The Institution of Engineering and Technology

ITS United Kingdom
Better transport through technology

The Local Authority Guide to Emerging Transport Technology

2017 – 2018

A practical guide to assist local authorities in planning, specifying and procuring future transport systems

"A vital tool for decision makers planning local authority ITS policy."

Darren Capes, Transport Systems Manager, City of York Council

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The *Local Authority Guide to Emerging Transport Technology* is published by the Institution of Engineering and Technology in partnership with ITS United Kingdom.

The Institution of Engineering and Technology

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ITS United Kingdom
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Intelligent Transport Systems (ITS) are the integration of information and communications technology with transport infrastructure, vehicles and users. ITS range from traffic signals to Mobility as a Service, from sat nav to navigation systems to assist disabled travellers, and so on. They are an essential part of Intelligent Mobility and Smart City concepts.

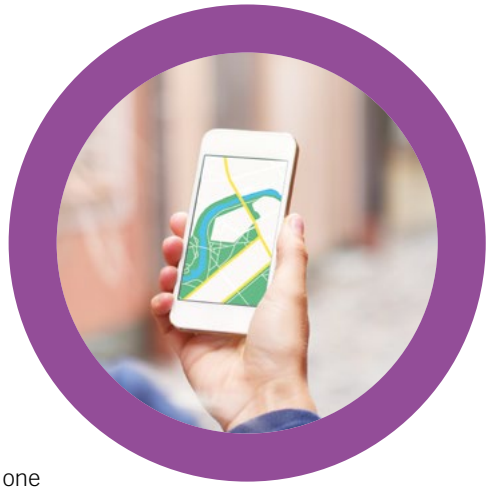
ITS United Kingdom is the UK organisation for all who work in ITS. It is a not-for-profit public/private sector association financed by members' subscriptions. ITS (UK) provide a forum for all organisations concerned with ITS.

ITS (UK) works to bring the benefits that ITS can offer in terms of economic efficiency, transport safety, and environmental benefits to the United Kingdom. The membership, around 150 organisations, comprises Government Departments, Local Authorities, transport operators, consultants, manufacturing and service companies, and research institutions.

New members are always welcome and benefit from activities including seminars, workshops and regular news dissemination. ITS United Kingdom encourages discussion on issues such as public/private co-operation, standards, legislation, information provision and new technology.

Find out more at **www.its-uk.org.uk** or email ITS (UK) on **mailbox@its-uk.org.uk**

FOREWORD



When it comes to exploiting technology, transport in the UK has been at the cutting edge. But expectations are growing. With the explosion in mobile phone use and the advent of ever more powerful data networks, the public are entitled to assume that everything about their travel experience can and should be improved through technological innovation.

And technology offers big opportunities for providers of transport, whether they are delivering a service or managing a network. Everyone sees the need to get more out of existing transport infrastructure as one way of continuing to meet ever growing demand for travel. It is not just users who will benefit from that: better and more cost effective ways of operating and maintaining road networks is also good news for taxpayers.

As we move further into the digital age, it becomes ever more important to embrace new approaches to traffic management. This means change and learning for those involved in transport. Ideally, we should do this together. So it is vital that we continue to share what we know and what we do.

This Government is playing its part by investing in a large programme of research and trials to test different technologies and identify the physical and digital infrastructure needed to support an increasingly connected world. In doing this we are working with colleagues across local government, industry and academia.

This IET and ITS (UK) guidance document shines a light on the great things going on around the country and helps make the theory more real. It will be a practical and valuable tool for all of us working hard to deliver better transport.

Andrew Jones MP
Parliamentary Under Secretary of State for Transport

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INTRODUCTION

Welcome to the second edition of the Institution of Engineering and Technology and ITS United Kingdom Local Authority Guide to Emerging Transport Technology. This Guide is intended to assist local government officers, elected members and those working with local government to understand some of the challenges and opportunities that authorities will face in coming years in delivering local transport and highway services.

The speed of technological change is accelerating. The widespread adoption of internet based technology and complex data processing is changing the way we think about data and its possibilities. Advances in processing performance and basic equipment costs are allowing powerful capabilities to be embedded in ever smaller, cheaper devices and this is in turn leading to an increased public expectation of what technology can do and how organisations will use it.

Outcomes of technology innovations that apply to all sectors are illustrated with the following examples:

- The uptake and use of smartphones for mobile internet access has grown dramatically, with two-thirds of adults now owning one (compared to 39% in 2012).
- Smartphones are now the most popular device for accessing the internet and the amount of time adults spend online continues to rise rapidly.
- People now instinctively turn to social media rather than more formal information sources to find out more about events or incidents that are affecting them.
- Services are becoming more efficient through the acquisition, analysis and application of 'Big Data'.

The advances we see in everyday life in smartphones, communication and entertainment are also happening in the world of transport and travel technology. This will, over the next few years, fundamentally alter the way local authorities provide local transport and engage with the travelling public. Terms such as driverless cars, connected vehicles, mobility as a service, big data and cloud computing are all widely used today, but what do they mean and how will they effect the work of local authorities? Many other less well known but equally important changes are also coming; for example, wider use of Internet Protocol (IP) communications, embedding processing power into devices and sensor data from social media.

We are moving away from a world where local authorities are solely responsible for transport technology and into one where they play a part in a wider technological ecosystem. Politically derived outcomes that make a city or region more attractive (such as health, economic prosperity, safety, sustainability and education) have traditionally been a driving force to improve transport. However, the devolution of powers to a more regional/ local level is accelerating the demand for innovation as councillors are held more accountable for delivering tangible improvements and benefits to the local community.

As the use of social media data and the rise of transport service providers like Uber show, people have an increasing expectation of having access to live reliable information and exercising greater spontaneity. These expectations, together with the ongoing need to enhance safety and provide for ever increasing levels of travel, mean the challenges local authorities face go far beyond simply replacement of existing systems and 'business as usual'. The pressure to make sound decisions that demonstrate good value for money whilst recognising the changing face of local government and increasing public expectations is huge; it is the aim of this Guide to help with this.

All these opportunities and challenges are happening against a backdrop of shrinking local government, and no authority is immune from the pressures to reduce costs and find new, innovative ways of providing services more cost effectively. Technology can help with this, through the use of open standards to reduce specialisation and the use of cheaper commodity systems to replace older, expensive proprietary ones. However, technology also presents challenges; in a world where most authorities are losing their own technical staff and becoming more reliant on consultants, contractors and suppliers, understanding the possibilities of technology and the ways it can assist in delivering wider outcomes is essential, as is the ability to write effective briefs and specifications.

This Guide is designed to aid understanding of emerging technologies and how they will shape service delivery and decision making in local authorities. It has been produced by the IET, in collaboration with ITS (UK), whose deep and impartial involvement in all aspects of technology across all industry sectors gives it a unique ability to consider what the future might hold. The Guide is not intended as a detailed study of current transport technology as there are many others able to do this, but what it does do is look at how the wider world of technology may influence the development of local transport. It includes case studies that highlight real world examples of the use of new and innovative technology solutions in local transport. It also offers guidance on procurement, producing briefs and specifications, and security issues. Whilst doing this, the Guide maintains its focus on the challenges that face local government, of cost efficiency, doing more for less and ensuring best value in procurement and whole life costs.

10 LOCAL AUTHORITY OBJECTIVES TECHNOLOGY CAN HELP TO DELIVER

As local authorities develop corporate objectives, it is very likely that improved transport, or the economic, safety and social inclusion benefits that transport can deliver, will feature among them. This need to address transport as a key corporate objective will in turn lead to aspirations for improved transport provision, many of which can be made deliverable by emerging technologies. The list below outlines ten example areas:

1. AIR QUALITY AND EMISSIONS

Accurate, real-time air quality monitoring is a useful addition to traffic management. It can be used to divert traffic onto different routes if traffic pollution is building up in specific areas. In the longer term it can be used to manage low emission zones and adjust the tariff depending on prevailing conditions or even to ban vehicles entirely if certain limits are reached.

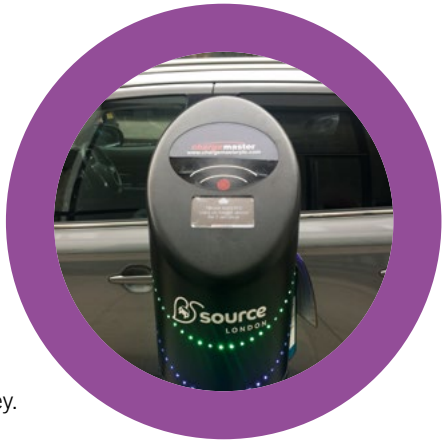
Pollution monitoring equipment can be installed in local hot-spots and the information fed back into a traffic management centre and appropriate measures implemented either automatically or manually. For example, introducing speed restrictions or using traffic signals to 'gate' traffic away from sensitive areas such as schools or pedestrian areas or control their access. onto feeder roads towards congested junctions. If desired, they can also be used to issue warnings via social media to make those with respiratory issues aware of potential problem areas.

In Utrecht, a city in the central Netherlands, a system has been trialled to divert HGVs away from areas of high pollution in real time. The city of Leicester has also been developing an integrated traffic management and air quality system to generate traffic control plans which are optimised to improve air quality.

For more information on air quality monitoring see the RAC Air Quality & Road Transport – Impacts and Solutions report.[i]

2. ELECTRIC VEHICLE CHARGING

One of the reasons drivers are deterred from adopting Electric Vehicles (EVs) is 'range anxiety': the fear of running out of charge, being stranded and not able to charge the vehicle when needed.



Relatively low cost charging infrastructure can be used by incorporating charging points into lamp posts without the need for investing in substantial roadside installations or having to make dedicated charging bays. As charging points become more prevalent, an approach is needed that ensures there is a good mix of rapid and slower charging points so that drivers can either charge up quickly if they are on a longer journey or charge over the working day at the office or station car park. A system is also needed to balance the occupation of the charging points so that they are not used as 'free' all day parking spaces in cities – according to research from Newcastle University around 90% of vehicle chargings are unnecessary as the vehicle already had enough charge to complete the next stage of its journey.

EVs can be considered as part of the electricity supply network and they can be used for load balancing by storing electricity in the vehicle batteries themselves and releasing it to the network as needed. Additionally, used EV batteries which are no longer suitable for vehicle use can still be used to store and provide power to buildings.

3. FLOATING VEHICLE DATA FROM CONNECTED VEHICLES

Floating Vehicle Data (FVD), also called probe vehicle data, is a Cooperative Intelligent Transport System (C-ITS) service whereby connected vehicles reveal their location on the road at multiple points and the time difference between their locations provides a measure of journey time between the points. By combining data from many individual vehicles, the network manager can obtain information about traffic speeds in different parts of the network.

There are potential benefits of this new source of traffic information as it can supplement or even replace other forms of point-based speed data collection. Note, however, that FVD does not measure traffic volume or density, only speed. There are also costs in terms of collecting and processing the data. A local authority could choose to install roadside beacons and collect the data directly (from suitably equipped vehicles). However, drivers would need to see a benefit in supplying the data, particularly as they may feel that their privacy might be compromised. (Depending on the system architecture and operational practices, there are schemes which anonymise the data and prevent tracking of individual vehicles). Alternatively, a local authority can choose to purchase FVD from a third party supplier such as Tom Tom or INRIX.

For more information see the IET Insight on Big Data in Transport published in 2016.[ii]

4. GREEN LIGHT ADVICE TO CONNECTED VEHICLES

Cooperative ITS (C-ITS) links vehicles and road infrastructure with services that benefit both. An emerging capability of some infrastructure-based traffic signals is the provision of information on the likely future state of the signals (red or green) on each arm of the junctions ahead of time.

Such information about future Signal Phase and Timing (SPaT) is potentially of benefit to drivers approaching a signal; the vehicle could, for example, slow its approach so that it uses less fuel, and reaches the signal just as it changes to green. The benefits of this are better informed drivers and improved air quality (as a small number of vehicles taking advantage of the service would likely influence many more). This C-ITS service has been called GLOSA (Green Light Optimised Speed Advice) and is likely to become one of the first and most widely used services.

There are currently various technologies and communication options for implementation. For example, the signal information can be directly broadcast (to suitably equipped approaching vehicles) or signal information can be made available on a web server and then downloaded to a smartphone and displayed using an app. The GLOSA service is currently in a trial phase in several local authorities.

For an example of green light advice to connected vehicles in the UK, see the Newcastle COMPASS4D project.[iii]

5. INTEGRATED PAYMENT FOR TRANSPORT SERVICES

Government, transport authorities and transport operators have done much to make transport data available to encourage efficient planning and use of our transport infrastructure. This has stimulated the technology market but has not driven the change in travel behaviours desired.

One of the barriers is seen as the complex and inconvenient way we pay for transport; with cash, smart cards, toll tags and various combinations for car parking. The success of future travel concepts such as Mobility as a Service (MaaS) will rely on an easy payment mechanism with one travel account being the route to on-demand services. The technical foundation for this 'one account' already exists and has the potential to be demonstrated across Europe for tolling interoperability. This will allow travellers to use their home country account to pay seamlessly for international travel.

Delivering transport services from one account in the future requires a clear understanding of the benefits, challenges and commercial arrangements in place. Considerations for authorities include:

- How is a single account managed, hosted and prohibited from forming a monopoly?
- Can equitable revenue sharing across service providers give a real benefit to the travellers?
- What are the desired traveller behaviours and outcomes?
- Will existing contracts and concessions be an impediment to integrated payment?
- Choice for the traveller is important.

6. INTERNET OF THINGS FOR ASSET MANAGEMENT

The Internet of Things (IoT) involves sensors and communication devices embedded in objects which are able to provide basic information about the object and its contents.

It seems likely (at least from trend analysis and press reports) that both consumer and commercial products will increasingly be connected to the internet and will be providing data. The technical arrangements, protocols and standards are still emerging but there could be very rapid progress. For local authorities, having assets that can monitor their own status and health has potential advantages for asset management and maintenance (and hence for budgets).

Areas that need to be considered when using connected devices include incompatibility, new requirements for communications, data storage and processing, and vulnerability to hacking (see cyber security).

IoTUK is a national programme designed to accelerate the UK's Internet of Things (IoT) capability. Delivered through the Digital Catapult and the Future Cities Catapult, IoTUK is a programme of activities that seeks to advance the UK's global leadership in the Internet of Things (IoT) and increase the adoption of IoT technologies and services throughout businesses and the public sector. [iv]

7. MOBILITY AS A SERVICE (FOR INTEGRATION OF SERVICES AND OFFERING MOBILITY PACKAGES)

Mobility as a Service (MaaS) is the general term used for the shift to a service based transport model where passengers pay once for the entire door to door service regardless of the mode of transport and the service providers. In this integrated model all the individual services necessary for an entire journey are supplied together into one service package. For example, an app that might be used to arrange and pay for a user to be collected from home by a taxi, taken to station to board a specific train and then collected at the next station and taken to hospital for an appointment.

MaaS is very much an emerging approach and requires a considerable amount of data to be available, which will need to be shared between service providers, such as taxi hailing and despatch systems, real-time public transport information, timetables and the like. As well as relying on good quality information to be available it requires a reliable high speed data network throughout the area so that users are not suddenly left in a dead spot with no access to the information they need. Approaches are also required to ensure that no digital exclusion occurs for people without access to the necessary technology or with disabilities which mean they cannot use it.

The ultimate benefit of MaaS is that a journey can be planned and paid for at the touch of a button and that it makes amendments to the journey in real time, for example sending the taxi earlier if the traffic is bad or even automatically rescheduling the trip in its entirety if a meeting is cancelled!

For more information on MaaS see the Transport Systems Catapult report: Mobility as a Service: Exploring the Opportunity for Mobility as a Service in the UK which was published in July 2016. [v]

8. SMART STREET LIGHTING

Smart lighting is an essential part of any town or city and may get taken for granted as a fixed cost. There are a number of approaches to making it 'smart' that can reduce energy costs but still ensure that sufficient light is available for the prevailing conditions without paying for energy costs for high levels of light that are not required.

At its most basic level, traditional street lights can be replaced with LED lighting to reduce long-term operation costs and the installations associated carbon footprint. In addition to this, individual lights can be timed so that some of them switch off in the early hours of the morning.

It is however possible to build more intelligence into the lights themselves by coupling them with noise or movement detection equipment. This enables the light levels to be maintained at a lower level normally and then increased automatically to react to crowd levels or if there is a disturbance. In addition, lighting levels can be controlled manually from the local CCTV control centre to enable individual areas to be better lit if an incident occurs. The lighting columns can also be used to incorporate pollution sensing equipment and Wi-Fi to provide useful services to citizens and town planners. Monitoring the Wi-Fi usage and footfall data can be used to generate useful insights into how the town centre operates.

The city of Glasgow is using smart street lighting as part of its Future Cities Demonstrator. [vi]

9. SOCIAL MEDIA STRATEGY – FOR TRAFFIC & TRAVEL INFORMATION AND CUSTOMER FEEDBACK

Social media is increasingly being used to disseminate information and opinions about the transport network.

Real-time updates can be published quickly to a wide audience, for example information about cancellations or disruptions due to accidents or weather conditions. However travellers without access to smartphones or tablets will have no way of accessing this information.

Tools such as sentiment mapping can be used to monitor social media feeds relating to the network in real time. Sentiment mapping displays a map of the transport network and transport related social media comments posted in the geographical area are monitored and displayed to show what is being said on the network and whether the comments are positive or negative which can be used as an early sign of network problems.

Social media is a double edged sword though, because users expect their comments to be replied to quickly and delays in replying or an unprofessional response can cause high levels of dissatisfaction.

Image credit: fyv6561 / Shutterstock.com

Collaborating with the Department for Transport, Zipabout, Transport Focus, Nottingham University and Keolis, the Transport Systems Catapult has been working on a project using sentiment analysis to measure customer experience and influence traveller behaviours. [vii]

10. TRAFFIC MANAGEMENT

Traffic management can greatly assist the smooth and efficient operation of the network. A key responsibility for local authorities is the planning and operation of traffic lights where junctions will benefit from such control.

Many levels of sophistication of traffic control exist and one of the issues for local authorities is to decide what type of control is the most cost beneficial at different locations and as the network changes over time.

Fixed time signals and signals that operate different fixed time plans throughout the day are relatively inexpensive but can be inflexible to demand.

MOVA (Microprocessor Optimised Vehicle Actuation) matches the supply of green signals on different arms of a specific junction to the demands as measured by infrastructure-based traffic sensors. Area-wide traffic control systems, such as SCOOT (Split Cycle Offset Optimisation Technique), optimise the network flow based on demand on a network-wide basis.

As well as choosing the control sophistication level for the general traffic using the network, local authorities also need to think about road users such as pedestrians, cyclists and buses and may need to implement policy decisions about the priority given to different road users. Linking general traffic control with other systems such as access control, parking and bus priority comes under the general heading of traffic management. A key issue for local authorities is to identify the requirements of the whole traffic management system and then think about how different components of the system should be procured, upgraded, managed etc. Local authorities will be keen to avoid supplier lock-in when integrating components.

SOURCE OF BENEFIT vs POLICY

EMERGING TECHNOLOGY	Air quality and emissions	Congestion	Safety	More for less	Smarter asset planning and management	Accesibility for all	Cost of travel to economy	Town centre vitality	Network resilience	Better traveller information	Smart ticketing
IoT		✓	✓	✓	✓✓✓	✓✓	✓	✓✓	✓✓	✓	✓
Big data	✓	✓✓	✓	✓✓	✓✓	✓	✓		✓	✓✓✓	✓✓
New sensors from outside transport	✓	✓✓	✓✓	✓✓✓	✓✓	✓	✓	✓✓	✓✓✓	✓✓	✓✓
Mobility as a Service (MaaS)	✓✓✓	✓✓	✓				✓✓	✓✓✓			
Cloud technology		✓✓		✓✓✓					✓✓✓	✓✓	✓✓✓
Connected vehicles	✓✓	✓✓✓	✓	✓	✓✓		✓	✓	✓	✓✓✓	
Autonomous vehicles	✓✓	✓ ?	✓✓			✓✓✓	✓✓	✓✓		✓	
Crowd sourced data		✓		✓✓✓	✓✓	✓✓	✓	✓✓	✓✓	✓✓✓	✓
Low cost communications				✓✓✓	✓				✓✓✓	✓✓✓	✓
Social media		✓✓		✓✓		✓✓✓	✓	✓		✓✓✓	✓✓✓

TRANSPORT DATA: OPPORTUNITIES AND CHALLENGES

Advances in sensing, communications and computing technologies and their pervasive nature is enriching our world with vast amounts of data. If exploited, such data can bring significant benefits in relation to cost efficiency, improved decision making, and the enhancement of existing services and products and the development of new ones.

Like other sectors, the transport industry has a wealth of data available about its infrastructure, operations and customers across different modes and from different actors. Such actors include highway authorities, public transport operators, taxi and freight operators, information service providers, vehicle manufacturers, insurance providers, and mobile network operators. Furthermore, near future technologies such as connected and autonomous vehicles and the Internet of Things will further enhance the data offering to the transport industry.

Harnessing these existing and future data sources will bring significant benefits and opportunities. From the perspectives of local authorities, such benefits include:

- Improving asset management and decision making and the move towards condition based maintenance with the potential of huge cost savings.
- The prospect of new data analytics tools that, through fusing multi-sourced data, will lead to improved traffic and incident/event management; and better transport modelling and demand forecasting through improved knowledge about travellers demand and behaviours.
- Cost-efficient methods for managing public transport services and monitoring the performance of contractors against defined targets.
- Satisfying the increasing demand of transport customers for timely and accurate information about their door-to-door journeys. The Traveller Needs and UK Capability Study reported that 72% of UK travellers use smartphones and 54% of them consider it essential for their travel.[viii]
- Realising the smart mobility vision where an integrated, multi-modal, seamless and user focused approach to transport is seen to enhance the efficiency of transport systems, optimising the use of existing infrastructure and influencing the ways in which people use transport services.[ix]

Realising these benefits, and many more, requires the opening and sharing of transport data which is faced by a number of financial, commercial, technical and political challenges. Transport is a multifaceted domain with a wide range of stakeholders. Currently, data is fragmented with organisations working in silos independent of each other. There is a need to move from this silo mentality. Industry is aware of the need to exploit transport data and some authorities are moving towards much closer integration and collaboration.

The public sector faces the financial challenge in terms of the costs associated with generating the data (i.e. hardware/software implementations), opening the data, and managing and maintaining the supply of both static and real-time data feeds. The private sector, on the other hand, presents a big player in terms of transport data. However, such data is not open or shared and there is a need for innovative business models to address the associated commercial challenges. In order to make best use of transport data, it needs to be encompassing, useable and distributed over a common format and standard, making it easy for app developers and analytics providers to extract the significant value that lies in the fusion of multiple datasets. Furthermore, there is a need for a strong political will both at the national and local levels to drive the value realisation from the opening and sharing of both public and private transport data.

CYBER SECURITY

Cyber security is highly important in the adoption of new technology. Data breaches, attacks on systems and compromised security can lead to reputational damage and potential legal action. All organisations are potentially at risk, not just those possessing private or valuable information, but also those with systems and equipment connected to the internet.

There are many forms of threats and they vary significantly in intent, form, and effect. Simple steps such as those in 'Cyber Essentials' go a long way to protecting systems and many authorities have established capability in data security.[x] However, most authorities are much less well equipped to deal with threats to networks connecting 'on-street' equipment, the use of internet connected 'edge devices' or equipment with inbuilt internet connectivity, in the Internet of Things. Particularly in traffic systems, authorities may be used to completely private 'copper pair' networks. Replacing these with internet-connected devices has many benefits but brings new risks.

When planning to use Internet Protocols on street or when building external networks, users must ensure that overall networks and individual devices are protected. In many attacks, the attackers have taken control of millions of internet connected devices rather than stealing data. Hence, devices like traffic signals must be properly protected, as they pose a threat to wider digital security. New on street systems give a vulnerability to the whole authority's IT systems and need to be protected at the network level (to prevent hacking attacks) and at a physical level, to stop users connecting unverified equipment. This may mean extra physical security for example on cabinets.

Hacks and attacks of malicious intent are easy to consider. But all security strategies need a thorough and honest assessment of the risks and capabilities of your system and human resource. Accidental damage, weather, hardware malfunctions, loss of telecommunications or power, and user errors are others to consider. To protect against these and other risks, it is important you include security in design of networks and that those specifying, procuring and installing equipment are experienced and fully conversant with the end use. The design and specification of new systems should also have a clear view of the wider systems and networks they will connect to via roads authorities' IT departments. And the importance of security needs to be communicated, e.g. unpredictable passwords. Every person with access to your system is a potential vulnerability.

Although there can be benefits from connecting new on street equipment to existing networks such as for schools, this may create wider vulnerabilities. You should consider segregating networks and providing firewalls. Designers of systems must be aware of the regulations local authorities' IT departments work under and why they need to be involved at an early stage.

Systems are increasingly being connected to one another to create a 'system of systems'. Traffic systems are being integrated with connected vehicles, which in turn will be integrated with mobility services. Your systems increasingly will become part of a wider 'ecosystem' and understanding how this will evolve and investing in defences is critical. As we move to the full realisation of the Internet of Things, and as connected vehicles become a reality, security risks will grow exponentially. Authorities must then ensure they have the right design advice to minimise this risk. So to assist local authorities, the Government has set up a National Cyber Security Centre (NCSC) as a unified source of advice and support for private and public sectors. It offers the latest cyber security advice and guidance as well as an archive of documents on its website.[xi]

NEW PROCUREMENT MODELS

One of the major benefits that new technologies can offer is the ability to move away from traditional procurement and ownership models. In the past, it has generally been the case that to operate a technology system, it was necessary to undertake a capital purchase of the hardware required, acquire the necessary software licensing and ensure sufficient on-going revenue (operational) funding was in place to pay for future maintenance, licensing and asset renewal. This often placed a heavy burden on local authorities and could result in the need to support incompatible systems spread over various, underutilised computers and systems being operated well beyond their economic life due to the inability to fund their replacement.

As the underlying technology on which transport and travel systems relies becomes increasingly based around the principles of the internet, so these traditional methods of ownership and operation become less relevant. Opportunities to buy systems as services, use remotely hosted and 'cloud' solutions and the ability to rely on cheap communications media are becoming increasingly common as the traffic and transport technology industry adopts the approaches found in the internet and telecommunications industries.

PROCUREMENT MODELS

Where once it was necessary to buy technology as a capital procurement it is now common to see technology as a service. Many suppliers can offer systems remotely hosted in secure, highly resilient data centres that rely on the availability of cheap, reliable Internet Protocol (IP) communications links. This allows systems to be procured flexibly using models including:

Revenue only - many systems can be procured with no capital outlay and fully financed through regular revenue payments. This allows systems to be procured based on a 'Service Level Agreement' (SLA) rather than a detailed technical specification and means the responsibility for ensuring sufficient hardware is provided, maintained and renewed as required and operated reliably and efficiently rests with the service provider. This model suits applications where the owner has access to revenue funding but not capital. It is common in areas such as bus real-time prediction systems where bus operators are able to contribute to the operation of the system based on their ongoing use of it rather than as a large up-front capital commitment.

Capital/revenue split - many public bodies find access to capital somewhat easier as a result of grant funding. This can be used to fund the 'one-off' set up costs of a new system and reduce the ongoing costs. The benefit of this solution, apart from the reduced revenue costs that are attractive to public bodies, is that by retaining an element of ongoing revenue commitment, systems can still be provided through an SLA, with future maintenance and upgrade costs built in.

Shared services - there is increasing pressure being placed on public bodies to merge services and work together to realise savings. The possibilities offered by IP, and the ability to host systems far away from their users make it possible for one authority to provide services for others. The move to virtualised servers, (where the needs of systems can be spread and balanced across numerous physical computers), means that it is not impractical for one organisation to provide the hardware to offer an agreed level of service to others. In an arrangement such as this, there are benefits of scale that come from large, joint procurements, benefits to the hosting organisation in realising an income stream from the other users of the system, and a benefit to the other users in reduced operating costs. Such arrangements are becoming common in joint payroll and finance systems and are now possible for transport systems such as Urban Traffic Management Control (UTMC) and Urban Traffic Control (UTC) services.

Guaranteed income - there are some systems in transport where an income can be identified to assist in operating costs. This can apply to systems that generate revenue (website and mobile apps from which advertising revenue can be earned) and systems that have a revenue 'through-put' that can be utilised (car parking or smart ticketing solutions). Such systems can be procured based on an agreed level of income which can provide impetus for the supplier to seek out and develop the potential for revenue generation. Such systems usually employ a 'cap and collar' arrangement in which levels of income below an agreed level require the short-fall to be shared between supplier and client and above an agreed level result in a profit sharing mechanism being triggered.

With all these models it is essential that when systems are procured it is based on a realistic SLA. By ensuring this is the case, systems can be procured on an 'outcome' basis where the technical details can be left to the suppliers to decide. This approach offers great benefits in terms of flexibility and cost-effectiveness but does require a very clear understanding of what is required and the interdependencies that exist with other systems.

An outcome based procurement can free clients form the need to fully specify the details of a system and can encourage innovation from suppliers but it does mean that it is critical to ensure that the parts of the system that do need to be specified in detail, (interfaces with other systems, fixed data input and output requirements) must be identified. It is also the case that particular care needs to be taken with the procurement process is required to ensure the tender exercise allows innovation and cost saving opportunities where possible but is capable of ensuring a fair and robust analysis of potentially very different proposals is possible.

USE OF FRAMEWORKS

There is an increasing move to the use of framework arrangements for procurement. This approach can result in significant savings to the procuring authority as the costs of mounting individual procurement exercises for each project are replaced with the much lower costs associated with framework use.

The Crown Commercial Service, (CCS) is increasingly implementing frameworks such as G-Cloud, that can be accessed by all public sector bodies and which cover a huge range of products and services. It is also increasingly common for larger public sector bodies and regional purchasing organisations to let their contracts with a framework element that others can access too, to purchase similar goods and services. Where possible these arrangements should be used and advice should be sought from authorities' procurement experts.

RISK MANAGEMENT

Care must be taken when proposing capital or revenue based procurement models that an appropriate level of risk and reward is maintained. For example, a supplier expected to maintain a travel information system for five years, who is paid by a single 'up-front' capital payment has little motivation to continue to invest in the system. Or, a supplier expected to fund the costs of implementing of a new and complex database based purely on future revenue payments is likely to build a large margin into these payments to ensure the initial outlay is repaid.

As well as taking care to ensure the risk and reward offered by a contract is realistic, it is also important to ensure the expectations of the SLA used to manage the delivery of the service is also realistic. Although it may appear attractive to write highly onerous requirements into an SLA, costs will rise as the supplier charged with delivering builds such requirements into the systems operating costs. An example would be requiring 24 hour availability for a system only used during office hours.

Procurement models in which the costs of ongoing maintenance and upgrades are the responsibility of the supplier, funded to some degree through an agreed ongoing revenue service charge do however mitigate a risk commonly found in public bodies; that systems fall into disrepair or disuse because the funding for future renewals cannot be found. By taking advantage of the opportunities offered by new technologies (remote hosting, hardware virtualisation, pay-per-use, etc), it is possible to reduce costs of operation or deliver far more versatile and ambitious systems than would otherwise be possible.

SPECIFYING YOUR EMERGING TECHNOLOGY NEEDS

Irrespective of whether you are planning to specify and deliver an entire project yourself or are considering engaging consultants or contractors to undertake this on your behalf, the text below provides some pointers as to what would be prudent to consider and avoid commonly observed flaws in specifications such as:

- Not conveying the vision for the project both to stakeholders and suppliers.
- Overly specifying the technical solution rather than focussing on the desired objective.
- Failing to specify the requirements for the project that will be delivered from within the client organisation (e.g. provision of business process details and data sets).
- Interleaving the management products specific to the project (e.g. quality plan, project programme) with the specialist/technical products, that will remain once the project has been delivered, i.e. the desired functionality.
- Wildly varying levels of detail in the requirements, particularly in terms of the physical technology as opposed to the required functionality.
- Introduction of bespoke commercial requirements when standard terms of contract or established framework contracts would suffice make the project more attractive to suppliers.
- Unrealistic expectations with respect to what the project can deliver within the budget or timescales.

It is important to recognise that emerging technology is, by its very nature, going to be innovative and may also involve change to how parts of your organisation conduct their daily activities. Change is always much easier to introduce if relevant stakeholders have been actively engaged in a consultation process.

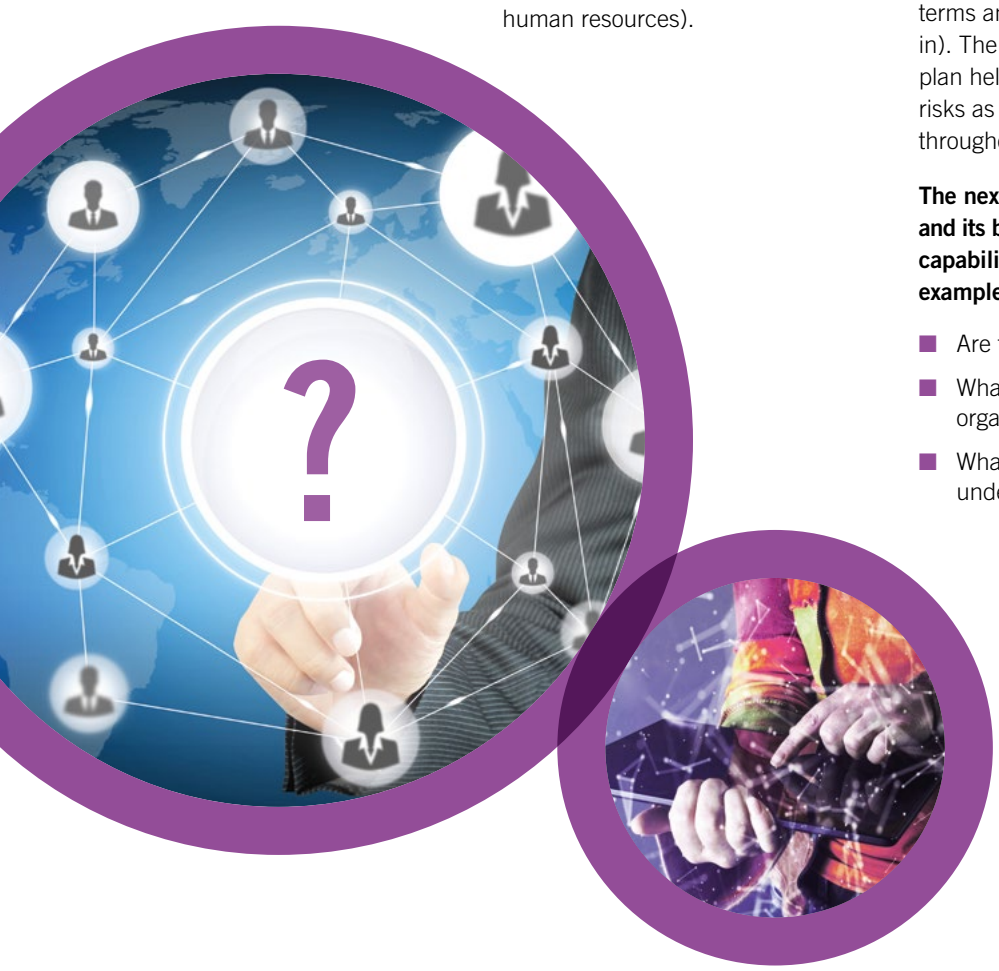
The best way to initiate this consultation is through the provision of an initial vision that conveys:

- The potential advantages or benefits of the emerging technology and also the risks.
- A high level description of what you propose to achieve compared to the present (baseline) position.
- What business outcomes you expect your project to deliver (and at what stage).
- How those business outcome(s) contribute to the goals, strategic objectives or business priorities of your organisation.
- A high level plan, including any interim stages to achieving that vision.

Portraying the vision in this manner will also assist with:

- Making sure your project receives recognition and endorsement from political leadership/corporate management and any constraints (e.g. budget, programme).
- Identification of the relevant stakeholders and capture their concerns or objectives.
- Identification of how your project will impact upon any other initiatives/projects that are proceeding in parallel.
- Identifying if and how you require support to deliver subsequent stages of the project.

It is important to identify key stakeholders and then approach them to test the initial vision and start the engagement process. The type of stakeholders to involve will vary depending on the level of innovation and/or change that the project is anticipated to create. However, typically stakeholder consultation should include a representative group of those who will be involved and/or directly affected by the project, either during its development or once it has been delivered (e.g. operations staff, maintainers, representative user groups, finance/procurement staff and human resources).



With good engagement, these stakeholders will assist in flushing out further high level requirements and, importantly, identifying any constraints that will need to be actively managed and future training/support requirements as well as developing 'lessons learnt' feedback.

Depending on the level of innovation, you might also want to consider wider stakeholder engagement with:

- Suppliers, as they are likely to be more familiar with the most recent technology developments, understand how practice is emerging and may be able to assist through the provision of 'Lessons Learnt' from other comparable supplier projects.
- Entrepreneurs, for example through hosting a hackathon or similar event (as this is where you are most likely to receive indications of any 'disruptive technology/service' that might influence the effectiveness of delivering your project).

Care should be taken to understand and recognise what you might want from those stakeholders at subsequent stages of project development and also what those stakeholders might want in return, some might be mutually beneficial such as: developing strategic relationships or using standard commercial terms and others which are not (such as vendor lock-in). The development of a stakeholder management plan helps to manage expectations and associated risks as well as keeping stakeholders engaged throughout the development of your project.

The next step is to look inwardly at your organisation and its business drivers to determine your organisation's capability and/or desire to deliver the project, for example:

- Are there sufficient resources with the right skills?
- What impact will the project delivery have on your organisation?
- What transformational steps might be required to undergo the proposed change?

This will potentially open up non-technical issues that will be terminal for the project unless managed effectively so it is suggested that you consider your outcome to assess your organisations readiness in terms of the following:

a) The requirements of any existing business processes and resourcing as a result of achieving the desired outcome:

- Will any existing business process or resource be affected?
- Are existing business processes documented if they need to be incorporated?
- How will new business processes develop and who will develop them?

b) Current and future requirements for data and data management (including sharing), particularly:

- What data do you currently have and what is its quality?
- Does your data currently support the tasks you need of it (e.g. asset management, performance monitoring)?
- Is there a requirement to share your data (with other internal services within your organisation and/or to make it accessible to third parties)?
- Are there any legal implications?

c) Does your organisation have any specific policies that will impact upon the outcome (e.g. branding, code of connection)?

d) Are there any existing system/service constraints (e.g. to use an existing Internet Protocol (IP) communications network, enhancing it as required in accordance with defined design criteria)?

e) Capacity to train relevant personnel.

Once the internal considerations are complete, it is then possible to define the scope of the project for implementation by your chosen project team and identify more specific risks that your project might face in terms of quality, programme or price, as well as any mitigation. This scope definition additionally provides an ideal opportunity for reflection and re-assessment against your organisation's strategic aims and objectives, as well as providing the opportunity to manage expectations of the stakeholders, particularly if one or more of their requirements are not being included in the refined vision.

MAKING THE MOST OF WHAT YOU HAVE

Before considering emerging technologies, it is worthwhile considering if you are making the most of your current infrastructure and resources and any works being planned. There are several areas where local authorities are already doing this:

- **Build in extras for the future.**

  Just as when installing an extension to your home, it is wise not to think of what you have now, but what you will require in the short-term future. An example of this is the City Of York Council's policy on signal pole installation, which includes running a communications cable up to the top of each new pole, in preparation for a future application. It costs an extra few pounds now but avoids major disruption and a larger spend in the future. Future use should be considered when designing ducts, power supplies and ordering communication bandwidth.

- **Spread your data.**

  Data such as CCTV images, car park availability, roadworks schedules and traffic congestion can be published by many service providers, alongside other local authority data so customers can access a nationwide service. This avoids maintenance of local authority websites. Think about making your data available via UTMC, open data sites, or supplying to services like Elgin and INRIX.

- **Think about services not systems.**

  To measure congestion, are you really better buying, installing and maintaining ANPR/Bluetooth detectors, when data on congestion can be bought as a service from UTMC providers, Google, INRIX, TomTom and HERE? As the number of connected vehicles continues to grow, when letting maintenance contracts consider how long your current equipment will be relevant for. On street parking can be measured with a variety of sensors in the bays and on lamp posts, but can also be delivered as a data service based on vehicle movements.

- **Do not over specify design life.**

  For devices at the roadside, it has been good practice to make sure they can last, as resources for replacement cannot be guaranteed. However, the future replacement might be delivered as a service, or a different technology. Will variable message signs still be the way to communicate with drivers in 20 years? It may be that a short-term low cost but lower life solution might be the best investment.

- **Share and move infrastructure to the cloud.**

  Cloud hosting now offers ways to remove the need for a computer server room. Traffic systems hosted on the cloud can be shared amongst local authorities and joined together seamlessly. Some companies offer a fully hosted service including operations. One size will not fill all, but the early worries about security and latency have been overcome.

- **Make your infrastructure have more than one use.**

  CCTV, for example, can now be used for journey time, enforcement, monitoring and secure uses. You do not need a pole with three cameras when one camera can satisfy all user requirements.

- **Work with your neighbours.**

  Technology suppliers prefer bigger contracts due to the economies of scale. The new Traffic Management Technology 2 framework gives you access to a host of suppliers, but why not check if your surrounding local authorities have the same requirements as you, and see if you can save money by working together.

- **Specify the problem you want solved, not the detail of how to do it.**

  Too often specifications from local authorities are focused on the solution, resulting in technology suppliers not being able to innovate or provide the latest solutions. Make sure you demand the level of performance, not the detail of how it is done. See the section on 'specifying your emerging technology needs' for more details.

- **Ask for help.**

  There are many forums, working groups and suppliers all keen to share knowledge. The traffic industry is small but friendly, so do not be afraid of asking for help.

DOING MORE FOR LESS

In the previous publication of this Guide it was noted that local authorities were under on-going budgetary pressure to reduce their operating costs and expenditure even when grant funding is available to procure and implement new schemes and initiatives. This updated publication reaffirms that there are additional pressures on local authorities to address issues such as congestion, access to public transport, air quality for electric vehicles, 'connected' vehicles and better information provisions. These challenges appear contradictory – i.e. the need to address more policy objectives with less funding and staff resource. Many local authorities have lost the expertise to make best use of the technology they already have, which suggests that the commitment to invest in new technologies has to be proven beyond any doubt.

This publication outlines ways to accommodate reduced overall spending while maximising the productivity and safety of networks while simultaneously minimising environmental impact. The lack of predictability of travel times and the reliability of the road network are major concerns for businesses. Logistics companies allow extra time between deliveries in order to account for unreliable networks which may cause late delivery, yet on days with little or no delays the lorries return to their depots early, but as they have insufficient time to deliver more goods, are non-productive. The same applies for the public travelling for work. Delayed travel to a workplace will have a financial knock-on effect.

The UK's transport asset is finite and it needs to be actively managed to maximise value from it. Well-planned management of infrastructure can improve its productivity and thus postpone further capital investment in new construction with considerable cost savings. Using technology to 'sweat the assets' can deliver consistent journey times, information services and informed demand management.

To increase the predictability of journey times, a number of technologies can help ease congestion in urban areas thus giving a direct impact on air quality and emissions from transport.

For example:

- Adaptive traffic signal control systems continuously adjust the timing of traffic signals - based on the changing arrival patterns of vehicles at intersections. Implementation of this technology has resulted in a decrease in traffic delays by 20% and a reduction in vehicle emissions of 5%.
- The bus information service for a city centre could link to the traffic management network run by Highways England, allowing better quality information to be provided to drivers and bus passengers who are making multimodal journeys involving both car and bus. Such links rely on common standards which minimise future cost and maximise sustainability of those systems.

As this publication shows, 'more' can be achieved at 'less cost' with the UK road network, to achieve transport policy objectives such as reducing congestion, road traffic accidents and emissions. The targeted application of technology can provide effective improvements in shorter timescales to transport networks, whilst helping to boost the economy and support policy objectives. New methods of procurement need to be implemented so that new technology not only performs its function but also offers further benefits from integration with existing systems which will secure real community wide benefits at less cost.

A78 FAIRLIE TRAFFIC LIGHTS SAVING LIVES

Images courtesy of Clearview Intelligence

Delivery Partners:
Clearview Intelligence, Transport Scotland, TransServ

BACKGROUND

On the 14th February 2013, a Heavy Goods Vehicle crashed into a residential property close to the existing signalised junction on the busy A78 in the village of Fairlie, North Ayrshire, tragically killing the inhabitant of the property and causing substantial damage and disruption on local roads.

As a result of this fatality and an ongoing campaign by Fairlie residents for road safety improvements, Transport Scotland and their operating partner for the South West region, Scotland TranServ, conducted a series of traffic surveys which showed frequent occurrences of unsafe driving behaviour and speeding.

Various traffic calming solutions were put in place, including vehicle activated signs on the approach to the village and new road markings such as dragon's teeth, speed limit roundels and 'SLOW' markings. However, follow-up surveys showed that a significant proportion of vehicles were still travelling in excess of the 30mph limit within the village itself.

FIRST USE

Clearview Intelligence worked with TranServ to develop an innovative scheme which would use the existing traffic signals in the village to help slow down speeding drivers. Rather than opt for the more obvious 'big stick' approach of speed enforcement cameras, the scheme aims to positively influence driving behaviour and acts as a 'carrot' for speed compliance. This concept has already been used successfully in countries such as France, Portugal and Spain.

APPLICATION

The design, managed and implemented by Clearview, with supply chain partners Dynniq Group and Coeval Ltd, incorporated the use of advanced wireless vehicle speed detection, vehicle speed activated signs and existing traffic signals to slow down road users by intentionally stopping them at the signalised junction.

A key challenge was to design the complex operational configurations to ensure that the traffic lights change to red in a safe and timely manner without creating additional dangers for road users or pedestrians at the junction.

Approaching vehicle speeds are calculated using pairs of wireless vehicle sensors upstream of the stop line in both directions. The vehicle speed is relayed to the traffic signals and if speeds are above the set threshold then the traffic signals are programmed to turn to red, thus stopping the speeding traffic and increasing their overall journey time through the village.

BENEFITS

The use of wireless detection technology eliminated the need for costly ducting and trenching that would have had an adverse impact on traffic congestion and caused disruption in the village and could have weakened the integrity of the road surface on this heavily used route. The innovative approach seeks to foster a change in driver behaviour rather than implement enforcement measures for speed reduction.

Vincent Tait, Road Safety Manager for Scotland TranServ said: "We are delighted to be the first in Scotland to introduce these vital road safety measures."

Policy and Research Director at the Institute of Advanced Motorists, Neil Greig, commented: "Law abiding drivers have nothing to fear from this system. It also offers the opportunity to penalise speeders quickly and fairly. If nothing is gained by speeding, then that can only help reinforce the safety message."

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APPLICATION OF A DATA MANAGEMENT SOLUTION TO INCREASE THE QUALITY AND CONSISTENCY OF BUS SERVICE DATA

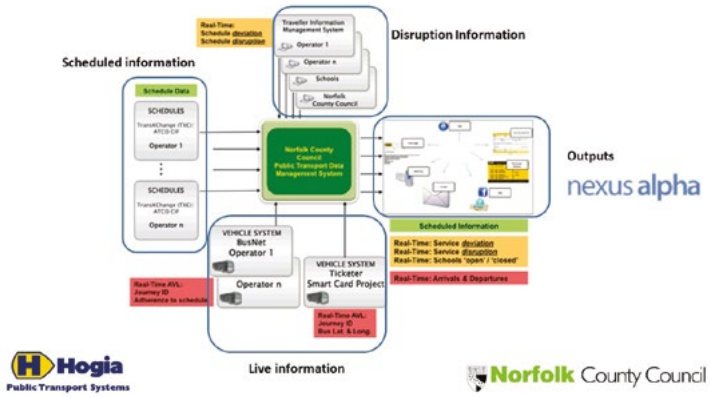

Image courtesy of Hogia Transport Systems and Norfolk County Council

Delivery Partners:
Hogia Transport Systems Limited, Norfolk County Council

BACKGROUND

There is increasing pressure on local authorities to process bus service data from bus operators more efficiently and with diminishing staff resources. This complex data needs processing into a form suitable for the production of timetables and other at stop information, information for Traveline and others and to drive Real-Time Passenger Information (RTPI) systems.

In 2007, the Department for Transport had a stated aim that 100% of all bus service registrations, variations and cancellations would be submitted electronically. In 2016, it was estimated that only 30% of bus service data was made available in this way.

Norfolk County Council (NCC) recognised this data management challenge ahead, and has taken early steps to introduce a comprehensive data management solution.

This solution was delivered in partnership with Hogia using their advanced data integration and management tools that are widely deployed in Scandinavia and support all relevant UK data interchange standards (TransXChange-TXC, ATCO-CIF, SIRI).

FIRST USE

NCC first deployed the technology in 2011, although the technology had previously been developed with Scandinavian transport authorities. The solution was used initially to import data directly from bus operators who had their own scheduling software using the TransXChange (TXC) data interchange format. A simple to use and web-based scheduling package has also been commissioned by NCC and made available for all bus operators to use, which is typically being used by medium and smaller bus operators who do not have access to a scheduling package of their own.

With Hogia's technology at the heart of the NCC public transport data management system, the Council was able to reduce the staff requirement for handling public transport data from 5FTE to 1.5FTE.

APPLICATION

The technology enabled NCC to make a dramatic improvement in its data management process, significantly reducing the number of staff needed, while increasing data quality. The technology validates and checks data for consistency and accuracy, before consolidating and exporting to third-party systems using UK and international data interchange standards. NCC extended the system to provide a 'data broker' function, which feeds multiple third-party systems with consistent data, ensuring the public receives the same information via all distribution channels.

NCC has retained the capability to distribute both scheduled and real-time departure information, even though in 2014 it closed-down its original RTPI system due to reductions in available budget. Data is fed into the new solution from bus operators' own Automatic Vehicle Location (AVL) systems, from which real-time travel information is determined.

By feeding vehicle location and journey details from on-vehicle ticketing systems directly into the Hogia solution, NCC has been able to add significant value to the Department for Transport funded rural smart card ticketing pilot project by avoiding the necessity to fit additional AVL equipment to the buses in order to deliver RTPI.

The technology also enables a single member of staff to deliver service deviation (long-term schedule changes) and disruption information (short-term schedule changes) consistently across all multi-media distribution channels.

The technology can be delivered as a 'cloud' solution enabling customers to have just the functionality they require.

BENEFITS

Norfolk County Council realised several benefits from the solution:

- Return on investment achieved before the predicted 3-year break-even point;
- A reduction in staff requirement to handle public transport data from 5FTE to 1.5FTE;
- Improved staff morale from removing mundane data entry and checking tasks;
- The process of entering bus schedule data and converting to suitable data formats for third-party downstream systems used to take up to three weeks. This is now completed in hours (even with the reduction in staff resources);
- Greater accuracy is achieved in the data made available for downstream systems, e.g. Traveline, and in the production of bus stop information (both expensive to correct when the data is found to be incorrect post-production);
- Improved data accuracy means the operational tracking of vehicles is maximised (raised from circa 60% of vehicles tracked to circa 95%+);
- NCC is the first local authority in the UK to offer all operators a data entry tool for the generation of electronic schedule data, as will be required by the Bus Services Bill, particularly benefitting small and medium sized operators.

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CUTTING-EDGE VEHICLE SHARING USING REAL-TIME VEHICLE, INFRASTRUCTURE AND PUBLIC TRANSPORT DATA

Images courtesy of Carplus

Delivery Partners:
Carplus, Co-wheels, Frome Town Council, Trip IQ

BACKGROUND

Co-wheels operates over 30 car clubs, increasingly introducing shared electric vehicles. Trip IQ's platform is being introduced by them to upgrade vehicle booking and management. This is a fully managed, cloud-hosted service giving tools for cutting-edge vehicle sharing using real-time vehicle, infrastructure and public transport data.

In Frome in Somerset, Co-wheels' vehicles are charged by solar panels, reducing carbon emissions. The Frome club has strong support, so the new TripIQ software will allow the operator to ensure requested cars are sufficiently charged between users.

FIRST USE

This is the first known integration of charge levels with booking, and with public transport integration for full Mobility as a Service provision.

APPLICATION

Future developments will combine charge state information and charging post availability, to avoid the customer support and operational issues of electric vehicles in shared fleets. The technology also facilitates public transport integration and third party electronic payment methods into car share models.

BENEFITS

Carplus' research shows that each club vehicle removes upwards of ten cars in London, and five elsewhere in England. Members reduce driving per year by 750 miles in London and 1,000 miles per year elsewhere in England. This combination can reduce congestion, emissions and parking requirements. Shared vehicles are in use 25% of the time compared to around 5% for the average vehicle, have higher occupancy than average (2.5 people compared to 1.6) and emit at least 30% less CO_2 than the national fleet. And, where schemes such as Frome generate renewable energy, the footprint is reduced further.

However, shared electric vehicles must be closely managed to ensure they are charged for each user. The Trip IQ system allows operators to manage bookings by charge status, so allowing seamless use and making joining an electric vehicle car club a viable alternative to car ownership.

The development of Mobility as a Service depends on solutions that both integrate with public transport and allow people to make journeys not possible by it. Outside urban centres this is particularly challenging. The Frome Co-wheels vehicles are an example of how this might be achieved.

Further information:
w: carplus.org.uk
co-wheels.org.uk
tripiq.eu
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DIGITAL UNATTENDED SYSTEM FOR ENFORCEMENT OF COMPLEX MOVING TRAFFIC OFFENCES

Image courtesy of Videalert

Delivery Partners:
London Borough of Barnet, Videalert Ltd

BACKGROUND

To make roads safer, improve traffic and reduce pollution, the London Borough of Barnet wanted to enforce moving traffic contraventions at more than 20 locations and increase parking related road safety at 32 schools. To deliver this, the Council awarded a contract to OpenView Security Systems to install Videalert.

FIRST USE

Videalert developed the UK's fully digital unattended system for enforcement of moving traffic offences. Following an initial installation at the London Borough of Redbridge, it has now been deployed in seven boroughs. It combines video analytics with Automatic Number Plate Recognition (ANPR) to track vehicles automatically, and so only captures vehicles committing contraventions in even complex traffic scenarios, without generating many false alerts.

Videalert also developed the first similar system for school 'keep-clears', which now has been successfully deployed at 50 schools. Using a single camera at each location, it detects vehicles stopping on the 'keep-clears' for a predefined period and automatically zooms in to capture evidence.

APPLICATION

The London Borough of Barnet has deployed the Videalert system at 26 locations to enforce box junctions, banned turns and restricted access. Videalert delivers effective and reliable unattended enforcement in high traffic flows by combining ANPR with video analytics. This provides additional intelligence to accurately capture only vehicles committing an offence, something not achieved using traditional systems.

The system has also been installed outside 20 schools, where it automatically captures video evidence of vehicles stopping on 'keep-clears'. With one camera, it continuously monitors restricted areas, captures only vehicles that actually commit an offence, generates video evidence packs and transmits them to the Council. There are plans to increase the system to over 100 cameras, making this the UK's largest deployment.

BENEFITS

Automating enforcement ensures higher levels of productivity at a lower cost than manual systems - up to a six-fold increase in contraventions. It can also deliver substantial cost savings by reducing the number of staff required to attend the cameras. For example, some London boroughs have more than 60 operators manually attending enforcement cameras.

Costs are further minimised by combining infrastructure wherever possible, as Videalert's re-deployable units can support multiple cameras without a 'processor on a pole' for every activity. This helps future proofing because it supports multiple applications, eliminating the need for standalone solutions. Several councils are now using the same platform in the same way as the London Borough of Barnet to improve both safety outside schools and enforce traffic contraventions.

Further information:
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ENABLING VEHICLES TO COMMUNICATE SAFETY HAZARDS TO OTHERS ON THE ROAD

Image courtesy of HERE

Delivery Partners:
Finnish Transportation Agency (FTA), Finnish Transport Safety Agency (Trafi), HERE Global B.V.

BACKGROUND

HERE was selected by Finnish traffic agencies to lead a two-year pilot project called NordicWay Coop to enable vehicles to communicate safety hazards to others on the road.

The public phase of pilot commenced in May 2016 and assesses the capability of current and emerging mobile network and location cloud technologies to support the timely communication of critical safety information.

Drivers can effectively warn others approaching the area and alert the authorities about obstructions on the road, unprotected accident areas or poor visibility with two taps on their smartphone.

FIRST USE

The pilot covers three major highways in southern Finland and is the world's first C-ITS (Cooperative Intelligent Transport System) deployment based on LTE mobile networks. It utilises standard and commercial networks as well as location cloud and data analytics from HERE to connect vehicles and traffic management centres in an intelligent system.

The first phase of the pilot saw HERE and its partners successfully test the technical maturity of the system. Based on analysis performed by the independent Finnish Technology Research Centre (VTT) in that test, it takes on average a total of 1.42 seconds for end-to-end transfer of alerts via standard 3G. This includes a) message creation in a vehicle, b) transfer and processing and c) targeted delivery to only those road users that are impacted by the incident, as well as relevant traffic management centres.

The second, public, phase of the pilot began in May 2016 with hundreds of drivers recruited to try out the system on the road. This phase is expected to complete by the end of 2017.

APPLICATION

In this pilot, drivers voluntarily share notifications about safety hazards and road conditions initially using an app on their Android smartphone. Drivers can report road hazards and have an increased awareness of road conditions such as where there might be black ice or an animal on the road, traffic build-up or an accident.

HERE believes that smartphones and other handheld devices will not be required in the longer term for the communication of safety messages on the road. Rather, in the medium to long-term, the same technology architecture deployed in this pilot would harness data generated automatically by a vehicle's on-board sensors.

BENEFITS

The Finnish Transport Agency explains: "This is an EU-funded project aiming for better traffic safety. Unlike other solutions which require expensive new roadside infrastructure, this project uses drivers' own smartphones and current mobile phone networks. This makes it fast to implement and cost-effective."

Further information:
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INSTALLATION OF INTELLIGENT ROAD STUDS TO REDUCE ROUNDABOUT INADVERTENT LANE TRANSGRESSION

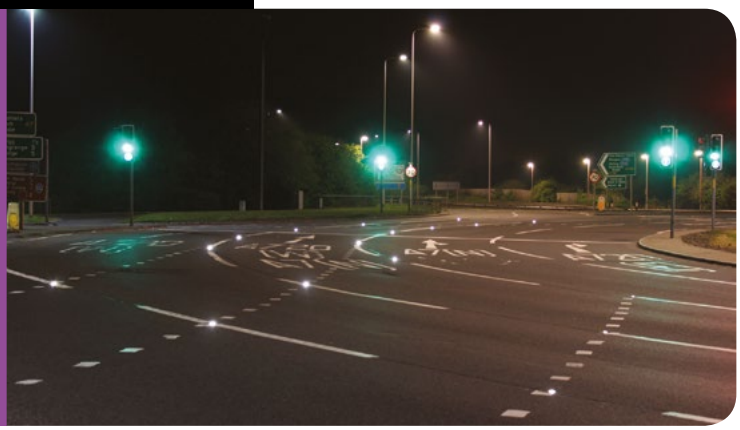

Image courtesy of Clearview Intelligence

Delivery Partners:
Amey, BEAR (Scotland), Clearview Intelligence, Transport Research Institute at Edinburgh Napier University, Transport Scotland

BACKGROUND

Sheriffhall is a six-arm roundabout which connects several important routes, including the A7 and the A720, and handles upwards of 42,000 vehicles a day. It is the only at-grade junction on the Edinburgh City Bypass and the high traffic volumes mean it has the potential to become very congested at peak times. An improvement scheme undertaken in 2008 widened the circulatory carriageway and the three congested approaches, dramatically increasing Sheriffhall roundabout's capacity.

The new scheme featured multiple sets of lane designation signs and markings, and a comprehensive lighting scheme to ensure clarity in all conditions; however, despite these measures, Sheriffhall roundabout remained highly prone to accidents with statistics recording the highest number of collisions of any roundabout on the Scottish trunk road network in the 10 years to 2013.

FIRST USE

In 2014, following a Stage 4 Road Safety Audit which cited poor lane discipline as the prime cause of collision at the roundabout, BEAR (Scotland), the contracted Operating Company for Transport Scotland at the time, proposed a new, more radical approach to improve the safety record of the roundabout.

The audit suggested that lane transgression was likely to be due to the level of difficulty that certain drivers may experience in understanding and reacting to the complexity of the junction. Therefore, an LED-powered, intelligent road stud scheme was proposed to guide traffic through the roundabout. The intention being that the studs would encourage drivers to stay within their lane by drawing drivers' attention to the delineation of the existing lane markings and guide them through the roundabout.

APPLICATION

The key aim of the active road stud scheme was to guide A720 traffic around the roundabout lanes. However, a potential issue became apparent that drivers on the circulatory carriageway from the minor arms would be confused by the studs. As this would be counterproductive, a more innovative solution was sought. The solution came in the form of a scheme using actively controlled road studs whereby the studs are switched on and off in coordination with the traffic signals on the roundabout.

As the traffic signal turns red, all of the studs on that section switch off and then the studs at the next section illuminate as the corresponding traffic signal turns green. In this way, drivers get an illuminated green phase to guide them all the way around and off the roundabout, with clear visual definition of the lanes to heighten lane discipline and reduce preventable collisions. This scheme is the first of its type in the UK.

BENEFITS

Researchers from the Transport Research Institute at Edinburgh Napier University undertook a full 'before and after' study on driver behaviour at the roundabout.

The research found Clearview's Intelligent Road Stud (IRS2) reduced in lane transgression activity across nearly all vehicle types and manoeuvres and has had a significant positive impact on collision risk at the roundabout, meaning less congestion and fewer accidents on this major gateway to Edinburgh.

This scheme attracted widespread industry recognition in 2016, winning the following awards:

- Chartered Institution of Highways & Transportation - John Smart Road Safety Award
- National Transport Awards - Most Innovative Transport Project
- Highways Magazine Excellence Awards - Road Marking Project of the Year
- Scottish Transport Awards - Excellence in Technology and Innovation Award

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INTELLIGENT FLOOD WARNING SYSTEM INFORMS TRAFFIC CONTROL STRATEGIES

Images courtesy of SWARCO

Delivery Partners:
SWARCO Traffic Limited,
Warwickshire County Council

BACKGROUND

SWARCO Traffic has designed and installed an intelligent flood warning system to divert drivers away from a ford in Kenilworth that has been causing severe problems during flood events. The ford can be the cause of significant traffic problems during flood conditions; partly because drivers are unsure whether the road is passable and also because smaller cars can get into trouble when a passing larger car causes a bow wave.

FIRST USE

Although not using any 'new' technology, this is an example of using new way of thinking to address an old problem: Swarco applied their proven expertise in traffic management technology to redesign a bespoke system that had previously been used to warn of high winds or traffic queues, and adapted the concept to a new 'flood warning' environment.

APPLICATION

Working closely with Warwickshire County Council engineers, SWARCO has provided a set of four warning signs; two on surrounding roads and two in close proximity to the ford. The two that are closest warn of low level flooding to alert drivers of the risk of aquaplaning. When the water rises above 100mm, the outer signs are activated to enable drivers to take an alternative route. The trigger levels for water depth can be altered if required.

Water level sensors from OTT Hydrometry are used to detect rising water levels in the Finham Brook where it passes under the A452. Messages from the sensors are sent to Warwickshire's UTMC system via a count control cabinet. The messages from the sensors are actually sent as car park occupancy messages to the UTMC system which in turn triggers the sign activation.

BENEFITS

Linking the flood warning signs via the UTMC system enables central monitoring of the road's condition in periods of flood. It also enables other traffic control strategies to be implemented in event of the flooded road becoming impassable. For example, signal timings at junctions in the surrounding area could be changed automatically to cater for a change from the normal traffic flows caused by drivers taking alternative routes.

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oneTRANSPORT

Image courtesy of oneTRANSPORT

Delivery Partners:
Arup, Buckinghamshire County Council, Clearview Intelligence, Hertfordshire County Council, Highways England, Imperial College London, InterDigital Europe, Northamptonshire County Council, Oxfordshire County Council, Traak, Worldsensing

BACKGROUND

The availability of transport-related data from multiple sources across different modes and geographic boundaries has the potential to enable a multitude of innovative applications and services for travellers and transport planners. However, supporting such data feeds may be financially challenging for local authorities and the lack of standardized interfaces has led to data silos and many disparate applications.

The development of an open data platform and marketplace provides an economically attractive solution for local authorities (data providers), and easy and standardised access mechanism to data for applications providers (data consumers).

FIRST USE

oneTRANSPORT is believed to be the world's first multi-region open marketplace for live, multi-modal and multi-system transport data, built around the open 'oneM2M' international standard for Internet of Things (IoT) systems.

Conceived in 2014, the oneTRANSPORT initiative has been progressively and collaboratively developed by a consortium of 11 organisations: InterDigital Europe (platform provider), Arup (transport expertise and market intelligence), Buckinghamshire County Council, Hertfordshire County Council, Oxfordshire County Council, Northamptonshire County Council and Highways England (data publishers and use case owners), Clearview Intelligence and Worldsensing (sensor providers), Traak and Imperial College London (data analytics) and with strong support and sponsorship from Innovate UK.

Recently, Birmingham City Council joined oneTRANSPORT through the Smart Routing project, which will deliver the world's first commercial-grade mobile app based on oneM2M.

APPLICATION

Through the oneM2M standard, the oneTRANSPORT platform enables efficient, secure and dynamic access to data from existing transport infrastructure, legacy systems, new transport sensors (e.g. Bluetooth traffic sensors) as well as future IoT devices.

oneTRANSPORT was successfully demonstrated during the F1 Grand Prix and MotoGP events at Silverstone in 2016. Integrated data included live traffic flow, roadworks, and Variable Message Signs. Furthermore, IoT data feeds from newly installed parking devices and Bluetooth traffic sensors were integrated. A dashboard was developed to provide a consolidated view of live data for event organisers allowing them to actively manage the transport and parking needs.

BENEFITS

oneTRANSPORT benefits multiple stakeholders including road users, public transport users, data providers, data users (app developers and analytics), data platform operators and the community as a whole. Such benefits include:

- improved travel experience
- reduced impact of congestion due to accidents and roadworks
- reduced time to find parking for road users
- decreased road transport emissions due to modal shift
- better information about transport users for local authorities

Benefit analysis has been performed in accordance with DfT's Transport Analysis Guide (TAG). The quantitative assessment has identified an average annual benefit of approximately £3-4 per capita based on the five local authorities (i.e. an average annual benefit of approximately £12m-16m for all the five local authorities). It is important to note that the value of the quantified benefits has associated uncertainties and depends on a number of assumptions with regards to a set of parameters including, among others, the target population and penetration rate.

Through compliance with oneM2M, oneTRANSPORT offers open interfaces and a cloud-based federated architecture that can scale up to support multiple business models at national and international scale whilst avoiding vendor-lock-in.

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SMARTPHONE ENABLED PEDESTRIAN CROSSINGS TO ASSIST THE VISUAL IMPAIRED

Images courtesy of Neatebox

Delivery Partners:
City of Edinburgh Council, Neatebox

BACKGROUND

Neatebox is an inclusive solutions led company, working with proximity aware technology, which focuses on creating and providing products that improve the quality of life for specific users but which ultimately aim to provide and support an inclusive society.

Through his work with Guide Dogs for the Blind UK, Gavin Neate, CEO of Neatebox, has become increasingly aware of the accessibility being built in as standard to modern smart devices and began to see the need for smart technology to increase the development of inclusive solutions.

Neatebox have used their knowledge of visual impairment and routine experience of unsafe and poorly installed pedestrian crossings to design a system by which the blind, visually impaired and pedestrians living with reduced mobility could interact with the environment around them simply using their smartphone and the Bluetooth Low Energy (BLE) functionality within.

The user runs the free Neatebox Pedestrian Crossing application and once they come into close proximity with a pedestrian crossing box fitted with Neatebox BLE technology, the button is either pressed on the phone, or it can be set to press the button automatically within a certain time frame to allow the crosser to get ready. This removes anxiety and limitations on users and is not limited to those with impairments as it can also be used by anyone who has their hands full!

The app also gathers a lot of data on how people move around a city which is collected and can be analysed. This contributes to the goals of Smart Cities, MaaS and future planning for cities and towns.

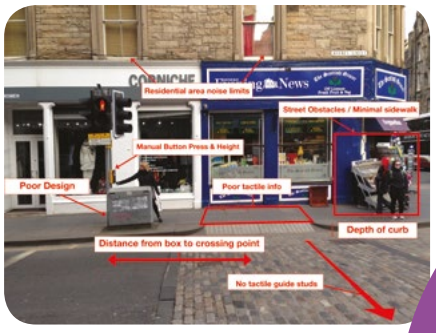
FIRST USE

The first active test site was on Holyrood Road in central Edinburgh.

APPLICATION

Since their first installation, Neatebox have created two more test sites. In partnership with Lothian Health Board, there have been four installations on Lauriston Place in Edinburgh, chosen due to its proximity to the Princess Alexandra Eye Pavilion. The technology is also incorporated on the privately owned pedestrian crossing at the RBS Head Office in Edinburgh. This is the first private installation of its type in the world and can also be pressed using a smart watch.

Neatebox has carried out extensive user testing with a wide variety of disabled users at their trial sites and are fine tuning the development of the product and application so that their technology can become part of the industry standard for pedestrian crossings, which will be ready for summer 2017.



BENEFITS

Maintaining an active life improves the social, commercial and physical mobility of those in society who have permanent or temporary challenges in this area - this also reduces the pressure on the health system by encouraging motivation and addressing loneliness which can positively affect potential triggers for mental illness. As the ageing population figures are set to double by the year 2050, and this will increase the figures of those with a disability, it is future proofing for our smart cities.

The technology has the benefits to be either retrofitted into existing pedestrian crossings or become part of the manufacturing process for any new installations. With around 300,000 pedestrian push buttons in the UK, Neatebox is looking to increase production and see the technology rolled out across the country to the benefit of a wide range of users.

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USING CROWD SOURCED DATA TO PROVIDE COST EFFECTIVE JOURNEY TIME INFORMATION

Image courtesy of Rennicks UK Ltd

Delivery Partners:
Clancy Plant Hire Ltd, Highways England, Rennicks UK Ltd, Transport for Greater Manchester, Virtus Ltd

BACKGROUND

The Department for Transport (DfT) recently issued a Major Project instruction that specifies journey time information must be displayed in "all Major Projects schemes … that; are longer than four kilometres in length and; have more than three months left to completion as of end of June 2016". This is in response to feedback from motorists that one of their frustrations is the length of roadworks and that the travel time to the end of the works is often unknown.

Providing accurate journey time information allows drivers to make more informed decisions about when to travel or what route to take. However, installing the detection equipment required can be expensive and time consuming.

Rennicks' Virtual Journey Time Solution makes use of crowd sourced data to provide the ability to deliver journey time information to drivers in a cost effective way, without the need to install detection equipment at the side of the road. The journey time information can therefore be provided quickly, without any disruption to road users, whilst also removing the risk to engineers working at the side of the road.

FIRST USE

This was deployed in October 2016 on the Manchester Smart Motorway scheme which requires a large number of complete carriageway closures, and therefore traffic is forced to follow diversion routes. It is not economically viable to install journey time detection equipment on such a large number of diversion routes, but using this virtual journey time solution allows the traffic management designer, Virtus Ltd to set up journey time measurements 'with the click of a mouse,' meaning they can set up a journey time information system for each road closure.

The system has delivered improved journey time information to drivers to encourage them to follow advised diversion routes rather than 'go it alone'. The scheme will run until September 2017.

APPLICATION

Improved journey time reliability and increased driver satisfaction are well-recognised benefits of journey time information. But journey time information is not deployed as frequently as it could be due to the high cost of generating the data.

This innovation provides a new way of creating journey time information without the expense, complexity, delays and risks associated with installing equipment at the roadside.

The Rennicks Virtual Journey Time System (RVJTS) is a hosted software platform that integrates with specific crowd sourced data to derive the required journey time information. A user only needs a web browser to access the map based graphical interface to define a route that they want journey time information for. Once configured, the RVJTS will then request the current journey time for that route at regular intervals. The RVJTS converts the response into a feed that is sent to mobile variable message signs positioned at suitable locations for display to drivers.

BENEFITS

These journey time routes can be created, edited, and deleted at will, with no need to install any detection equipment on the side of the road.

The ongoing costs of this solution are therefore significantly cheaper than the traditional method of calculating journey time information, which requires Automatic Number Plate Recognition (ANPR) cameras or Bluetooth sensors to be installed and maintained.

The key benefits and areas of cost savings with this approach are:

- No hardware to install, resulting in reduction of costs for:
  - Depreciation of assets
  - Civil engineering
  - Provision of reliable power for the detection equipment
  - Traffic management
  - Regular realignment of sensors
  - Hardware failures or hardware becoming out of date
- Improved safety as there is nothing to install on the highway
- No delays associated with hardware procurement or additional planning activities
- No ongoing hardware maintenance costs
- No ongoing communications costs
- No CO_2 emissions
- Not subject to vandalism

The ability to set up and move the location of the measured journey time route 'at the click of a mouse' is a significant benefit and allows users great flexibility if they need journey time information for either short-term or long-term projects.

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USING VIRTUAL LOADING BAYS TO INTELLIGENTLY MANAGE RESTRICTED KERB SPACE

Image courtesy of Grid Smarter Cities

Delivery Partners:
Grid Smarter Cities (Grid), Westminster City Council

BACKGROUND

Kerb space in city centres has many competing users and often inflexible enforcement and expensive traffic management methods. Virtual Loading Bays (VLB) by Grid Smarter Cities, a real-time dynamic, solution which helps councils to intelligently manage restricted kerb space.

VLB allows councils to utilise kerb space by enabling drivers to reserve the space, anywhere from routes that traditionally prohibit loading and unloading to red routes to (no loading) double yellows outside peak traffic hours, therefore minimising congestion and allowing parking in busy and difficult to reach locations in close proximity to delivery points.

Booking VLB's in advance of a driver's arrival in the city enables an integrated and positive traffic management strategy, reducing congestion and smoothing traffic flows. The delivery point may be informed of the driver's imminent arrival, on the approach to the booked VLB.

VLB's can be used by fleet administrators and office-based transport staff to make multiple bookings in correct bays and timeslots, on behalf of drivers. The driver can set off with the knowledge of exactly where and when to park, so vehicles can be left and deliveries made with confidence.

This VLB concept can also be applied to virtual:

- Charging bays (The system can be applied selectively to vehicle type and class to encourage use of cleaner vehicle types)
- Parking bays (coach and car)
- Disabled bays
- Skip bays
- Street works and utilities

FIRST USE

Grid undertook its first proof of concept of Virtual Loading Bays in Westminster City Council in 2011. The trial lasted a period of 12 months and looked at the operation impact of these bays on enforcement and the impact and ease of their use for freight delivery companies.

The outcome based on the modelling and economic analysis indicated that the introduction of a VLB system in Westminster would not only provide a solution to in managing congestion and smoothing traffic flows, but could also provide substantial economic benefits of around £1.7m a year.

APPLICATION

Virtual Loading Bays as a solution has been included in the Mayors Air Quality Action Plan. This document outlines the actions for boroughs to consider delivering locally as part of their London Local Air Quality Management action planning obligations. The document states that "benefits would arise from reducing the levels of illegal parking by goods vehicles during the busy peak periods, thus reducing levels of congestion".

Furthermore, Grid is continuing its engagement with local authorities, freight operators and local businesses to identify penalty charge notice (PCN) 'hotspots' and 'difficult to deliver' locations.

An agreed list of VLBs will be uploaded to the Kerb system with details of operation and tariffs and will become available to 'on the street' freight operators and back office enforcement officers.

BENEFITS

Benefits include those to the council and the city residents directly, at a commercial and environmental level:

- Saving capital expenditure by reducing the time and fuel used searching for available kerb space, which will also reduce emissions and improve air quality.
- Preventing unnecessary PCNs and the cost of administering them, as the pre-booked bay becomes 'legal'.
- Facilitating rapid loading/unloading due to alerting customer of the driver's imminent arrival, which in turn will reduce congestion.
- Increasing residential parking bays due to effective kerb space management.
- Key routes are kept clear.
- Companies can efficiently manage multiple drop offs/pick-ups.

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VEHICLE TRIALS

UK AUTODRIVE

UK Autodrive is a consortium that is trialling automated vehicle technology. It is funded by Innovate UK to support the introduction of self-driving vehicles into the UK.

Test track and on-road vehicle trials are planned up to October 2018, with connected and autonomous vehicles and pods expected to become a regular sight in Milton Keynes and Coventry using cars provided by project partners Ford, Jaguar Land Rover and Tata Motors.

The trials are intended to demonstrate how connected and autonomous vehicle technology works in a live urban environment in order to solve problems such as congestion and safety. Self-driving 'pods' will be deployed on a city-wide scale and key stakeholders (e.g. legislators, insurers and investors) will examine key challenges.

Gowling WLG and AXA are expected to provide guidance on legal and insurance issues affecting the connected and autonomous vehicle technology. (A data protection white paper was published in May 2016.)

The wider roll-out of connected and autonomous vehicles will be examined by teams from Cambridge and Oxford universities, including public attitudes to connected and autonomous vehicle technology the business case for self-driving pods, scaling up and how connected and autonomous vehicles influence congestion. Safety, security and communications requirements for connected and autonomous vehicles will also be examined.[xii]

UK CITE

UK Connected Intelligent Transport Environment (UK CITE) is a project to create the most advanced environment for testing connected and autonomous vehicles. It involves equipping over 40 miles of urban roads, dual-carriageways and motorways in the West Midlands, with combinations of three 'talking car technologies' and testing for a fourth, known as LTE-V. The project will establish how these technologies can improve journeys, reduce traffic congestion, provide entertainment and safety services through better connectivity.

The UK CITE project is worth a total of £7.1m (including the investment from government) and will enable automotive, infrastructure and service companies to trial connected vehicle technology, infrastructure and services in real-life conditions on roads within Coventry and Warwickshire.

The UK CITE consortium comprises leading industry, academic and local and national governmental organisations. It is jointly led by Visteon Engineering Services Limited and Jaguar Land Rover and includes Coventry City Council, Coventry University, Highways England Company Ltd, HORIBA MIRA, Huawei Technologies (UK) Ltd, Siemens, Vodafone Group Services Ltd, and WMG at University of Warwick. The UK CITE project will create the UK's first fully connected infrastructure on public roads using a combination of wireless technologies, which can enable real-world testing in a safe and managed way.

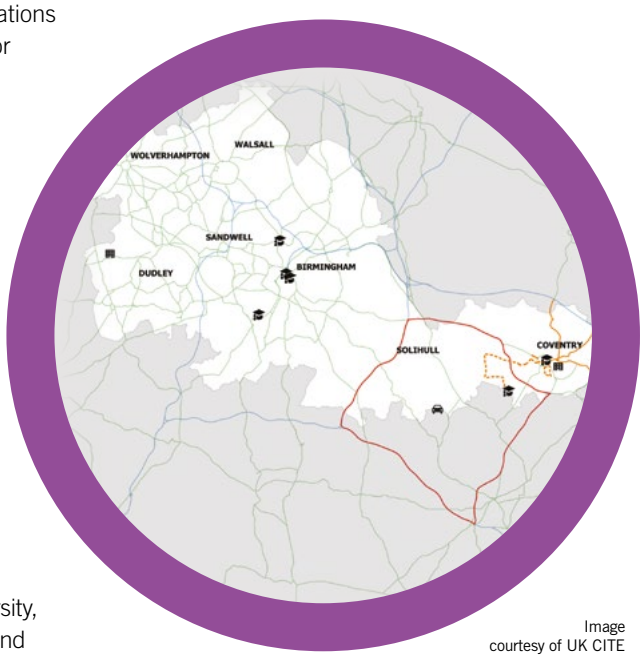


Image courtesy of UK CITE

The trials are likely to start on public roads in 2017, following comprehensive initial tests on HORIBA MIRA's City Circuit, which is a safe and fully controllable purpose built environment for the development and validation of connected autonomous vehicle technologies and services.[xiii]

VENTURER

Image courtesy of VENTURER

The VENTURER project brings together partners from public, private and academic organisations in order to establish a world class test site for connected and autonomous vehicle technology in the south west of the UK. It will focus on the people and technology issues associated with connected and autonomous vehicles, providing an understanding of the blockers and drivers to wide-scale connected and autonomous vehicle adoption. Particular attention will be paid to user-acceptance, insurance and legal implications of increased vehicle autonomy. As well as undertaking large numbers of vehicle tests on real roadway and pedestrian areas involving two main vehicle types (car and pod), a realistic simulation environment has also been developed.

The VENTURER project will last three years and is taking place in the Bristol and South Gloucestershire region, with an independent test site established as part of a sustainable and ongoing facility. Connected and autonomous vehicles are being deployed on real roads in an urban environment in a controlled and measurable way as part of testing and validation.

The VENTURER project focuses on the behaviours that will drive adoption of connected and autonomous vehicles and the insurance and legislative developments that are needed for on-road connected and autonomous vehicle deployment. VENTURER is exploiting leading UK sensor fusion and wireless technologies, and developing virtual and physical test capabilities.

The VENTURER consortium includes the University of Bristol, Bristol City Council, AXA, First Group, the University of the West of England, Atkins, Fusion Processing, South Gloucestershire Council, Williams Advanced Engineering, BAE Systems, Bristol Robotics Laboratory (BRL) and Burgess Salmon. [xiv]

GREENWICH AUTOMATED TRANSPORT ENVIRONMENT (GATEway)

GATEway is an £8m research project to understand and overcome the technical, legal and societal challenges of implementing connected and autonomous vehicles in an urban environment. It is led by the Transport Research Laboratory (TRL), using its UK Smart Mobility Living Lab in the Royal Borough of Greenwich to trial and validate a series of different use cases for automated vehicles, including driverless shuttles and automated urban deliveries.

Image courtesy of GATEway

GATEway will help industry and policymakers to understand the implications of connected and autonomous vehicles. Also, it will provide a safe and validated test environment in the UK, which will improve job creation and investment in connected and autonomous vehicle technology.

GATEway will demonstrate safe and efficient integration of automated transport systems into real world urban environments and help to understand technical, cultural, societal and legal challenges and barriers to adoption of automated vehicles. Also, it will encourage stakeholders and the wider public to engage with autonomous transport technology and it will generate knowledge about automated transport deployment in an urban environment. GATEway provides a test bed in London for evaluating automated transport systems and it promotes the UK in the global connected and autonomous vehicle market, encouraging inward investment and job creation.

A fleet of up to seven shuttles will operate on a set 2.5km route around the Greenwich Peninsula. Public attitudes to connected and autonomous vehicles are being investigated by gathering information from co-creation workshops. [xv]

A2 M2 ITS CONNECTED CORRIDOR

The A2 M2 ITS Connected Corridor is a partnership of Kent County Council, Transport for London, Highways England and the Department for Transport to pilot a linear 100km connected corridor on the A2/M2. The corridor combines different road types including a major urban tunnel, motorway, rural dual carriageways, London urban roads and Kent link roads to ensure there is a challenging traffic environment and to integrate traffic information and other services for both urban and strategic road corridors. The majority of the route is on the Strategic Road Network, linking London with the Port of Dover and major developments including Bluewater Shopping Centre. There are major intersections including the M25 and the route to Dartford Tunnel along the proposed corridor.

The corridor will utilise both ITS G5 (Wi-Fi), cellular and hybrid solutions and their potential supporting technology to initially deliver a number of Amsterdam Group Day One services (previously identified through feasibility studies). Going forward it is envisaged that the corridor will be used as a test bed for evaluating new technologies and services and would be used to build new business, transport and economic models through engagement with interested stakeholders and industry.

Providing vehicles and people with a reliable and fast connection opens up benefits to a significant number of parties on the Corridor including;

- **Highways England –** the potential to improve traffic management and traffic information services, reducing the requirement for roadside infrastructure. The potential to receive geographically referenced vehicle data about road surface condition and friction also has the potential to optimise network assessment and road maintenance planning.
- **Road users (including vehicle passengers) –** the benefits of connectivity, when fully realised, will provide end-to-end journey planning information with the potential for enhanced infotainment and office applications for the benefits of passengers.
- **Local highway authorities along the corridor route –** benefit from improved traffic management, traffic data and connectivity.
- **Emergency services –** better incident management resulting from improved traffic management and information.
- **Mobility service providers and traffic data providers –** the potential for enhanced data and vehicle information.

DRIVE ME

The autonomous Volvo XC90 SUV is the first in a series of autonomous cars that will eventually be handed to real families in Gothenburg to be driven on public roads. The Drive Me pilot project in Gothenburg is the first in a number of planned public trials with autonomous driving Volvo cars. A similar project to the one in Gothenburg will be launched in London in 2017, while Volvo is also assessing bids from interested cities in China to launch a Drive Me project there within the next few years.

Volvo currently offers a semi-autonomous functionality called Pilot Assist on its 90 series cars. The Drive Me cars will add hands-off and feet-off capability in special autonomous drive zones around Gothenburg, powered by what Volvo calls the Autonomous Driving Brain. Volvo aims to collect feedback and inputs from real customers using these autonomous cars in their everyday lives.

Volvo aims to further fine-tune its autonomous driving technologies and make its offering as relevant as possible to customers ahead of a commercial introduction around 2021. [xvi]

Image courtesy of Volvo

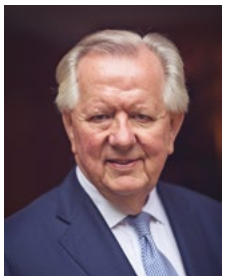
FINAL REMARKS

This report is a valuable resource to help local authorities understand the value technology can bring to transport. It provides them with an update and insight on the emerging technologies that are currently available and how these technologies can benefit transport in their local regions.

The report highlights case studies and examples from local authorities in the UK and across Europe that have used emerging technologies to improve their transport systems and to solve specific transport problems in their region. It also looks at how data and the Internet of Things can act as a service to aid mobility – and the impact these will have on local transport in the next five years. By exploring new procurement models and encouraging local authorities to specify technology in a more informed way, the report aims to help local authorities to do more for less.

It is important that as new technologies emerge, local authorities are aware of the latest developments and are supported in obtaining the right information to make informed decisions on whether such technology is the right option for them.

Jeremy Watson CBE
IET President



There's no doubt that emerging transport technologies have the potential to provide local transport authorities with important tools to deliver their policy objectives. But those same local authorities are finding it really hard to attract the skilled staff they need to procure and implement these technologies. Cuts to staffing budgets and strong competition for competent Intelligent Transport Systems (ITS) specialists combine to make it difficult for those local authorities to be intelligent clients who are able to make the most of the new and exciting opportunities provided by these new technologies.

Organisations such as ITS United Kingdom and the IET can and should help. By facilitating knowledge sharing and making it easy to keep up with new technical developments while keeping in touch with leading experts those industry associations deliver high levels of support at low or no cost. They provide accessible and welcoming real and virtual platforms where staff can update their knowledge and make crucial new contacts.

This publication is an excellent example. Updating the 2014 first edition provides a new set of case studies demonstrating how highways authorities have successfully implemented new technologies or used established technologies in new and effective ways. It provides signposts to other constantly updated sources of relevant information. As this second edition demonstrates, ITS (UK) and the IET are committed to keeping this second edition abreast of developments. I hope you have found it a useful and easy way of updating your knowledge and welcome your suggestions for future topics you would like us to include.

Steven Norris
ITS United Kingdom President

USEFUL LINKS

This page gives some useful links to other networks and resources. It is not a comprehensive list and should be used as a useful starting point.

IET:

Emerging transport technology case studies and links to other useful resources for local authorities:
theiet.org/ITS

ITS (UK):

ITS (UK) free publications page:
its-uk.org.uk/publications

ITS (UK) free newsletters and magazines:
its-ukreview.org

ITS (UK) local authority/urban interest group:
its-uk.org.uk/interestgroups/group/local-authority--urban

Other UK networks:

Transport Data Initiative (TDI):
transportdatainitiative.com

Transport Technology Forum (TTF):
ttf.uk.net

Urban Transport Group:
urbantransportgroup.org

Free online resources:

PIARC RNO-ITS online handbook for ITS:
rno-its.piarc.org

The ITS Observatory:
its-observatory.eu

Transport Systems Catapult publications:
ts.catapult.org.uk

Free subscription commercial magazines:

ITS International:
itsinternational.com

Smart Highways:
smarthighways.net

Thinking Highways:
thinkinghighways.com

Transport Technology International:
traffictechnologytoday.com/magazine.php

GLOSSARY

ANPR	Automatic Number Plate Recognition
ATMS	Advanced Traffic Management System
AV	Automated Vehicle (also referred to as Autonomous Vehicle)
AVL	Automatic Vehicle Location
C-ITS	Cooperative ITS (earlier referred to as CVHS or IVHS)
CAV	Connected and Autonomous Vehicles
CV	Connected Vehicle
DfT	Department for Transport
EV	Electric Vehicle
FVD	Floating Vehicle Data
GLOSA	Green Light Optimised Speed Advice
GPS	Global Positioning Systems
I2V	Infrastructure to Vehicle (also V2I)
IET	Institution of Engineering and Technology
IoT	Internet of Things
IP	Internet Protocol
ISA	Intelligent Speed Adaptation
ITS	Intelligent Transport Systems
ITS (UK)	the UK association for the promotion of Intelligent Transport Systems
MaaS	Mobility as a Service
MOVA	Microprocessor Optimised Vehicle Actuation
PCN	Penalty Charge Notice
RFID	Radio Frequency Identification
RTPI	Real-Time Passenger Information
SCOOT	Split Cycle Offset Optimisation Technique
SLA	Service Level Agreement
SPaT	Signal Phase and Timing
TCC	Traffic Control Centre
TIC	Traffic Information Centre
TRL	Transport Research Laboratory
UTC	Urban Traffic Control
UTMC	Urban Traffic Management Control
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
V2X	Vehicle to Everything
VLB	Virtual Loading Bay
VMS	Variable Message Sign
WIM	Weigh in Motion

ACKNOWLEDGEMENTS

This report was produced through a working group lead by the IET. The IET would like to thank this working group for their commitment and contributions. Without their time and support it would have not have been possible to produce this Guide.

Our thanks also go to all those who submitted case studies to us. We wish it could have been possible to include them all.

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Joanne Dodds (AECOM)
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Special thanks for their contributions also to:

James Gleave (Transport Futures)
Khalid Nur (Arup)

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iii http://www.compass4d.eu
iv https://iotuk.org.uk
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xv https://gateway-project.org.uk
xvi http://www.volvocars.com/intl/about/our-innovation-brands/intellisafe/autonomous-driving/drive-me

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