**Advances in Real Time Passenger Information**
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## 1    Introduction

BustrackerSEStran is a regional fleet management and live bus information system covering south-east Scotland. The availability of Real Time Passenger Information (RTPI) plays a significant role in increasing bus patronage in both urban and rural areas, improving social inclusion, and improving accessibility to employment opportunities and healthcare. This paper considers the challenges associated with delivering a successful long-term, multi-stakeholder public sector transport project of this type against a backdrop of:

- significant capital and revenue budget cuts;
- evolving systems & communications options; and,
- changing stakeholder aspirations.

## 2    Background

### 2.1    SEStran

SEStran (South East Scotland Transport Partnership) is one of seven Regional Transport Partnerships (RTPs) in Scotland, set up by the Transport (Scotland) Act 2005, with a core remit to develop a Regional Transport Strategy (RTS). SEStran covers a wide range of geographical locations from the highly urban, Edinburgh city centre, to the rural Borders. A main aim of the RTS is to promote transport policies and measures which support regional growth. SEStran aims to provide a transport system which allows the economy to function efficiently and allows all groups in society to share in the region's success through high quality access to services and opportunities, respect to the environment and contributing to better health. Achieving this requires public transport improvements which enhance the range, quality and reliability of services across the area.

### 2.2    RTPI Network

The bus network in the region serves an area of very mixed urban/rural character. It is delivered by a mixed economy of bus operators of significantly varying sizes. Stagecoach and First Bus are the largest commercial regional operators. Edinburgh is predominantly served by the publically owned Lothian Buses, with the City of Edinburgh Council being the major shareholder. Through its RTS, SEStran was mandated to develop a system similar to the successful City of Edinburgh Council/Lothian Buses project already operating in and around Edinburgh. The new SEStran system would cover the region and be open to multiple bus operators whilst respecting commercial confidentiality. The feasibility report recommended a 1000 bus system with 600 real time passenger information displays and 150 traffic signal priority junctions.

## 3    Initial Implementation

### 3.1    RTPI System

Phase 1 had a £6m budget and included 500 buses and 100 on-street signs. Following government elections in 2008, changes to all RTP funding arrangements resulted in specification amendments to reduce capital costs. Since then SEStran has successfully secured funding from local authority partners, the European Regional Development Fund and the Bus Investment Fund (BIF). The project currently includes:

- the core regional system platform hardware and software;
- all Stagecoach and First bus services operating in the region;
- 3 on-street electronic bus stop signs;
- bus operator fleet management tools and integrated voice communications ;
- 150 off-network TFT passenger information screens within a wide range of public and commercial premises;
- web / mobile & app based passenger information providing flexible and immediate access to:
- live bus stop departure times for SEStran equipped buses operating across an area spanning Edinburgh, Carlisle, Glasgow and Dundee;
- 24/7 scheduled bus stop departure times for all First & Stagecoach services at every bus stop in the SEStran region;
- relevant service disruption information affecting your stop when you make your mobile /web query;
- Location & street named based searches to find relevant stops in the area.
- a live link providing BustrackerSEStran information on the national TravelineScotland "NextBuses" mobile app



**Figure 1:    Example of on-street signs**

The initial deployment focused on major bus operators but SEStran is committed to an inclusive system providing live bus departure information for *all* bus operators across the region. With over 45 independent bus operators delivering over 600 registered commercial and subsidised services, this poses an ongoing technical and administrative challenge.

Bus services in rural areas are generally less frequent than in cities. Accordingly, the impact of missing a bus on a rural, infrequent service is often greater than missing a bus in a city. With the ultimate aim of having all bus operators in the region on real time and thus increasing bus patronage, SEStran is aiming

to expand the existing RTPI system to include smaller bus operators who predominately operate in rural areas. Through identifying relevant funding streams, SEStran is working to upgrade ticket machines with these operators. This will both enable RTPI capabilities and prepare the services for smart ticketing developments. Coupled with the increase in SEStran's RTPI signage, bus travel in the South East of Scotland becomes ever more attractive as bus passengers are armed with the knowledge of a bus's actual time of arrival at their stop and with the confidence that it is on its way.

Consultation with small operators also revealed different operational requirements. For example, smaller operators do not require the comprehensive fleet management tools used by larger operators, preferring a "lighter touch" solution which does not require SEStran's on-bus hardware. The increasing availability of GPS/GPRS/3G enabled ticket machines and growing support for SIRI data interface standards offers a potential way forward in this area. However, it could increase rather than reduce the ongoing data management challenge for SEStran to maintain the accuracy and timeliness of underlying data and live bus predictions.



**Figure 2:    Ticket Machines supplied by SEStran**

## 4    A Change of Direction

In 2014, Stagecoach started to roll-out a ticket-machine based, fleet management and live bus information system across their entire UK fleet.  Deployment in Stagecoach Fife was programmed for 2015. SEStran immediately recognised the significant implications and risks for the regional project but also saw an opportunity to expand BustrackerSEStran following another successful BIF 2014 bid.

BustrackerSEStran was modified to accept a SIRI Vehicle Monitoring (VM) data feed supplied by the new Stagecoach system.  This ensured BustrackerSEStran could continue to calculate and disseminate live departure times for all Stagecoach services across the region. In addition, the new SIRI VM interface provided a suitable platform to integrate smaller bus operators using the "light touch" ticket machine based approach discussed above. The successful 2014 BIF bid also included the transfer of the Stagecoach on-bus equipment to First Scotland East. This meant that by March 2016, BustrackerSEStran included all First & Stagecoach vehicles and offered a platform to accommodate smaller bus operators.

## 5    Further Development

With insufficient funds to install traditional at-stop electronic displays, SEStran investigated alternative ways to maximise the availability and impact of live bus information. This resulted in another successful £0.5m BIF bid to implement an alternative low cost, internet based digital signing initiative.  The project is currently being delivered and will provide 250 digital signs in key public locations across all 8 SEStran partner authority areas. Typical sites include hospitals, sports centres, libraries and schools, etc. A small

number of commercial signs have already been successfully installed in retail centres, tourist attractions, theatres, offices etc.



**Figure 3:    Digital Signs in Waverley Mall, Edinburgh**

### 5.1    Key Features of the Digital Sign Network

An annual fee per screen has provided SEStran with an ongoing revenue stream to help sustain the BustrackerSEStran system. This initiative builds on previous investment and increases network coverage of the system.    For each customer, SEStran creates a branded, personalised sign configuration which displays:

- Live bus and, if appropriate, rail and tram information from a selection of nearby stops/stations;
- Marketing material or other location specific information supplied by the customer; and,
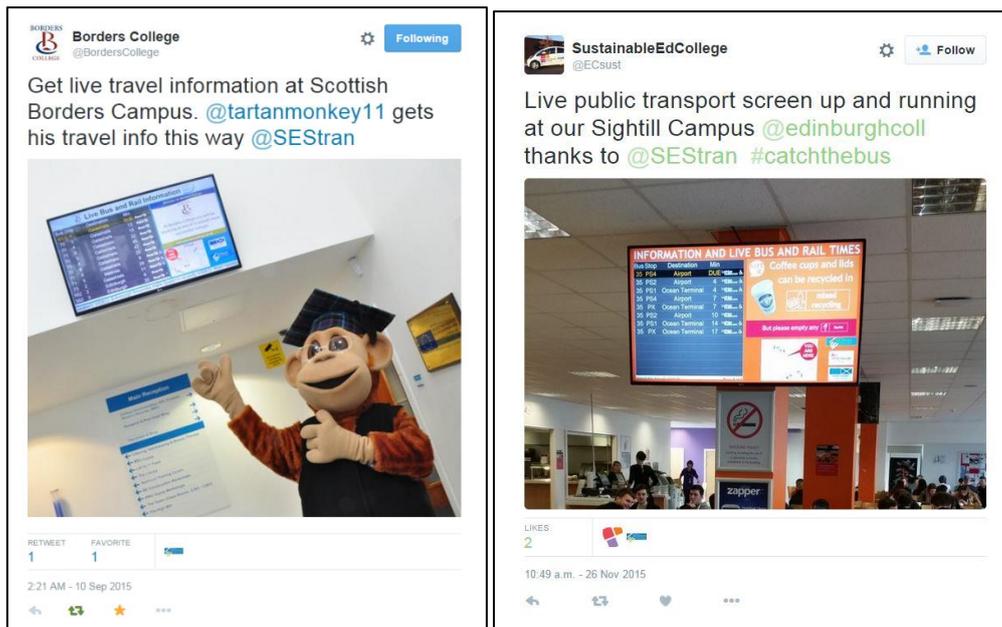- Selected ticker / news / weather feeds.



**Figure 4:    Examples of screens in-situ**

The customer provides the power and internet connection, and installs the screen/computer hardware. This is issued free of charge by SEStran as part of the project but some commercial customers have also provided the screen and computing hardware. SEStran then configures the individual signs to the customer's requirements, commissions the screen and manages the back-office system. Pro-active customers can manage their own screen content, if they wish. They cannot, however, amend the public transport information elements.

The digital signing initiative is extremely effective as it:

- builds on previous investment;
- provides a low cost deployment model;
- raises the profile and increases the coverage of the BustrackerSEStran system;
- builds partnerships with local businesses; and,
- offers a potential revenue stream.

## 5.2    Expansion of the Digital Sign Network

The BustrackerSEStran digital signing project offers significant added value to TravelineScotland due to the live data link implemented under a previous phase. This means all newly equipped/monitored buses will immediately deliver live bus times on TravelineScotland's national web and mobile services. The TravelineScotland system is reliant on the underlying local authority and regional bus systems, such as BustrackerSEStran, for the delivery of live bus information at a national level.

SEStran is using TravelineScotland's national data set to provide the baseline scheduled service and timetable information for small bus operator services. This TravelineScotland Transxchange file includes all service registrations and is updated on a weekly basis. SEStran will compare live SIRI VM feeds from small operators with this data set to generate live bus predictions within BustrackerSEStran.

## 5.3    Partnership Working

SEStran has 8 local authority partner authorities including:

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

The BustrackerSEStran project has demonstrated significant levels of partnership working at all stages of the project, from feasibility to commissioning. The digital signing initiative demonstrates that SEStran is pro-active in seeking new partners to exploit the ongoing potential of the system and previous investment. This will continue as the project grows, and will be maintained after it reaches full-fleet deployment. This is because the BustrackerSEStran system is a live system which impacts directly on the day-to-day activities of bus operators, public sector transport officers, digital signing partners and, ultimately, the travelling public.

## 6    Benefits of Delivering Live Bus Information

### 6.1    Economic Benefits

There are direct revenue benefits for SEStran partner operators in line with the research done by Caulfield and O'Mahony (2003) showing that the use of RTPI delivered increased revenue due to increased passenger numbers, and improved on-time performance whilst reducing operating costs due to more accurate fleet information leading to greater efficiencies. Caulfield and O'Mahony go on to point out that the costs of implementing an RTPI system are recouped in a relatively short period of time and the benefits accrued far outweigh these costs.

However, quantifying the value of live bus information has been notoriously difficult because projects are often delivered as part of a wider package of improvements. Nevertheless, numerous studies have linked live bus information with patronage growth. The scale of predicted benefits varies from 3 – 15%, but the impact is invariably positive.

There is now another indicator of the economic benefits of live bus information as the quantitative benefits are defined in the latest UK "WebTag" guidance. WebTag is used when assessing and comparing the economic benefits of government funded transport projects using multi-modal transport models. The need for accurate and reliable real time passenger information has long been assumed but the fact that the Department for Transport assigns a quantifiable, positive value to live bus information within multi-modal models helps reinforce the case.

### 6.2    Psychological Benefits

The benefits of live bus information are not just economic; there are also direct psychological public benefits, especially as regards the perception and the impact of 'waiting time'. Ferris *et al* (2010) demonstrated that there was an "overwhelmingly positive change in overall satisfaction as a result of using" RTPI, due to increased confidence in the transport system. They also went on to describe RTPI as a huge public benefit for a relatively low cost.

Live bus information can help alleviate consumer stress associated with waiting in the following situations:

- Unoccupied time feels longer;
- Anxiety makes waiting seem longer;
- Uncertain waiting is longer than known, finite waiting;
- Unexplained waiting seems longer;
- Waiting seems longer to new or occasional users.

Live bus information not only reduces actual waiting times by providing accurate information, allowing consumers to better plan journeys, but it also reduces anxiety when at a bus stop providing consumers with the perceived benefit of increased safety (*Schweiger, 2013*). This was also supported by Ferris *et al* (2010) who found that feelings of increased personal safety play an important role in using public transport, and that RTPI can help alleviate these concerns in the minds of the travelling public.

### 6.3    Accuracy and Reliability

The benefits of accurate and reliable live bus information can also be judged by the response from the travelling public.  The City of Edinburgh/Lothian Buses Bustracker system is noted for its accuracy and reliability, and for the popularity of its mobile applications. It has become an everyday part of using the public transport network in and around Edinburgh.

The SEStran Regional RTPI system has been specified to deliver passenger information of the same quality as is provided by the City of Edinburgh/Lothian Buses Bustracker system, and it further benefits from full fleet coverage. Full fleet coverage improves public perception because buses do not run "invisibly, a problem noted by the UK Passenger Focus report "Bus passengers' experience of delays and disruption". SEStran now has full fleet coverage of the major bus operators and is working to include all smaller operators. SEStran has already received requests from bus passengers for small operators to be added to the system which further indicates customer support for the project overall.

The importance of information accuracy cannot be stressed enough; when commuters perceive that the real-time information is generally inaccurate, they then:

- Feel less safe about commuting;
- Perceive that the service is unreliable;
- Feel less satisfied with the service;
- Feel more anxious while waiting.

It is a well proven fact that people feel losses more keenly than wins (Prospect Theory), it is therefore extremely important that the system is accurate as any drop out of inaccuracy will quickly degrade and detract from the positive benefits that the system provides when operating correctly. If unreliability continues for regular users or is encountered by a first time user then the commuter may stop using the service or look for alternatives.

SEStran has worked very hard to ensure that the system operates reliably, ensuring that system dropouts are rare, and putting in place systems and checks to address potential issues and correct them quickly if they do. This is done by working closely with partners, users and the public.

## 7 Public Demand for RTPI

Evidence of the need for RTPI is demonstrated locally in the SEStran region by the City of Edinburgh Council's Bustracker system. The BusTracker system is highly regarded, not least due to the high quality information given by the system. Requests for additional signs are still being received, and over 12 million information requests per month are now handled by the website and mobile app. In addition to the passenger-facing benefits of the system, Lothian Buses has modified its operational practices to make best use of the fleet management tools available. Drivers have responded positively, recognising that the on-bus systems give valuable information as they deliver the service whilst enhancing safety and security for them and their passengers.

In addition, the BustrackerSEStran app was downloaded 1400 times during a 4 week promotional period. This is the beginning of a co-ordinated marketing campaign to market the BustrackerSEStran system. However, BustrackerSEStran app & website statistics do not tell the complete story. As mentioned previously, TravelineScotland, the national public transport information service, uses BustrackerSEStran live bus information within its own website and mobile applications.

BustrackerSEStran is the source of all scheduled and live bus information shown on the increasing number of SEStran digital signs. From the perspective of social inclusion, SEStran has been successful in attracting funding from the European Regional Development Fund whose priorities include social inclusion and accessibility issues across rural and urban areas (ERDF priorities 3 and 4). SEStran is therefore committed to providing an equitable live bus information level of service across the region. Full fleet coverage combined with affordable web, mobile and digital signing services will help deliver this.

## 8    Conclusions

Like any project, BustrackerSEStran has evolved from its original concept to adapt to changing economic and technological landscapes. By any objective measure it has been a success, increasing bus patronage whilst itself attracting large numbers of users for its applications.

The BustrackerSEStran network has delivered an increase in satisfaction with public transport; the public spend less time waiting for transit, have increased feelings of personal safety when using transit, and reduced levels of stress due to the provision of RTPI. These outcomes are all positive when delivering a strategy aimed at increasing the use of public transport to reduce traffic congestion, reducing the overall environmental impact of transportation, and encouraging the development of sustainable liveable communities.

Key to that success has been close partnership working between public and private sector agencies, adaptability in the face of those changing landscapes, and a willingness to think 'out of the box' to overcome obstacles. The BustrackerSEStran project has also helped SEStran's partners reduce the costs of the network whilst increasing the network's efficiency. Ultimately this has resulted in delivering a better service to the travelling public and working towards reversing the recent national trend of declining bus patronage.

SEStran recognise that the perception of public transport is significantly enhanced when the system offers reliable and accurate live bus information for "every bus at every stop, 24/7". Live bus information then truly becomes part of the users' every day travelling experience. That is SEStran's ultimate aspiration.

## 9    References

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