£5 pcm)	60	355	21,300
3	ADSL costs	360	60	21,600
4	Radio Base Antenna rental	7,000	1	7,000
6	Replace life expired signs	3,500	14	49,000
7	Existing Aberdeen System Maintenance	100,000	1	100,000
			Total	**283,413**

Summary Costs

9.11 Table 9.9 below provides a summary of anticipated capital and revenue costs for the 3 schemes. Once a clearer picture of precise equipment requirements is available, these cost estimates should be developed further to identify site specific costs and any bulk discounts.

9.12 For comparison, a 'Do nothing' scheme has been included in the table. This includes the ACIS costs for moving and conversion of the PMR to a new Band 3, sub-band 1 radio and an allowance for ongoing replacement of life expired signs.

Table 9.9 Summary Costs

	Scheme 1 Expand existing system	Scheme 2 Replace with new system	Scheme 3 Provide parallel linked system	'Do Nothing' Keep existing system operational
Capital Cost	£804,469	£1,358,451	£845,125	£330,000
Revenue Cost (p.a.)	£275,447	£193,145	£283,413	£156,000
5 year Total Cost	**£2,181,704**	**£2,324,176**	**£2,262,190**	**£1,110,000**
10 year Total Cost	**£3,558,939**	**£3,289,901**	**£3,679,255**	**£1,890,000**

10 Business Case

10.1 The government sees publicly-available real-time information as important for improving the travelling experience and to enable the travelling public to be able to make informed decisions. There are also benefits for bus operators in terms of improved management of their fleets.

10.2 The complex structure of the bus industry and the very nature of bus operations present a challenge to the design and deployment of any RTPI systems to be employed.

10.3 Unless written into a statutory Quality Partnership the bus operators are under no legal obligations to commit to the delivery of an RTPI system. The most important factor for the operator is the need to have a clear business case. In such a volatile and risky industry any investment by the operator must be seen to generate sufficient demand to offset the additional spend in the provision of real time information.

10.4 There is particular concern amongst the bus industry where there is a limited availability of robust and relevant empirical evidence that real time information increases passenger growth. RTPI systems should be considered as complementary to investment in public transport itself and any investment be linked to the investment in buses itself.

10.5 It is the general consensus that the establishment of a robust business case for the operator can only be delivered with the close partnership working of local authority/central government funding. This points towards the need for public authorities to provide the substantial capital investment to pump prime the system and the associated infrastructure with the operator in a position to fund the revenue and maintenance of the system.

11 Summary and Recommendations

Existing Situation

11.1 There is currently a real time information system operating within Aberdeen. This system was originally installed in the 1990's although it has recently undergone a 'technology refresh' to bring much of the equipment up to current specification.

11.2 The entire First Aberdeen bus fleet is fitted with on-vehicle computers, radios and GPS equipment, permitting them to be tracked throughout the city via a PMR system with a base station on top of St Nicholas House in the city centre.

11.3 Information is provided to the public via signs at 140 bus stops plus a number of TFT displays in council buildings, universities, the hospital and a cinema.

11.4 Despite the recent technology refresh, many of the existing signs are approaching the end of their useful life, and do not, in any case, meet the latest guidance on DDA compliance.

11.5 The PMR system is also in need of a complete change due to an OFCOM frequency realignment that will result in the licence being changed, and the fact that St Nicholas House is scheduled for demolition in the next few years.

Future Requirements

11.6 There is a desire within Nestrans and Aberdeenshire Council for real time passenger information to be made available across the shire. Since the major bus operator outside Aberdeen City is Stagecoach, this will require their fleet to be equipped with AVL equipment. Aberdeenshire Council is keen, not least because it is an essentially rural authority, to provide information via as many methods as possible to ensure as many people as possible have access. They are therefore interested in mobile phone, internet and digital TV information provision as well as the more traditional signage.

11.7 Aberdeenshire Council also requires that any system must be compatible with the requirements/role of the Council as a major tendering authority for supported bus services.

11.8 Within the Aberdeen City, the council would like to extend their existing information provision to include mobile phone, internet and possibly digital TV.

11.9 First Group is happy with the system currently in place, and has recently replaced all on-vehicle equipment with the latest ACIS Deltatrak. The system provides them with the fleet management information they require to manage their operations. Whilst bus priority is apparently available across the city, it does not appear to be operating effectively throughout, and they would like some improvements in this area.

11.10 Stagecoach is happy to participate in a RTPI project, providing data from their scheduling system and buses, on the condition that no additional hardware is required on the vehicle (although software may be incorporated into their ETMs) and as long as there is no detrimental effect on their operation. They see a large benefit in equipping vehicles with AVL equipment from a fleet management perspective, and subject to suitable data sharing agreements will allow Nestrans to use this AVL information for RTPI. They do not, however, see a business case for RTPI itself, so are unwilling to fund the GPRS communications. Any fleet management information they require can be downloaded in the depot using their wireless LAN system.

Recommended System

11.11 Three primary system options have been considered in addition to the 'Do Nothing' option. These are:

i. Expand the existing Aberdeen system. This requires the moving of the existing PMR base station from St Nicholas House, and the migration to a new frequency. Outside the city, communications will be by GPRS to buses and ADSL to pole mounted information displays.

ii. Replace the existing system with a new region wide RTPI system. This will require all new equipment. It has been assumed that all buses and bus shelter signs will communicate via GPRS, with pole mounted information displays in Aberdeenshire using ADSL.

iii. Provide a parallel regional system linked to the current Aberdeen system. This will require a SIRI compliant interface between the systems to ensure data for both systems is used for real time predictions of all buses on all signs. It has been assumed that all buses for the new system will communicate via GPRS, with pole mounted information displays in Aberdeenshire using ADSL. The existing system's PMR radio will still need moving and migrating to a new frequency with consequent changes to all radio equipment.

11.12 Both options (ii) and (iii) offer the benefit of allowing a competitive tender. This is likely to result in a more competitive cost than would be gained by a direct approach to ACIS where they are aware that they have a monopoly situation.

11.13 The Indicative costs given in section 9 demonstrate that whilst option (ii), a complete replacement system across the whole of Aberdeen city and shire, would have the highest initial capital cost, over a 10 year period it will prove the cheapest.

11.14 It does, however, mean that the large investment in new on-vehicle equipment recently made by First will potentially be made redundant by the installation of AVL software on the ETM combined with GPRS communications. If ACIS were to win any system tender, then First could continue to use the Deltatrak units rather than installing software on the ETMs if they saw a benefit in this, although the communications would need changing to GPRS, so there would probably not be any cost savings.

11.15 This option offers the benefit of consistency of equipment throughout the region, making it easier to operate and maintain the system. It also means there will be a single new SIRI compliant RTPI system for neighbouring authorities to interface with, reducing the potential for compatibility issues.

11.16 Whilst option (ii) is the cheapest in the longer term, it should be noted that this reduced revenue cost only shows a payback during years 5 to 10 after installation. If initial capital costs are the primary consideration then both options (i) and (iii) are significantly cheaper (~£500,000).

11.17 It is important to note, that even the 'Do nothing' scheme has a significant cost attached to it of almost £2 million over the 10 year period. This is primarily comprised of capital costs to replace the PMR system and replacement costs for life expired signs.

Implementation Programme

11.18 Without clear details of the availability of funding it is obviously impossible to give firm recommendations on implementation programmes for RTPI. However, some general guidance on implementation order and details of minimum system requirements in phase one can be given.

11.19 It is important that existing facilities are maintained as much as possible. Therefore the initial implementation should look to replicate all existing signage prior to a switch off of the current system. Obviously the initial phase will need to include servers and communications equipment as well as AVL software and communications systems for any buses that need to be included initially. Provision of web based information and a feed to Traveline Scotland is likely to be the most cost efficient way of disseminating information to a wider audience than are currently served. This can then be supplemented with additional signs at key points as funding becomes available.

Appendix A

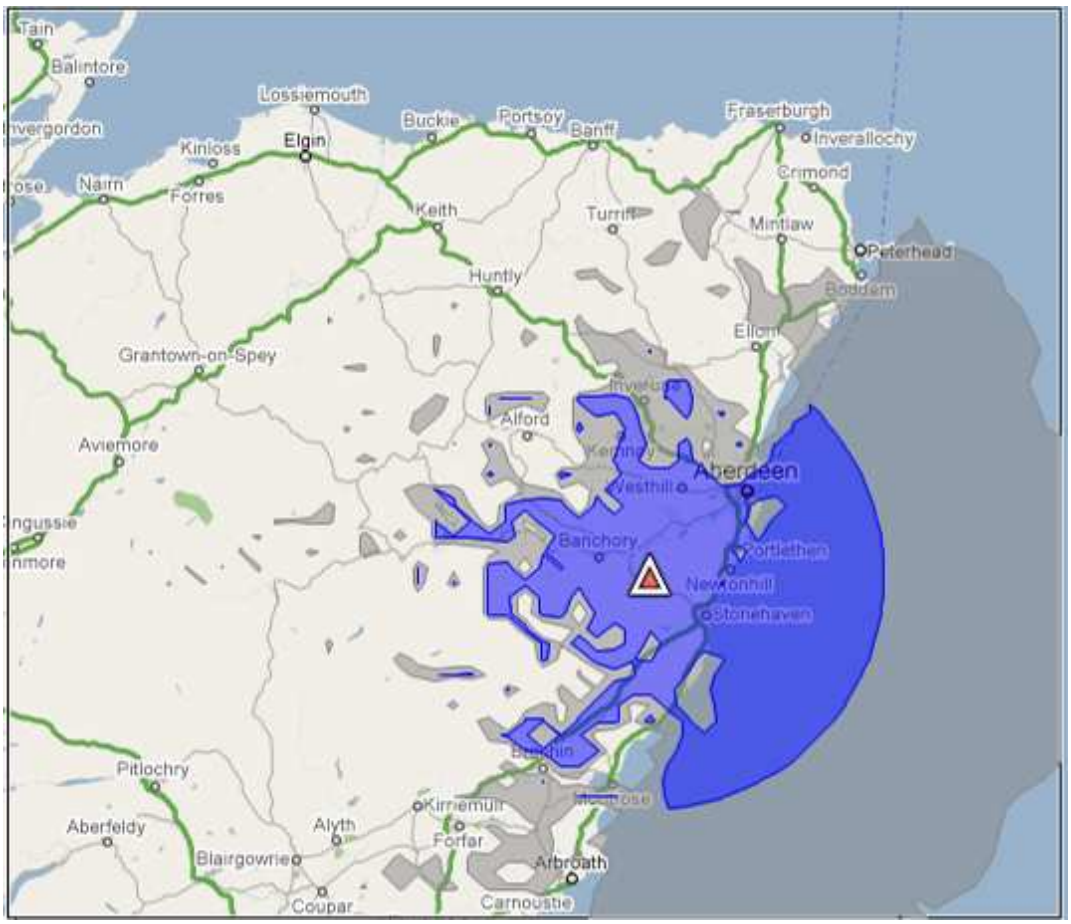
Glossary of Terms

Term	Meaning
3G	Third Generation mobile phone network
ACIS	Advanced Communications and Information Systems - The supplier of the current Aberdeen City RTPI System
ADSL	Asymmetric Digital Subscriber Line – A form of broadband communication allowing higher bandwidth communication in one direction than the other (commonly up to 8Mbit/sec download and 512Kbit/sec upload). This is the usual broadband connection for home use.
AVL	Automatic Vehicle Location
DDA	Disability Discrimination Act – Legislation to ensure that disabled people are not unfairly treated due to their disability. This originally came into force into 1995, and was amended in 2005.
Deltatrak	A proprietary name for the ACIS on-bus computer
dGPS	Differential GPS – A form of GPS using a receiver at a fixed, known location to calculate local correction factors to increase location accuracy for nearby mobile receivers.
ERG	A supplier of fare collection and ticketing equipment for the public transport industry
ETM	Electronic Ticket Machine
GPRS	General Packet Radio Service – A Time Division Multiple Access mobile phone technology used to provide data services. This is an earlier technology than WCDMA.
GPS	Global Positioning System – Free to access Global Navigation Satellite System originally developed for use by the US military.
GSM	Global System for Mobile Communications – The most commonly used mobile phone standard
HITRANS	Highlands and Islands Transport Partnership
LAN	Local Area Network – a computer network within a small geographic area, particularly a single building.
LCD	Liquid Crystal Display
LED	Light Emitting Diode
NEC	National Entitlement Card – Smartcard used in Scotland for gaining access to public services esp. concessionary fares on public transport
Nestrans	North East of Scotland Transport Partnership
OFCOM	The independent regulator and competition authority for the UK communications industries
PMR	Private Mobile Radio – a low cost licensed radio frequency range used primarily for base to mobile communications
PSTN	Public Switched Telephone Network – the conventional dial up landline telephone network
REACT	Talking sign system to help visually impaired people navigate more easily in public places
RTIG	Real Time Information Group – A members group formed to develop standards and protocols for RTPI systems to allow cross boundary linking and interoperability of systems

Term	Meaning
3G	Third Generation mobile phone network
RTPI	Real Time Passenger Information System
SA	Selective Availability – A method used by the US military to artificially reduce the accuracy of GPS for civilian use.
SHDSL	Single-pair High Speed Digital Subscriber Line – A form of broadband connection offering symmetrical upload/download speeds of up to 5.6Mbit/sec. This connection uses the entire line bandwidth and cannot therefore line share with voice communications
SIM	Subscriber Identity Module – A smartcard used to hold individual subscriber identity data for use on a mobile phone network.
SIRI	Service Interface for Real Time Information – an XML protocol for exchange of real time data between distributed computers
SMS	Short Message Service – a communication service allowing short text messages to be sent and received across the mobile phone network.
TACTRANS	Tayside and Central Scotland Transport Partnership
TFT	Thin Film Transistor – a display technology commonly used in flat screen computer monitors
UTC	Urban Traffic Control – a centralised computer system for controlling and coordinating traffic signals across a wide area
WAN	Wide Area Network – a type of computer network covering a wide geographic area.
WAP	Wireless Application Protocol – A open international standard used for accessing the internet from a mobile phone
WCDMA	Wideband Code Division Multiple Access – A means of sharing bandwidth used by the latest 3G and similar mobile phone communications technologies.
XML	Extensible Markup Language – an open standard language for computer communications

Appendix B

Radio Coverage Predictions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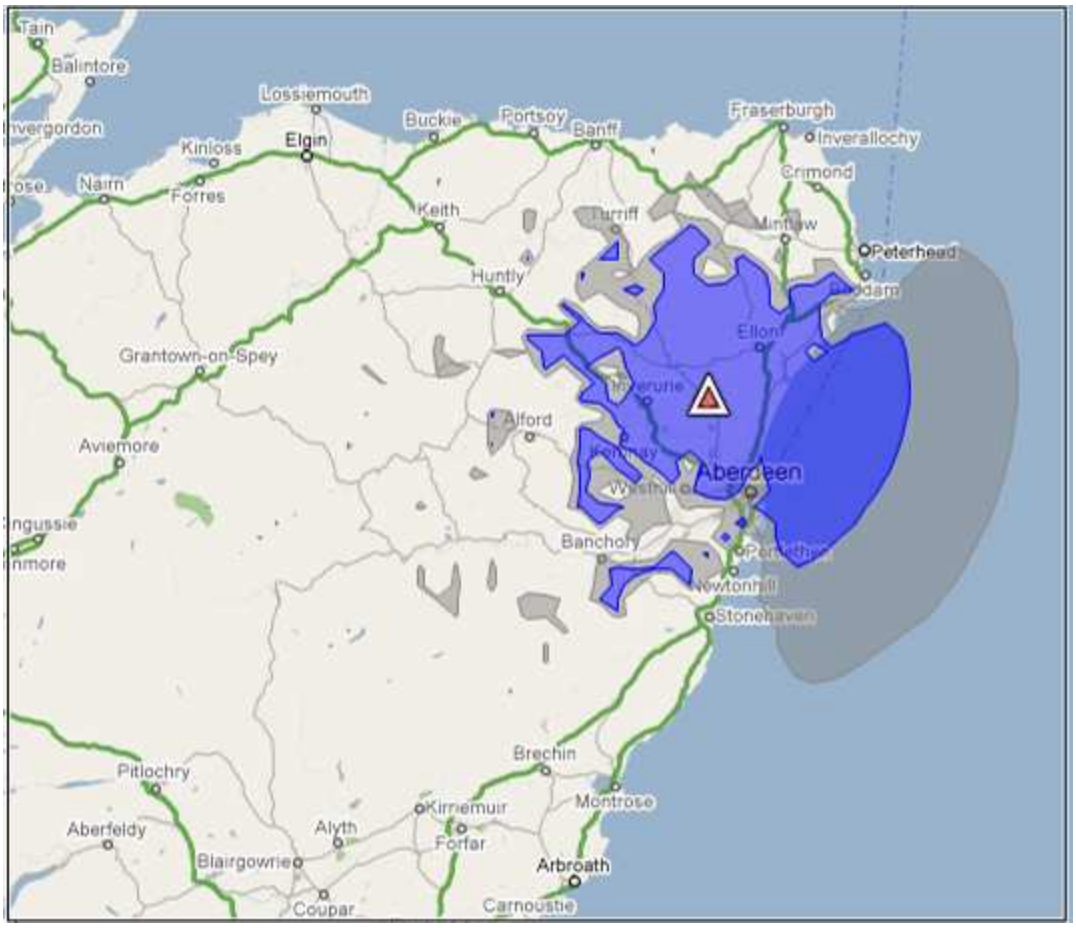
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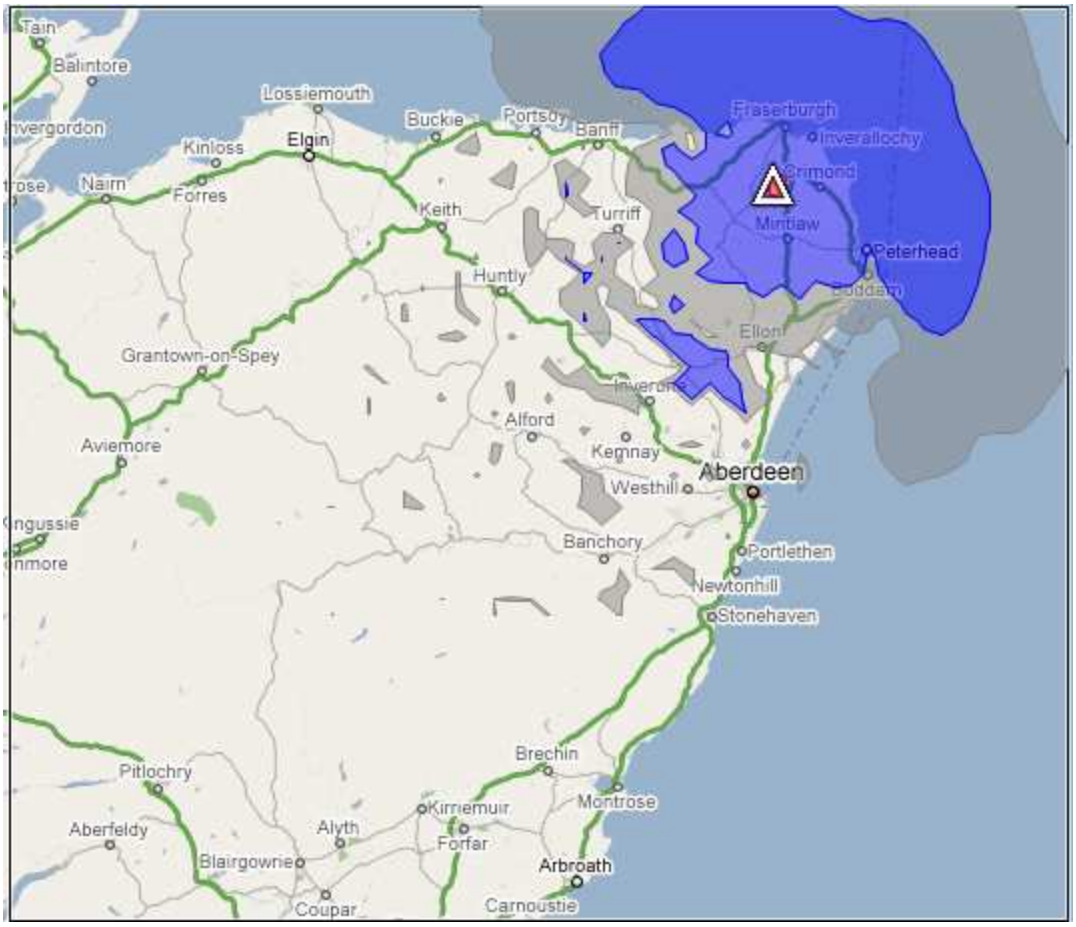
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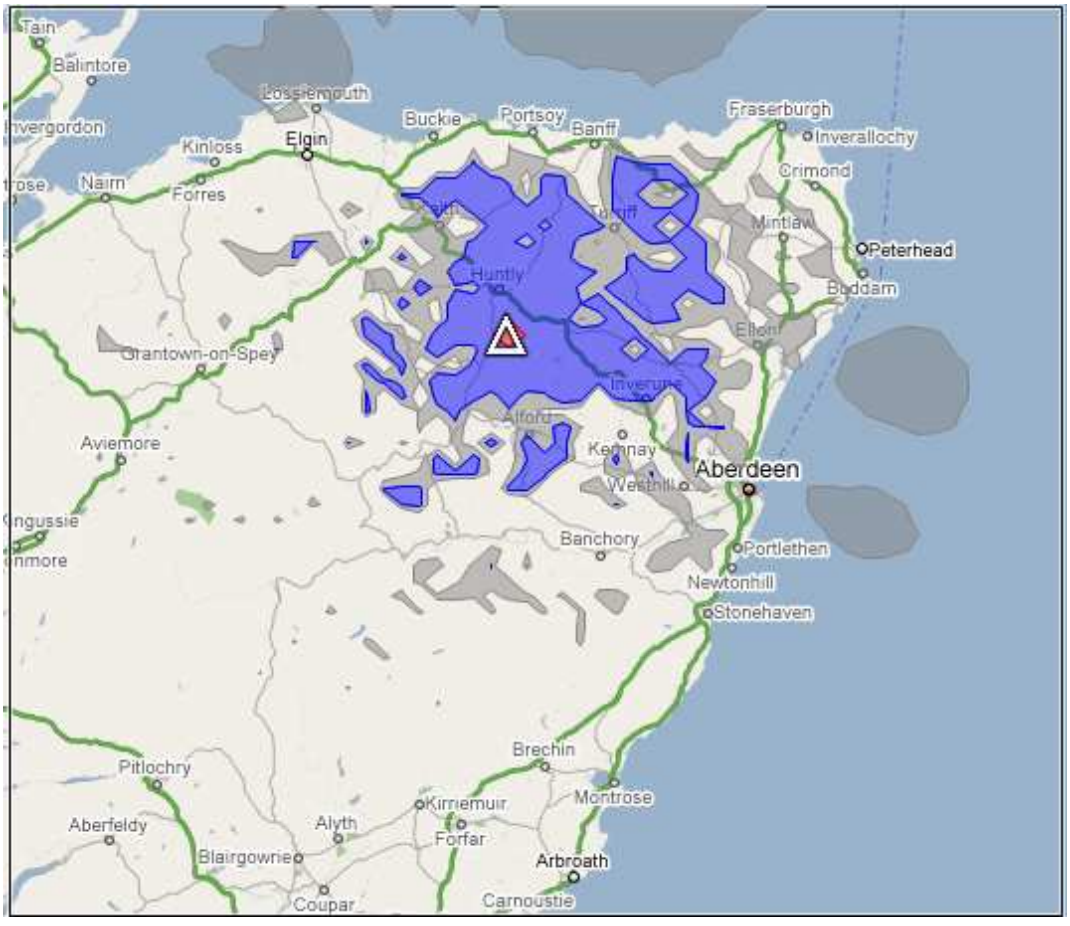
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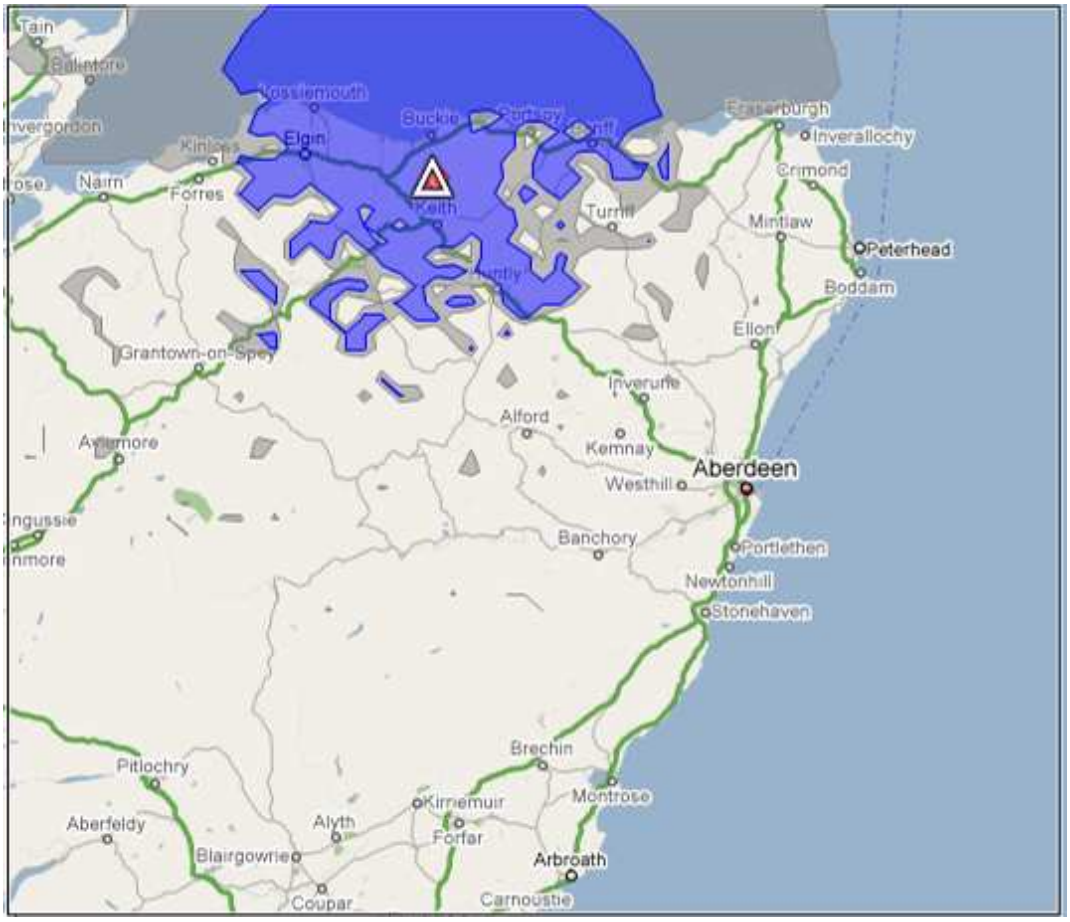
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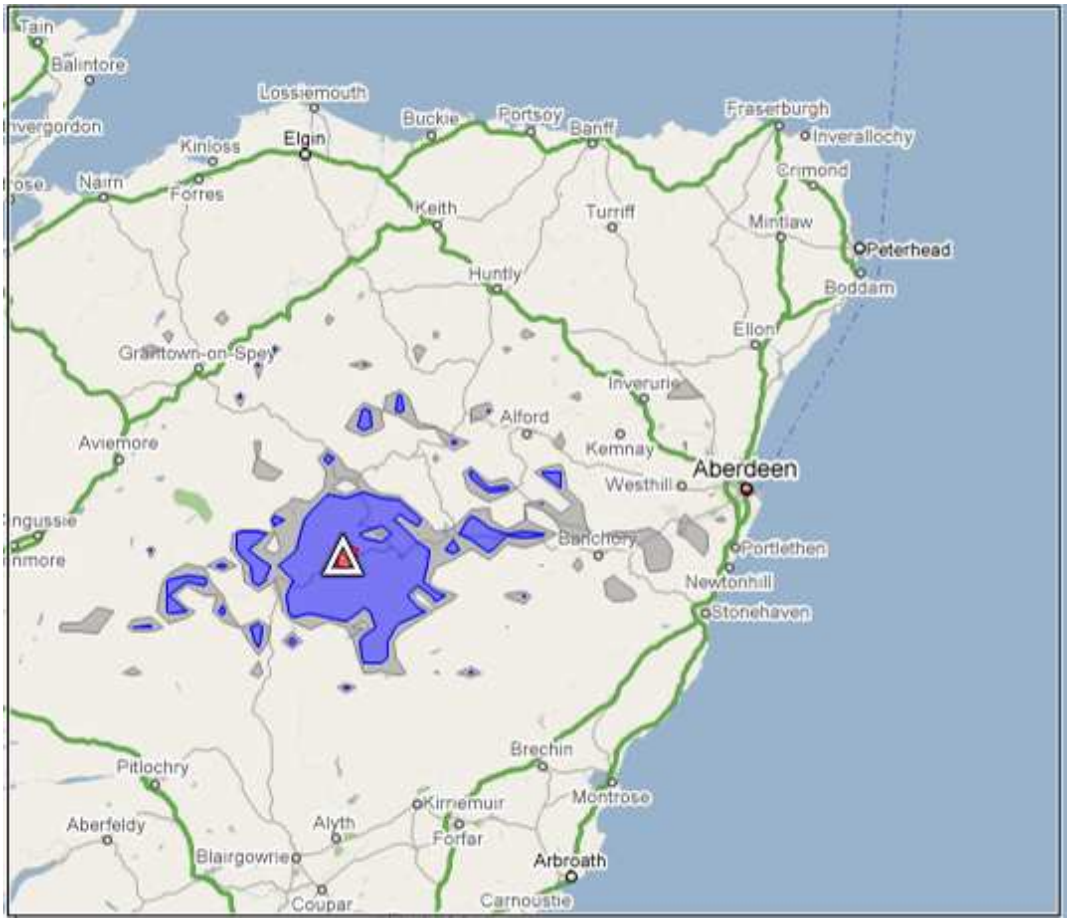
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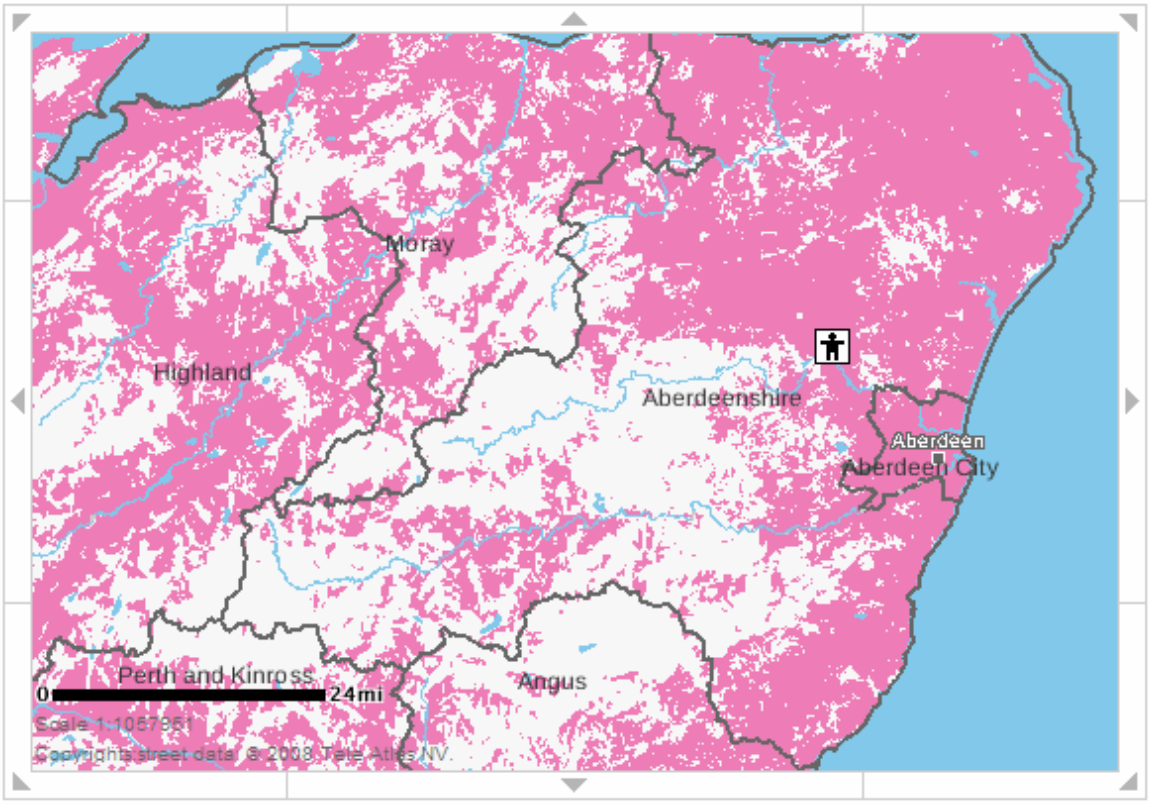
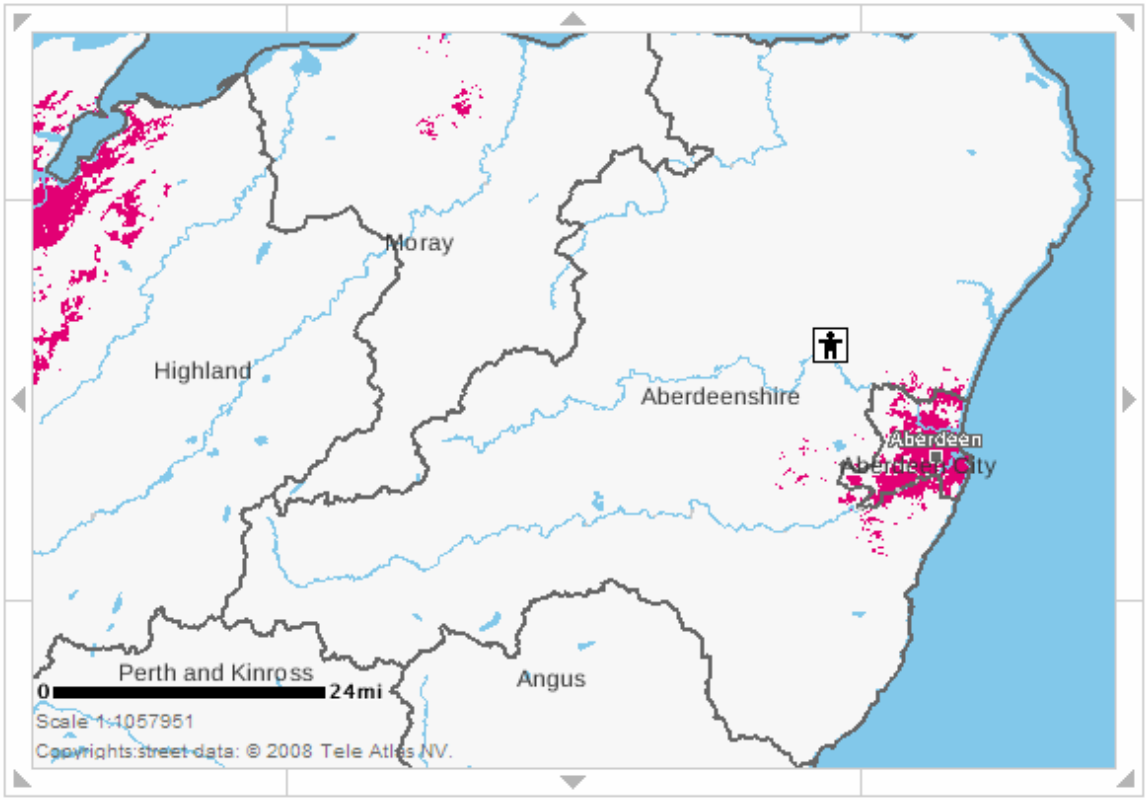
Appendix C

Mobile Phone Coverage Plots

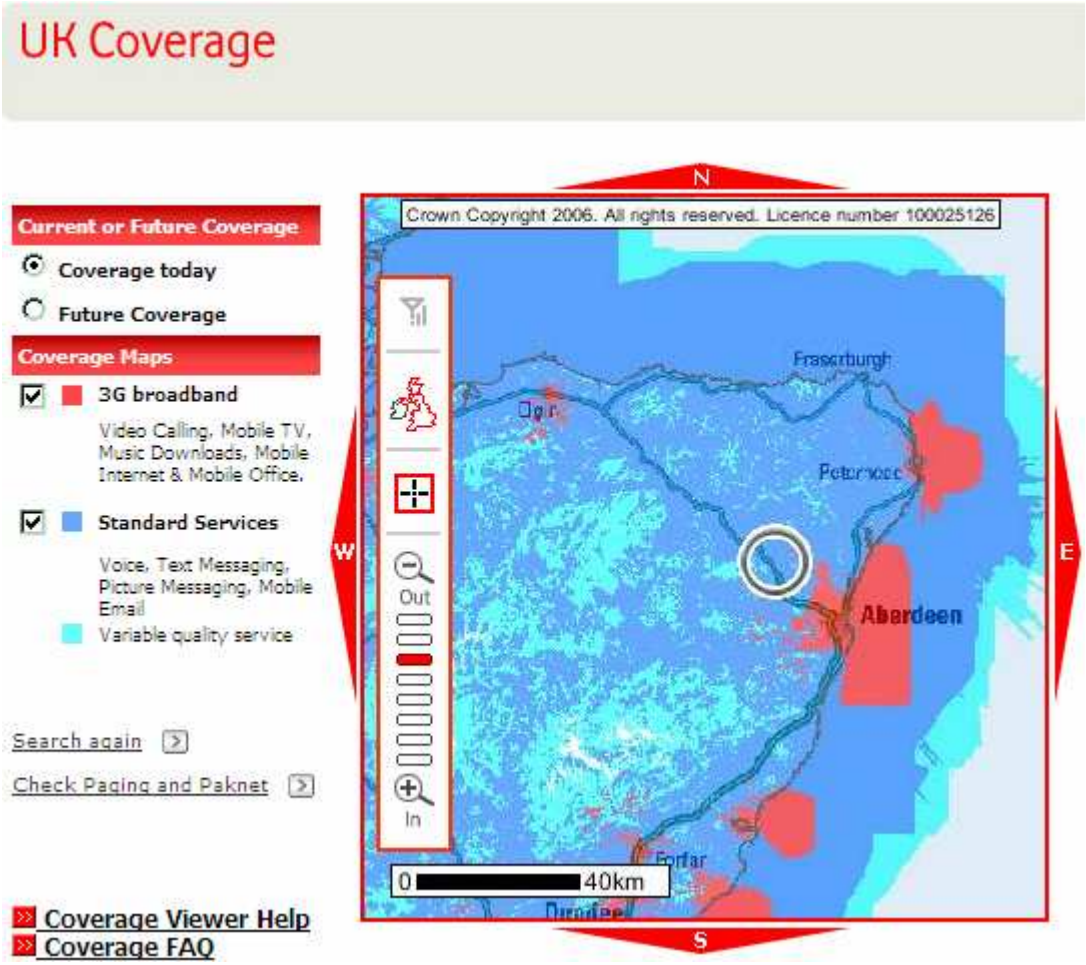
T-Mobile 2G Coverage



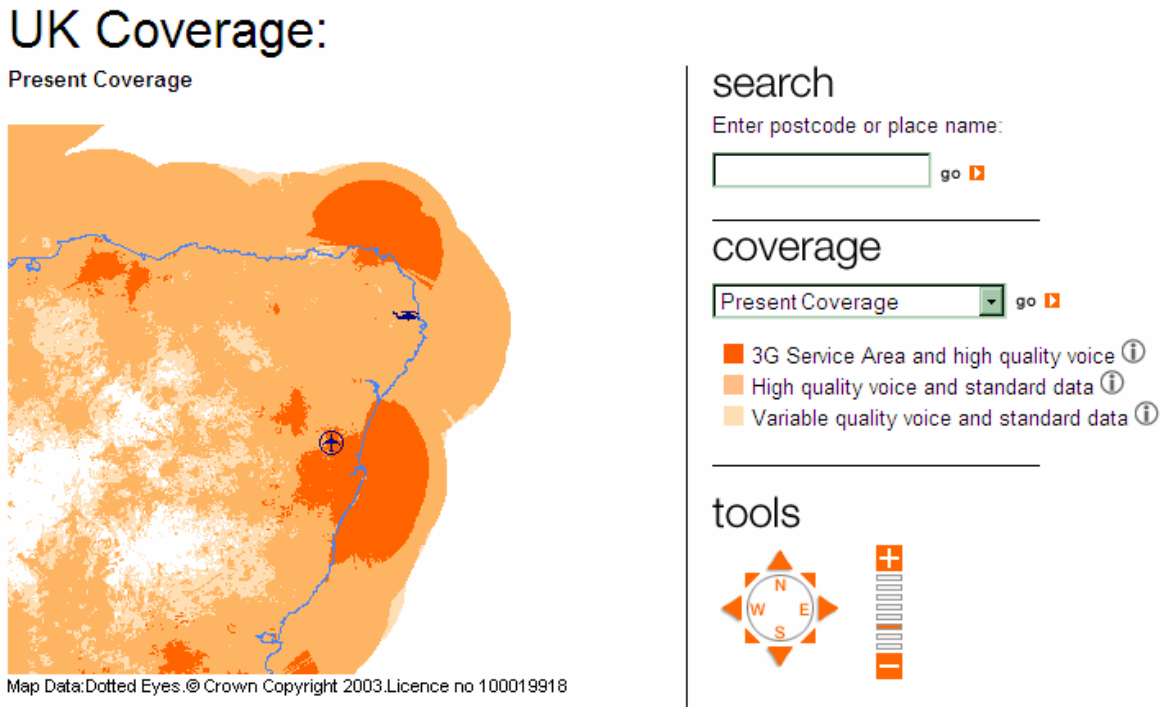
T-Mobile 3G Coverage



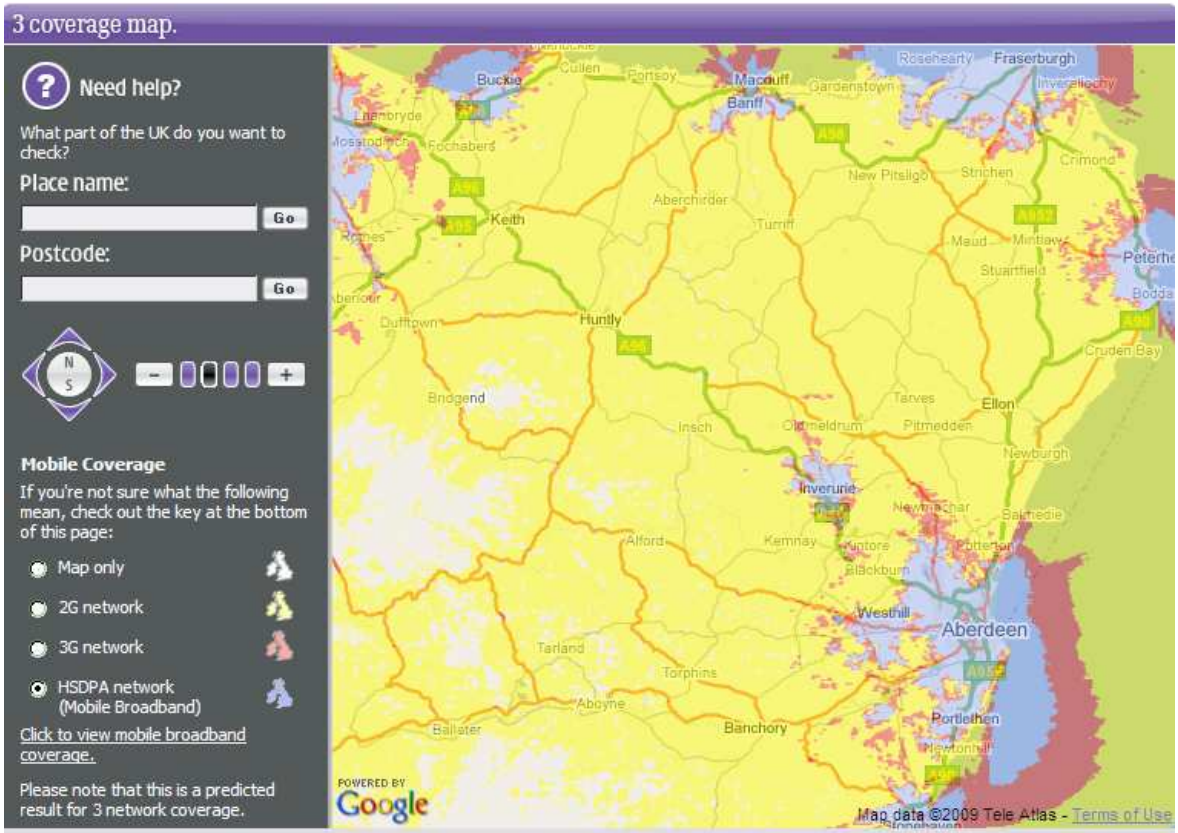
Vodaphone Coverage



Orange Coverage



‘3’ Coverage



2G network: gives you voice, text and picture messaging services.
3G network: gives you all of the above, plus video calling and the internet on your mobile.
HSDPA network (Mobile Broadband): gives you all 2G and 3G services, plus high-speed internet access on your mobile and with your dongle (USB modem). If you're a Mobile Broadband dongle customer, click to view more detailed mobile broadband coverage.

Although we try to make our maps as accurate as possible, the information is only a guide, and is not a guarantee of service availability in a particular location. If you would like more accurate and up to date coverage information, please contact our Customer Services team on 333 from a 3 mobile or 08707 330 333 from any other phone.

O2 Coverage