Department
for Transport

Intelligent Transport Systems in the UK

Progress Report

As required by European Union Directive 2010/40/EU

August 2017

The Department for Transport has actively considered the needs of blind and partially sighted people in accessing this document. The text will be made available in full on the Department's website. The text may be freely downloaded and translated by individuals or organisations for conversion into other accessible formats. If you have other needs in this regard please contact the Department.

Department for Transport
Great Minster House
33 Horseferry Road
London SW1P 4DR
Telephone 0300 330 3000
General enquiries https://forms.dft.gov.uk
Website www.gov.uk/dft

Contents

Introduction

As a world leader in Intelligent Transport Systems (ITS) the UK recognises the EU ITS Directive as an important opportunity to share skills and experience with fellow Member States, especially given the considerable investment the UK has already made in the development and deployment of ITS.

The following report is submitted by the UK Department for Transport (DfT) in accordance with Paragraph 3 of Article 17 of Directive 2010/40/EU which requires Member States (MS) to submit to the Commission by 27 August 2014, following the initial report, a report every three years on the progress made in the deployment of the actions referred to in Article 17 (1).

The report is an update on the previous National Report which was submitted to the Commission in August 2014. It is structured around the four Priority Areas identified by the ITS Directive and has been drafted in line with the Guidelines for Reporting by Member States, adopted by the European Commission on 13th July 2011. We have worked closely with ITS (UK) to supplement the national road operator information with wider examples of deployment by local authorities and the private sector.

The Guidelines for Reporting state that the reports to be provided under Article 17(3) of the Directive 2010/40/EU, hereinafter referred as 'the progress report', should follow the same structure as the initial report and should highlight the progress made since the previous reports. Further guidelines from the European Commission recommend that Member States should also include, where possible, relevant information on:

- Annual investments in ITS since 2010.

- Existing elements on assessment of performance of ITS in specific policy areas.

- Existing localisation/ maps of the deployment of ITS, ideally segmented by ITS core services.

The Report does provide information on investment and assessment where the data is available. However, this information is limited in certain circumstances. We will work with the devolved authorities to consider improved reporting for the next progress report.

In addition, we will support the Commission's study of the current levels of use across Europe of Key Performance Indicators (KPIs) within the field of ITS, with the aim of developing a consistent set of KPIs that can be used by different stakeholders across Europe to monitor, assess and report on ITS performance.

A selection of individual flagship UK ITS deployment schemes in the Arc Atlantique will be evaluated in order to show both their impact on the road network (in terms of safety, congestion, emissions) and their cost effectiveness (CBA). Along with outputs from other Arc Atlantique partners and the other 4 deployment corridors granted under the 2013 ITS Call, the outcomes of these evaluations will then be synthesized into a "global" EIP+ Evaluation Final Report. The Final Report will provide an overview of ITS Deployment in Europe in general and demonstrate the overall impact of co-funded ITS deployment across the European network as a whole between 2013 and 2020. These outcomes will be reported at the appropriate stage.

Member State Contact Information:

Mr Suku Phull   Tel: +44 (0) 7825 318413
Department for Transport   Email: suku.phull@dft.gsi.gov.uk
3/27 Great Minster House
33 Horseferry Road
London
SW1P 4DR
United Kingdom

1. National Approach to ITS

1.1 Our vision is for a transport system that is an engine for economic growth, but one that is also greener and safer and improves quality of life in our communities. By improving the links that help to move goods and people around, and by targeting investment in new projects that promote green growth, we can help to build the balanced, dynamic and low-carbon economy that is essential for our future prosperity.

1.2 Future technological developments will mean that ITS will play an increasing role in contributing towards achieving transport policy objectives, though the costs, benefits and effectiveness of deployed technologies will vary between Member States according to national priorities, existing infrastructure and network characteristics. It is therefore vital that Member States retain the final decision on whether and where to deploy systems to ensure that they are fully aligned with national policy objectives and make the best use of available resources.

1.3 The Government is determined to promote the UK as an ITS leader, to encourage growth in our academic and science base, and to create opportunities for inward investment in the research industries in our country. In choosing to develop and deploy ITS in the UK, the Department for Transport (DfT) is clear that legislative and administrative burdens must be kept to an absolute minimum. The UK sees the role of National Governments as enabling and encouraging the development and deployment of effective solutions to transport challenges.

1.4 The rapid pace of technological development offers the prospect that motoring will change significantly in the next quarter century. Increased automation and connectivity of driving functions has the potential to increase mobility for citizens and help ensure we have a socially inclusive transport network.

1.5 The centrepiece of the Government's work on these new technologies Vehicles has been the establishment in 2015 of the Centre for Connected and Autonomous Vehicles (CCAV), a joint unit between the Department for Transport (DfT) and the Department for Business, Energy and Industrial Strategy (BEIS). It was established to keep the UK at the forefront of the development and deployment of CAV] technology and it is responsible for:

- leading innovating policy development in this sector
- delivering a programme of research, development, demonstration, and deployment activity, worth up to £200 million, through Innovate UK
- providing co-ordination across DfT, BEIS and the rest of government
- being the single contact point for stakeholder engagement

- publishing a call for evidence on the UK's testing ecosystem for connected and autonomous vehicles
- launching a consultation on advanced driver assistance systems and automated vehicle technologies
- launching the BEIS £30 million collaborative research and development and feasibility study competition.

1.6 The Government is also engaging with a wide range of industry and academic stakeholders, including system suppliers, vehicle manufacturers, relevant trade and research bodies, innovators and operators, through formally-convened forums and on an ad-hoc basis, to ensure the successful implementation of Innovation and trchnology in local areas. Further details on these, and the CAV funding programmes, are included in the Annex.In addition to co-funding the establishment of the Transport Systems Catapult Centres (£16.9m over the first five years of operation) allowing the best of the UK's businesses, scientists and engineers to work side-by-side on R&D, transforming ideas into new products that generate economic growth, the Government also undertakes a range of horizon scanning and technology watch activities. Working with specialist groups we look for new and emerging technology and areas they can be applied to such as Smart Cities.

1.7 The Government's role in providing the right environment and support to allow new technologies to flourish, is vital. The Government has direct responsibility for the Strategic Road Network (SRN), and will be carefully considering the vision for and role of technology and information in the future operation, management and improvement of the performance of the SRN. The Highways England Delivery committed £150 million of innovation between 2015 and 2021. Additional funding for innovation will be provided by our research and development programme. The £150 million Innovation Designated Fund is being used support key priorities set out in the Road Investment Strategy. These include trials of connected and autonomous vehicle technologies, including the development of the A2/M2 London to Dover Connected Vehicle Corridor national pilot, and the better provision of better information to customers and improved management of our network and Infrastructure assets.

1.8 The projects being supported through the Innovation Designated Fund are spread across all areas of innovation, We have not fully allocated all funds to specific projects, to allow us to respond flexibly to new ideas and innovations as we progress through the funding period from 2015 to 2021 Highways England is also collaborating with Rijkswaterstaat, operator of the strategic road network in the Netherlands, to deliver innovative solutions to customers through the CHARM project which is defining and delivering a new generation of traffic management systems.

2.   Technical and Legal Framework

Introduction

2.1   The UK has no overall ITS architecture for the development and deployment of ITS but it has developed specific architectures and adopted specific interoperability standards and frameworks were deemed necessary to tackle individual policy problems. Each context is considered on a case by case basis in order to optimise the overall benefits in responding to strategic and local policy needs. The UK Government works closely with both public bodies and private industry to establish a clear position where appropriate.

Legal Framework

2.2   The legislative framework for the development and deployment of ITS services varies across the UK, mainly because of the devolution of certain statutory powers. The Traffic Management Act 2004, for example, places a Network Management Duty (NMD) on traffic authorities in England and Wales to make sure road networks are managed effectively to minimise congestion and disruption to vehicles and pedestrians.

2.3   The Traffic Signs Regulations and General Directions 2016 (prescribes the lawful placement and operation and display parameters of signs that are placed lawfully on the public highway in England, Scotland and Wales. These regulations define Variable Message Signs (VMS) and prescribe the messages that may be provided, together with the signs which form the basis of the pictograms displayed on VMS. Traffic signs in Northern Ireland are subject to the Road Traffic Regulation Order (Northern Ireland) 1997[1].

2.4   The managed and 'smart' motorway programme in England is delivered through secondary legislation. These Statutory Instruments permit variable speed limits and hard shoulder running at congestion "pinch-points" on the motorway – see for example the M62 Motorway (Junctions 25 to 30) (Actively Managed Hard Shoulder and Variable Speed Limits) Regulations 2012.

ITS Architecture and Standards

2.5   The UK has world-leading capability, facilities and experience in the Intelligent Transport Systems (ITS) sector. We have been an early adopter of systems, especially in the field of traffic and travel information. The development of these

---

[1] Northern Ireland Statutory Rules 1997/386

systems has required frameworks and standards to be adopted to ensure interoperability.

2.6 The UK strongly supports the value of standards in facilitating the effective operation of an open supply market. We do this in a number of ways, including:

- Developing and maintaining de facto standards, through collaborative public-private bodies.

- Developing and managing national specifications.

2.7 Participating in European or international standards through CEN/CENELEC/ETSI and ISO/IEC/ITU. There are key standards and specifications in use within the UK for:

- Urban Traffic Management Control (UTMC) systems, which are used principally on the local road network.

- DATEX II (European) which is used principally on the Strategic Roads Network (SRN) for traffic management systems.

- ITSO (principally UK) and EMV (international) for smart ticketing.

- Transmodel-based UK specifications (especially NaPTAN and TransXChange) and Transmodel "daughter" standards within CEN (SIRI, IFOPT, NeTEx etc) for public transport operations and passenger information – which enable data to be shared and exchanged and also for systems to be able to request and respond to enquiries to provide a federated travel information and journey planning architecture.

- RTIG specifications (principally UK) for certain key interface in bus operations.

- RDS-TMC for traffic advisory systems.

- General ICT industry standards (fixed and mobile internet, fixed and mobile telecommunications) such as 4g, 3g, GNSS, HTTP, GPRS etc.

- Local standards managed by Highways England for highway mounted systems, especially covering safety issues.

3. European Priority Area I: Optimal Use of Road Traffic & Travel Data Introduction

Using ITS to enable transport users to make informed choices about their journey

3.1 Accessible information on traffic and travel data is vital in enabling people and businesses to plan their activities, get easier access to markets and make strategic investment decisions. Such data therefore supports more effective logistics, infrastructure planning and better operations of our highway and public transport networks. The economic cost of inefficient travel and transport is high, and can be mitigated by open access to travel, traffic and road disruption data.

3.2 The UK has invested in ITS and the management of traffic data to provide more integrated services, better information to road users, and more efficient and safe operations of the highway network. The UK travel information infrastructure, for example, the National Rail Enquiries portal, Traveline and many commercial services including Google Maps and CityMapper provides a lot of choice for users. Further details of this investment, and the benefits it provides, were reported in the first National Report.

3.3 This area of activity has been significantly improved by significant growth data sharing and open data publishing and the opportunities that this has created for the private sector and most notably the Small Medium Enterprise (SME) sector to produce new applications, often for smartphones. This has begun to change the traditional dynamics between the public and private sector and put a real emphasis on the availability of data for re-use with minimal restrictions in terms of cost or terms and conditions.

The Open Data Agenda and traffic/travel Information

3.4 The UK Government adopted transparency and open data as key policy initiative in 2010. During the past seven years the Government has implemented a wide range of measures to make government and public services more transparent and to release data for use and re-use by third parties.

3.5 There is a great deal of potential to use "**Big data**" (the considerable volumes of data we now own and can access) to improve our understanding of customers' expectations. We can draw valuable insights from monitoring social media, or analysing and understanding travel patterns better. By making smarter use of this data we can ensure we make the right decisions about the services we deliver and how we invest in our network.

3.6 This is articulated in the Open Data White Paper that was published in June 2012 and which was accompanied by an Open Data Strategy in each key data theme including a Transport Sector Strategy that was published by the UK

Department for Transport. This includes a number of themes including the presumption to publish, commitment to the publication of core datasets, increasing the amount and relevance of data regarding the operation of public services, creation of a vibrant and dynamic market place and the drive to improve the quality of the data that is published.

3.7   In addition to the commitment to transparency in public finances and the operation of public services, the Open Data agenda also presents opportunities to provide better services to the public and to inform their travel choices. To date there has been a series of significant transport Open Data releases including:

- NaPTAN dataset of all 350,000 transport access nodes in Great Britain (bus stops, rail stations, metro stations, tram stops, airports, ferry terminals etc)

- Rail Timetables – dynamic publishing of up-to-date rail timetables for Great Britain

- Roadworks data for the Strategic Road Network (SRN) in England

- Roadworks data for local authority roads in about 90% of English authorities

- Real-time data about the operation of the SRN including speeds, incidents, traffic signs etc

- Car Park register of over 20,000 car parks across Great Britain

- Cycle routes across every local authority in England

- Bus timetables for every scheduled service across Great Britain

- Coach timetables across all of Great Britain

- Rail fares database for all services in Great Britain

- The routeing guide that indicates the validity of train tickets

- Real-time train running information for trains across the Network Rail system

- Next Buses API showing the next three departures from every bus stop in the NaPTAN database, in real-time where that data exists or timetabled if it does not

- National Chargepoint Registry provides a public database of publicly-funded chargepoints across the UK in support of the Government's objective to promote the use and sales of Ultra Low Emission vehicles (ULEVs) in the UK

- Accessibility data regarding the access for passengers with disabilities at stops and on services

- Registration details for every bus service operated in Great Britain.

3.8   As part of this process, Highways England has made available much of its traffic data. A service has been set up to allow partner organisations (for example local transport authorities, media organisations) access to the National Traffic

Information Centre (NTIS see section 3.44). Highways England's real-time data feed continues to be one of the most popular datasets downloaded from the data.gov.uk website. In July 2017 Highways England published a new configurable API provide network-wide data on junction flow at 15-minute intervals. Work has also commenced on 2-minute interval data which will provide a very granular measure of performance.

Progress since the National Report

3.9 In late 2012 Government announced plans to establish the world's first Open Data Institute (ODI) as the leading centre in which the exploitation of Open Data is demonstrated. The ODI incubates, nurtures and mentors new businesses exploiting Open Data for economic growth and promoting innovation driven by the UK Government's Open Data policy.

3.10 As a result of this open data policy, there are very limited licensing restrictions on its re-use. This has resulted in many hundreds of new applications being developed for smartphones and a study by Deloittes (circa 2016) that accompanied the independent review of the re-use of Public Sector Information by Stephan Shakespeare found that transport datasets were both the most viewed and re-used of all datasets by subject.

3.11 There has been a significant growth in the availability of data without recourse to the public sector. There are smart phone applications that allow the "crowd sourcing" of information on congestion conditions on the road network, such as Waze, information that is both inputted by motorists and floating vehicle data automatically generated by the apps tracking location referencing of the phones.

3.12 The UK public sector has demonstrated that it has a key role to play in opening up data, enabling developers and other third parties to access raw data which the private sector use to build new, innovative applications and services to provide improved information for the traveller. Some examples are listed below:

Transport for London Open Data (www.tfl.gov.uk/info-for/open-data-users/)

3.13 In a linked but separate initiative the Mayor of London decreed that all non-personal and non-sensitive data should be published and available for re-use. The timeline for the development of TfL Open Data can be summarised as follows:

- 2007 – embeddable widgets
- 2009 – developers area launched
- 2010 – additional live feeds for live running, timetables, planned disruption etc. hundreds of developers
- 2011 – tube tracking, journey planning API, over 1,000 developers
- 2012 – bus departures and London 2012, over 4,000 developers
- 2013 – single API, over 5,000 developers.

3.14 The Shakespeare Review on the re-use of public information commented "You can see (the value of Open Data) in the way we travel: live information about every detail of our transport system means we don't have to guess when the next bus will arrive or the most efficient route from A to B. These developments have been estimated to have generated a value of between £15 – 58 million each year in saved time for the users of TfL."

ELGIN – Open Data for Road Works

3.15 ELGIN is a private company that aggregates data from almost all the local highway authorities in England and Wales, providing the largest dataset on road works conditions, publishing 2.6 million individual road works annually (2.1m unique to ELGIN, and the rest for Highways England and TfL data which is fully integrated). It launched roadworks.org in March 2012 which publishes up-to-the minute information about local road works on a live map, which helps to reduce congestion and better co-ordinate road work planning.

3.16 Recently ELGIN has added diversion route information and provided the route planning functionality for the recent Tour de France Grand Depart in Great Britain

Cycle Streets

3.17 Open data on traffic conditions can benefit all road users. Cycle Streets provides a a UK-wide cycle journey planner system, currently in its live Beta testing phase that allows the planning of journeys by cycle and will highlight busy sections of road and factor in the delay to journey times caused by road geometry and traffic signals. It combines a number of datasets including, crucially for cycling journeys, data from Ordnance Survey on the gradient of roads.

Other Open Data Sets

3.18 In October 2013 the Government, public bodies and the transport industry announced their intention to make the following publically available, to help foster more innovative applications:

- Rail real-time information from the National Rail DARWIN API including details of disruption and short-term alterations to service

- Further information about MoT testing of vehicles (Subject to consultation)

- Bulk dataset of driving licence data (Subject to public consultation).

- Data relevant to air passenger user experience

- Further data on accessibility of public transport services.

3.19 The Government was also a founding member of the Open Government Partnership and has issued two National Action Plans and was instrumental in the design of the G8 Open Data Charter. It has embedded a Presumption to

Publish public data as Open Data but also stresses the importance of privacy (of individuals' data) and the need to effectively share data between public sector bodies.

Using ITS to enable transport users to make informed choices about their journey – Multi modal Journey Planning (Transport Direct)

3.20 By 2014 the UK Government found that it had encouraged sufficient publishing of transport data as open data to underpin a thriving journey planning market and could safely shut its pioneering Transport Direct (TD) service which had been set up as the cornerstone of the UK travel information system. TD was funded by central government with a build cost of £40m and annual operating costs of £7m. It combined all forms of public transport and enabled users to compare with road journeys and offered some pricing information for trains, coaches and the cost of driving. It was developed by federating existing journey planners and data sources together and enabling their integration through common data referencing and information sharing protocols to ask questions and receive answers.

3.21 In setting up TD, the Government recognised the existence of market failure in national, multi-modal journey planning. However it also noted that data about services generally existed and that these were often brought together at a city or regional level. Data was not however usually available for third parties to re-use without cost or restriction and journey planning services were generally costly and had limited geographical capability.

3.22 The advent of TD and the work on open data publishing and the response of the app developer community has radically transformed this situation. There are now a large number of high quality journey planners and, during 2014, Google Maps added public transport to its popular journey planning service. The government was therefore able to close TD on 30 September 2014.

3.23 In the ten years during which TD was live a number of factors transformed the market:

- Data is now commonly available as Open Data and this is normally free to access and has very limited re-use restrictions.

- Data quality has improved markedly.

- ICT costs have fallen dramatically, for example cloud computing has significantly reduced the cost of hosting services.

- Journey planning systems have increased their geographical capability and have also fallen in cost.

- New entrants into the travel information market have taken some of the burden off central and local government and service providers, for example Google.

- Travel information services such as Satellite Navigation have been bundled into other products such as vehicles and smartphones.

- Increasingly users have planned on the move rather than in advance of journeys on nomadic devices such as satnavs and smartphones.

- Pressure on public finances has increased the pressure on governments to reduce costs where sensible.

3.24 As a consequence of these developments and most notably the emergence of multiple Great Britain-wide multi-modal public transport journey planners, the UK Government has decided that at the end of the 10 year Design, Build and Operate contract for Transport Direct it would not re-tender the contract and leave provision of services to the vibrant market that has emerged.

3.25 Other areas of development include:

- Travel Demand Management – for London 2012, to match predicted demand for services with the known capacity of routes and stations a series of routeing rules was been drawn up to equalise these parameters. This is being applied today-to-day operations with reference to the major development works at London Bridge, led by Network rail and TfL.

- Accessible Travel Planning – given the success of this facility for the London Games, and the relative ease and cost of the implementation of the accessible network approach and the yes/no planning request, this was rolled on a national basis with TD and was embedded in the existing systems such as Traveline and will continue in the future.

- Real-time in Car Planning – implemented in Transport Direct and published so that it is available for journey planning services generally showing the effect of road restrictions on car journeys. This shows how unplanned disruptions can be described, and then applied to journeys.

- Real-time in Public Transport – an extension to the TfL system across the whole of Great Britain with the ability for multi-agency input and sharing via the Journey Web protocol, numerous potential applications from unplanned incidents to congestion and dynamic routeing advice.

- Plotting of Major Planned Road Changes – the Olympic Route Network

- and the major road events were plotted and their effect on traffic flows modelled across a wide network. This has potential for major roadworks, major events and known regular traffic problems.

3.26 National, multi-modal public transport journey planning will be provided from a number of sources including:

- Google Transit
- Traveline Information Limited
- Traveline Regions
- Transport for London

3.27 Each of these planners will use the Open Data provided via the Open Data programme to some extent and will be free at the point of use for users.

Open data "Continue the drive for open data, maintaining the UK position as a world leader"

3.28 The DfT has recently appointed a new Data Leader and formed a Data Board, focussed on managing DfT's portfolio of open data initiatives, priority workstreams including:

- The rail industry has opened up substantial amounts of data in recent years. DfT continues to work with the Rail Delivery Group on an action plan to improve the quality and openness of rail data.

- Local Transport Discovery project to be commissioned shortly to inform a work programme to release value from a range of local transport datasets.

- Bus Services Act (April 2017) enables regulations to be made to require local authorities and bus operators to provide information local bus services (i.e. routes, timetables, fares, tickets, live information and stopping places).

- Street Manager project – following a Discovery project a business case is being prepared to develop a new system which would exploit open data to transform the way streetworks are planned, managed and communicated.

- Traffic Flow Data (Highways England) – this has now been released ahead of schedule, which reports on traffic flows on the strategic roadwork at 15-minute intervals. This will aid the development of new services to help the public better plan and manage their journeys.

Traveline Scotland

3.29 Traveline Scotland is a partnership between Transport Operators, Local Authorities and Transport Scotland. Traveline Scotland provides up to date, accurate, impartial and understandable information on all public transport services within Scotland and from Scotland to major destinations in other parts of the UK. Scottish local authorities and major transport operators provide Traveline Scotland with data on public transport services running in their area. Traveline Scotland then utilises this information to provide a personal journey planning service 24 hours a day, 7 days a week via various methods of dissemination including:

- an telephone information line

- the Traveline Scotland website and mobile app (produced in partnership with Traffic Scotland)

- the txt2traveline SMS alert service to obtain bus stop departure information.

3.30 The Traveline Scotland website is now multi lingual and is available in French, German, Spanish, Portuguese, Italian and Gaelic. Recent improvements to support access to "in trip" information including mobile applications (My Next

bus) provided through network providers for internet enabled telephones and other similar connected devices and kiosk applications.

Interoperability/Compatibility/Continuity

3.31   As open data has become more commonly requested and used Traveline Scotland data is available in various standard data format including TransXchange, ATCO CIF and GTFS, for existing and new third party receivers.

3.32   Organisations can now add TLS's journey planning to their own website by simply downloading a software tool called a "page landing" wizard. As the destination site is pre-populated, this allows visitors/contractors/stakeholders visiting that organisation's office(s) to simple type in their start postcode. The software then produces an individualised journey plan to direct the visitor to the site by public transport.

3.33   For example using the Traveline Scotland's journey planner Strathclyde Passenger Transport, and NHS Greater Glasgow and Clyde can provide hospital patients with Personalised Journey Plans linked to their hospital and medical appointments. This has now been rolled out to NHS Lothian, Fife, Borders, Forth Valley, and Grampian & Highland. TLS also offers a free internet based "batch journey" planning service enabling the mass production of personalised journey plans for a range of organisations on a site specific basis.

Recent Developments

- The UK Government adopted transparency and open data as key policy initiative Redesign of the website to increase accessibility on tablets and mobiles

- Winner of the 2015 Scottish Transport Award for 'Excellence in technology and innovation' for the Glasgow Commonwealth Games app. During the event, the app offered over 1.4 million personal journey plans to 480,000 users visiting the 13 games venues

Future Plans

- The UK Government adopted transparency and open data as key policy initiative Journey Alerts, to warn of disruption that may affect usual journeys

- Options for emailing and sharing journey plans on social media

- An updated cycling journey planner

- A dedicated Access to Health microsite

- More information about accessible stations, stops and public transport services

- New tools for third parties

Smart & Integrated Ticketing

3.34 The UK Government (responsible for England) and the Devolved Administrations (in Scotland and Wales) continue to support ITSO[1] as a key technical specification for delivering smart ticketing.

Key National Activities

3.35 The **ITSO on Prestige** (IoP) project was completed in 2014. UK government funding of c.£70m has upgraded London's Oyster smartcard system so that it can accept ITSO smartcards and contactless payment cards.

3.36 This has enabled the train operating companies that operate services into London to offer smart ticketing. Southern launched their smartcard in late 2013, c2c will do so in 2014 and South West Trains is working towards full roll out in 2015. Other operators will go live as the SEFT Programme delivers (see below).

3.37 Transport for London (TfL) has developed back office systems to accept **contactless payment cards** (that is, credit and debit cards issued by banks and other organisations to the EMV standard) for travel in London. Payment cards have been accepted on London buses since 2013. The UK Department for Transport has reached agreement with TfL and train operators to extend this technology to all modes of transport within the greater London area in 2014.

3.38 The UK Department for Transport also sponsors the **South East Flexible Ticketing (SEFT)** programme to roll out ITSO smart ticketing to other train operating companies in south east England.

3.39 Beyond rail, the UK Department for Transport has been working closely with the major cities and conurbations (excluding London) in England to deliver smart and integrated ticketing in these areas through the Smart Cities Partnership. For example, in the West Midlands, Centro (now Transport for the West Midlands) has rolled out its Swift card, enabling the introduction of smart multi modal ticketing across local bus, rail and tram. The Department is now focusing on how it can support the delivery of the ticketing and partnership measures enabled by the Bus Services Act 2017.

http://www.itso.org.uk/

Highways England Traffic Information

3.40 Investment in technology remains a key element to improving the effectiveness of Highways England's operation of the strategic road network and in keeping traffic moving. With new technologies continuing to emerge both in the UK and internationally, to date Highways England has worked to identify and support those new and existing technologies that will best address traffic information and management needs on the Strategic Road Network. The evolution of the Smart Motorways concept is a good example of how Highways England has trialled, rolled out and refined a technology solution to meet operational requirements.

3.41 Highways England has been focusing vigorously on maximising the benefit of its investment in technology to date, whilst at the same time supporting the delivery of new technology through the Smart Motorways Programme.

3.42 This strategy for innovation, technology and research has been further strengthened in response to a key requirement of the Government's 2015 Road Investment Strategy.**Technology Asset Benefits**-

- Maximising the capacity and efficiency of the SRN - The long term trend shows road usage continuing to grow. Technology delivers cost effective ways to increase the capacity of the existing network space.

- Managing demand – Technology can be used to manage the number of vehicles accessing the network.

- Preventing and minimising the impact of incidents – queue protection technology, variable signage and traffic monitoring all help to reduce accidents and minimise their impact when they happen.

- Minimising the impact of road use on the environment – solutions which smooth traffic flow and reduce congestion also optimise the environmental performance of the network by reducing vehicle emissions.

- Maximising the efficiency of traffic operations - our National Traffic Control Centre, seven regional control centres and on-road traffic officers all rely on traffic monitoring, management and communications solutions to operate effectively.

3.43 Highways England's investment in technology delivers reliability, safety, and environmental benefits that can be summarised as follows:

- Ensuring operations are conducted as safely as possible - safer deployment and direction of traffic officer staff and the emergency services relies on technology monitoring vehicle flow.

- Ensuring the infrastructure is as safe as possible - technology is used to monitor the physical condition of the network, enabling targeted renewals and maintenance to the right place at the right time.

- Assisting road worker safety - traffic technology and information it provides to drivers assists with carrying out maintenance activities safely.

3.44 A milestone in the development of traffic information services was the introduction of the National Traffic Control Centre (NTCC) which latterly has evolved into the National Traffic Information Service (NTIS). The NTIS will pave the way to provision of more personalised traffic and travel information as well as support the future role out of connected vehicles (C-ITS), the latter of which is in the planning stages in South East England.

Highways England: National Traffic Control Centre (NTCC)

Overview

3.45 The NTCC was the hub of the English motorway network and one of the key ways in which the HA is delivering its aims of "safe roads, reliable journeys and informed travellers."

3.46 The main objectives of the NTCC were:

- Providing accurate real-time traffic information to the public using a number of different methods.

- Minimising the congestion caused by incidents, road works and events.

- Taking place near the motorway and trunk road network.

- Providing information on diversions to help motorists avoid queues.

3.47 In order to achieve these objectives, the NTCC collected traffic data from CCTV cameras and on-road sensors. This was used together with the information supplied by Traffic Officers, Police Forces, Local Highway Authorities and Service Providers etc. This information was then processed, analysed and disseminated to the public in a number of different ways.

Results

3.48 Overall the project has delivered a benefit ratio of roughly 2.4:1 (higher than expected from the original business case). Benefits were:

- Providing pre-trip information to drivers so that they avoid congestion.

- Providing in-trip information to drivers so they avoid congestion.

- Providing a single point of contact for HA stakeholders to obtain information on network state.

Interoperability/Compatibility/ Continuity

3.49 The NTCC contract was designed to deliver better information to the driver via numerous information sources and strategically manage traffic on the HA network.

3.50 The information collected by the NTCC operators was used to identify events (either future or current), form strategies to manage traffic flows, set information signs to warn drivers or give diversion routes, inform partner organisations, advise the media and either through the media or directly with the public, inform travellers about conditions on the Highways England network.

3.51 To meet these requirements the NTCC set up the following services:

- Traffic England – The Highways England traffic information website which makes details of, delays, closures, road works and other information publically accessible. This was done to allow those undertaking journeys to use the site to help them plan future journeys, to

avoid planned works (such as road works, planned closures etc) or check an imminent journey to verify current travel conditions.

- VMS – These can be set to warn travellers of planned future or current events, (roadwork's, planned closures or major events such as concerts, sporting events etc). VMS were set so travellers could avoid future congestion, divert around current incident or be warned about queues ahead.

- DATEX II – This service was set up to allow partner organisations (for example local transport authorities or media organisations) access to the NTCC's data. DATEX II delivered a data feed which was transferred between Information and Communication Technologies (ICT) systems without the intervention of control room operators or staff at the receiving end. This allowed data to be taken from the NTCC and added into partner organisation systems, which was then integrated with their own data. In terms of the media organisations this enabled them to better inform the public. At the end of the contract there were over 150 partners taking the DATEX II feed.

- Incident Information – Further services were set up to allow direct liaison between media organisation reporting incidents and the NTCC. This allowed media organisations the ability to obtain further incident details and report these to the public.

Highways England : National Traffic Information Service

Overview

3.52 The National Traffic information Service (NTIS) replaced the PFI contract National Traffic Control Centre (NTCC) in September 2011. The NTIS is provided from the Highways England National Traffic Operations Centre (NTOC) in Birmingham and delivers the following services:

- Provide accurate real-time traffic information to the public using a number of output channels.

- Strategic traffic management to minimise the congestion caused by incidents, road works and events taking place near the motorway and trunk road network.

- Provide advance warning of planned maintenance activities.

- The ability to report on network performance through accurate data collection and processing.

- The ability to measure the effectiveness of Highways England interventions.

- Improved road user satisfaction through provision of better information services to the public.

- Enabling more efficient operations through; (a) automated incident detection (b) system links to reduce manual processes; and (c) providing a single strategic overview of the network.

- A flexible solution that can be adapted to take advantage of more data and changes to operations, the organisation and new technologies delivered in-car or through mobile devices.

3.53 To assist in delivering these services real time traffic information and planned maintenance activities are published via the following outputs:

- The Highways England Traffic England website

- Email alerts

- RSS feeds

- Twitter

- Roadside variable message signs

- GiTHub for third party service suppliers

Interoperability/Compatibility/Continuity

- NTIS publishes all data in the Datex v2 European standard for data exchange.

- NTIS can collect third party data in the Datex v2 format.

- NTIS provides a GitHub page https://github.com/ntisservices with resources and sample code for developers making use of traffic data.

- NTIS control centre functions are in scope for the Common Highways England Rijkwaterstaat Model (CHARM).

Benefits

3.54 The table below shows the total estimated economic benefits of the National Traffic Information Service, showing the incremental change between the current (baseline) and the future (post transformation) service.

3.55 The economic value, in 2011 prices

£M Financial Year	2011	2012	2013	2014	2015	2016	2017	2018	Total
Total	21	40	49	55	58	61	64	28	377
Delay	12	23	29	33	35	37	38	17	224
Reliability	6	12	14	16	17	18	19	8	112
Safety	2	4	5	5	5	6	6	2	35
Efficiency	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.4	6

3.56   These economic benefits consist of values associated with:

- Delay: relating to drivers making informed decisions to avoid delays to their journeys.

- Reliability: relating to the time savings achieved by road users through improvements to the reliability of all journeys delivered by reductions in journey time delay.

- Safety: relating to a reduction in queuing incidents, facilitated by NTIS by informing drivers of events and allowing them to avoid congestion.

- Efficiency: relating to reduced operator workloads at RCCs through system links and automation delivered by NTIS.

NOTE: Based on the timescales for implementation and duration of the core NTIS contract (service delivery from September 2011 to September 2018), values for 2011 relate to the period September 2011 to March 2012 and values for 2018 relate to the period April 2018 to August 2018.

Highways England: Public Access CCTV

Overview

3.57   Highways England owns over 3,000 Traffic Cameras and has been using them to assist with the management of traffic on the trunk road and motorway network in England for 30 years.

3.58

3.59   The primary users of the traffic cameras are the Highways England Regional and National Traffic Operations Centre operators. The operators are able to move and zoom the cameras to monitor and manage congestion and incidents. The cameras give a bird's eye view of what is happening which helps the operator to decide on the support needed

3.60   Highways England has developed policies and a technical interface that allow stakeholders to view the images in a format suitable for their needs. An innovative partnering approach with media organisations and web hosts has been implemented, allowing nominated third parties or 'media partners' to access and disseminate still and live images to the public through their own traffic news bulletins and websites.

3.61   This approach has allowed Highways England to support businesses to develop innovative solutions to make images available to the public via mobile phones, Sat Navs, and other technologies, meaning citizens are able view network conditions almost anywhere.

Results

3.62   Two benefit realisation reviews have taken place with the media partner's service. To meet the original BCR of 1.58 to 1 the service needed to serve out

425,000 images a month. Currently these partner organisations, on an average month, serve out over 2.6 million images and have seen peaks, during periods of severe weather, of over 40 million images a month.

3.63 This project combined technical delivery, with policy and procedures, to allow the Highways England images to be viewed by the public. Delivering a service which allowed organisations to store and forward images enabled innovative solutions to be developed, for example iPhone and Android apps.

3.64 The project was delivered to enable citizens to view images of the network so they could see travel conditions for themselves. In doing this those using these services are able, pre-trip to consider: whether to travel/ to change route or mode of transport/ in-trip to divert onto a new route.

New Information Plan

Overview

3.65 Highways England has developed an information plan to focus on the delivery of traffic information. This plan describes ways Highways England will improve information services. It will also explains the longer term vision for information services. As vehicles, technology, data services and customer expectations evolve, Highways England wants to make sure that its information services are attuned to both what customers need and what they should expect from Highways England.

3.66 Research indicates that information delivered to the end user in the right way can help deliver a number of direct customer and economic benefits. Through the delivery of the plan future vision, Highways England intend to maximise those benefits and support economic growth.

3.67 Through implementing the actions in the plan, Highways England will:

- Engage with its customers; providing reassurance when all is well and accurate information when the unexpected happens.

- Provide accurate information about planned works, such as network changes or roadworks.

- Enable customers to make accurate, timely and appropriate decisions which benefit both themselves and other road users;

- Reduce the effects of incidents and delays, helping to reduce their impact on the environment.

- Help customers to understand how the network operates and how best to use it, seeking to prevent incidents and their effects.

- Provide a definitive source of data and information about the state of the Strategic Road Network for Highways England customers and stakeholders.

- Provide a robust framework for future development of ITS and information services

3.68 Priority Areas:

a) The provision of EU-wide multimodal travel information services.

b) The provision of EU-wide real-time traffic information services.

c) Data and procedures for the provision, where possible, of road safety related minimum universal traffic information free of charge to users.

d) The harmonised provision for an interoperable EU-wide eCall.

e) The provision of information services for safe and secure parking places for trucks and commercial vehicles.

f) The provision of reservation services for safe and secure parking places for trucks and commercial vehicles.

Service/ Priority Area	(a) Multi-Modal Services	(b) Traffic Services	(c) Safety	(d) E-Call	(e) Info - Truck Parking	(f) Res – Truck Parking
(i) VMS		√	√			
(ii) NTOC		√	√			
(iii) NTIC		√	√			
(iv) Smart M'ways		√	√			
(v) CCTV		√	√			
(vi) NRTS		√				
(vii) Info Plan		√				

Traffic Scotland Information Service

Overview

3.69 Transport Scotland manages a comprehensive, multi-modal transport network that helps keep Scotland connected; making journeys safer and more reliable.

3.70 The Traffic Scotland Information Service (TSIS) provides real-time and planned, future information about the Scottish road network to the travelling public. The platforms used and information provided includes:

TSIS Platforms	Information Provided
• VMS	• Incidents
• Desktop and mobile websites	• Roadworks (live and planned)
• Smartphone applications	• Planned events
• RSS feeds	• Event specific travel & traffic information
• DATEX II feed	
• FTP Service - Traffic Scotland Live Traffic Camera	• Live traffic CCTV images
• Twitter feed	• Park and ride locations
• Dedicated call centre	• Travel information kiosks
• National, local and commercial media	• Live VMS messages
• Streaming internet radio service	• Weather stations outputs & weather warnings
	• Freight information

3.71 The purpose of TSIS is to help drivers make informed decisions about the timing, routing and mode for current and future journeys. TSIS work with many other organisations including operating companies, media, Police, and the Met office to ensure they receive and disseminate the most accurate and up to date information.

3.72 TSIS is guided by the TSIS Development Strategy, which reflects the European, UK and Scottish policy framework and is constantly evolving in line with latest technological innovations. This ensures the continued efficient and effective delivery of robust, reliable and relevant services to regional, national and European travellers.

Progress

- Mobile site refresh - new user friendly, map-based mobile web solution

- User specified content – integration of services with social media, alerts, location based services, Traffic Scotland Radio; the aim is to proactively deliver real-time information to users when, where and how they want it.

- Weather and resilience – continued investment in providing accurate, location-based, weather and related road safety information in coordination with Police Scotland and the Met Office.

- Journey times – increased coverage in Central Scotland, strategic routes, Local Authority cross-jurisdiction projects, and more VMS journey times.

- Integration of new road schemes – TSIS updates have been made to accommodate new mapping, roadside ITS and real-time information services.

- Internet Radio - streamed over the internet (Traffic Scotland sites and joint Traveline Scotland/Traffic Scotland smartphone apps).

- Freight information services – static data covering location, description and contact information for ports, railheads, airports, lorry parking adjacent to the trunk road, and industrial estates; as well as freight specific road restrictions.

Interoperability/Compatibility/Continuity

- Cross Border Information Provision – data exchange through DATEX II

- Direct integration of intermodal travel planner Traveline Scotland.

- Guidance and information for Park and Ride sites.

- Developing relationships with large event organisers, covering sporting, music, public events to provide coordinated information and integrated access.

- Fusion of historic and live traffic data providing predictive journey time information.

- Integration of the real-time traffic information with the Twitter development platform so users can "follow" traffic events.

- Provision of interfaces allowing users to publish information on own web sites or similar applications.

- Includes RSS feeds for traffic information and road works, a DATEX interface (used by Google) and traffic images interface for media and private users.

- In accordance with the priority action areas, metadata for real-time traffic information services and safety related traffic information available in the UK National Access Point, data.gov.uk.

Future

3.73 Further development of user specified content of Traffic Scotland services, "My Routes" tool to create and personalised journey alerts

3.74 Moving towards use of in-vehicle information and the role personal devices will play in the future of connected vehicles, V2V and V2I.

3.75 In 2016 the Traffic Scotland website delivered 182 million page impressions, the usage of the service has increased over the years, with several significant periods of poor winter weather in 2010, 2013 and 2015; highlighting when there is additional increased demand for TSIS.

3.76 In 2016 the desktop and mobile website availability was over 99%

3.77 There were 196,000 Traffic Scotland Twitter followers in July 2017

Traffic Scotland National Control Centre (TSNCC)

Overview

3.78 The Traffic Scotland National Control Centre (TSNCC) is a purpose built facility to monitor and react to any incidents on Scotland's trunk road network 24 hours a day. Opened in 2013, the TSNCC also houses transport resilience functions during severe weather, including the mobilisation of the Multi-Agency Response Team (MART). The TSNCC uses modern technology and improved co-ordination to collate and communicate real-time traffic information on incidents and events that take place on the trunk road network, meaning travellers throughout the country are able to make better informed decisions about their journeys.

3.79 A back-up facility has also been implemented in Glasgow to provide business continuity, minimise down-time, and improve reliability and integrity.

Results

3.80 From the TSNCC operators can:

- Monitor the trunk road network using tools such as CCTV, weather
- station cameras, loops, roadside emergency telephones and journey-time information
- Gather information from the operational stakeholders such as the Trunk Road Operating Companies, Police Scotland, Local Authorities, broadcast media and the public
- Implement response strategies to help manage live incidents, for example diversion routes, weather warnings and high wind management strategies for major bridges
- Control trunk roads and motorways using VMS, overhead motorway signal controls and speed signals
- Provide RTTI relating to live incidents taking place using VMS, radio broadcasts, social media, a customer care line and the Traffic Scotland website.

3.81 Significant benefits have also been delivered by co-locating and coordinating the emergency travel response via the Multi-Agency Response Team (MART), having on-site interaction with Police Scotland, dedicated social media and radio presence.

National Traffic Data System

Overview

3.82 The National Traffic Data System (NTDS) is an enhanced data warehouse and data mining tool, designed to meet Transport Scotland's future business requirements and those of other stakeholders, such as staff managing the Trunk Road Network, Local Authorities as well as the public. The NTDS links data sets that were previously kept in silos, with a secure web-based, configurable reporting interface.

Results

3.83 The NTDS automatically validates collected data using a configurable, data driven, rule based engine. It contains automated data handling (collection, validation, flagging, patching, processing, storage, and output) wherever possible. It includes a wide range of parameterised reports which allow users to view the data in a number of different ways:

- Vehicle counts, speeds and weights
- Across different timescales (period of report down to 15 minute time bins)
- For whole roads, carriageways or individual lanes
- In tabular or graphical format
- Report output can be exported

Future

3.84 NTDS has been designed in such a way as to accommodate a variety of datasets in the future, most notably environmental and journey time data that fits well alongside the existing traffic data held within the system.

3.85 Simple data queries will be delivered via a public reporting website in real-time. More complicated queries for administrative data extraction reports, that would previously have required significant manual effort, can be delivered within minutes or hours depending on the complexity of the queries and the volume of data required.

Journey Time System

Overview

3.86 Real-time journey time information is a core element of the TSIS and key in improving the efficiency of the motorway and trunk road network. Since initial journey time work in 2002 the service has continued to be improved and geographically expanded. The service has also evolved in its delivery, technological solutions and the adoption of new partnerships:

- Journey times available in the public web services, VMS, DATEX feed and used for traffic management purposes on the Dashboard

- The service now uses a range of technologies to gather data including ANPR, TMUs and Bluetooth units

- Partnerships with Local Authorities have been built to provide seamless cross-jurisdictional journey times, making best use of resources and expertise

Results

- Improvements in how congestion, reliability and journey time reliability are measured on the trunk road network

- Implementation of a national trunk road journey time system, infilling gaps in network coverage using a range of technologies and private service provider's data

- LA partnerships with Edinburgh, Aberdeen and Dundee City Councils have been developed to share infrastructure and exchange data, providing journey times that cross from the trunk road to the local urban road network

- Network management website and reporting facility for viewing current journey time conditions and interrogating historic data

- Improved efficiency and accuracy of strategic routing decisions and in turn reducing travel times and congestion on the network and helping to improve safety.

Future

3.87 Completion and validation of the national trunk road journey time system for improved network operations and dissemination to the public.

Transport Scotland Priority Action matrix

Development	Optimal use of road, traffic and travel data				
	Multimodal	RTTI	SRTI	eCall	Freight Information
Traveline Scotland	☐				
Traffic Scotland Information Services		☐	☐		☐
National Traffic Data System		☐	☐		
Traffic Scotland National Control Centre		☐	☐		
Journey Time System		☐			
Text-to-Speech		☐	☐		☐
VMS		☐	☐		

Transport Northern Ireland – Enhancements to Trafficwatchni.com

Overview

3.88 The TrafficwatchNI website is a key means of disseminating information on traffic and travel issues. Recent enhancements include the inclusion of social media with an automatic link to the TrafficwatchNI Twitter feed, streaming CCTV feeds and information on other services in the region such as the Strangford ferry.

Objective

3.89 To provide a wide range of traffic information outlets to enable the public to make informed choices of their time, route and mode of travel.

Interoperability/Compatibility/Continuity

3.90 The traffic watch website provides traffic information on all classes of public roads in Northern Ireland.

3.91   Not yet undertaken.

Traffic Wales Website Improvements (2014 – 2017) – All Wales Road Network

Overview

3.92   The provision of travel information, which is both timely and reliable to the traveling public, is a vital component in ensuring a safe, reliable and informed journey.

3.93   Providing travel information complements the existing technology asset and makes use of existing data as collected over the Welsh Government strategic road network.

3.94   The Traffic Wales Service and associated social media feeds are therefore key tools for communicating Welsh Government motorway & strategic road network information to the public.

3.95   The purpose of the Traffic Wales Service is therefore to further assist the traveling public (within Wales) make informed decisions (both pre trip and on trip) about their journey, by providing up-to-date information about what is currently happening on the roads and forecast traffic conditions. With the Traffic Wales Service the travelling public can see if there are any major delays on their route and if so make an informed decision.

3.96   This project continues to align with the Welsh Government ITS Strategy development of the Traffic Wales Service, including:

- Improving the automated provision of information to the Traffic Wales Service from other systems.

- Sharing details of standard diversion routes associated with road closures.

- Expanding the accessibility of the Traffic Wales Service to social networks

Bi Lingual Service across all platforms

- http://www.traffic-wales.com/Home.aspx?lang=en-GB

- http://www.traffic-wales.com/?lang=cy-GB

https://twitter.com/trafficwales

- @TrafficWalesS

- @TrafficWalesN

- @TraffigCymruG

- @TraffigCymruD

3.97 For up-to-date traffic information and travel advice for Wales' motorway and trunk road network, contact Traffic Wales by telephoning the information line on 0300 123 1213 (available 24 hours a day)

Traffic Wales App:

3.98 https://itunes.apple.com/gb/app/traffic-wales-traffig-cymru/id526123711?mt=8&ign-mpt=uo%3D4

Future

3.99 The scope of the project will include the following:

- Route Planner
- Journey Time Planner
- Expansion of freight-related information
- Expansion of roadwork's/street work's information

- Support to the Welsh Government in establishing a communications strategy; covering expanded use of social media by the Traffic Wales service and trunk road agents.

Welsh National Traffic Data System (2014- 2017) – All Wales Road Network (completed)

Overview

3.100 The focus of this project was the introduction of a single all-Wales traffic data collection system that utilises an innovative, best-value, tailored combination of data gathering solutions and delivers the ability to broadcast information in near-real time. The project combined extensions of the existing data-gathering infrastructure (automatic number plate recognition (ANPR) and traffic counting sites) with the introduction of new collection methods that exploit opportunities afforded by recent technological developments, such as mobile device location information and global positioning system (GPS) tracking.

Future

3.101 The outcome of this project has been the provision of accurate, immediate information on traffic conditions to the travelling public, the Welsh Government and other stakeholders in the motorway and trunk road network:

- Reliable prediction of journey times delivers economic benefits

- Accurate and timely information provision facilitates incident response and empowers the public to make better travel choices

- Availability of information for future schemes

- Cross-organisational collaboration reduces public expenditure

All Wales Weather Station Further Improvements (2015 – on-going) – All Wales Road Network

Overview

3.102 The Welsh Government has 40 weather stations sited throughout their strategic road network, where information regarding wind speed/ direction, relative temperature/ humidity, precipitation, and road temperature are monitored. This data is returned via the gpsm/ 3G/ 4G network to a central hub for distribution to the Welsh Government and Trunk Road Agency to assist and inform their winter maintenance routines.

3.103 Currently this project is upgrading all technology to combined units, replacing poles to drop down poles and improving the civils infrastructure.

3.104 As result, improvements have been made to the over reliance to dedicated 3rd party suppliers, reductions to maintenance time and an increase to the safety of the work force.

3.105 The Welsh Government is committed to increasing the coverage of this network of weather stations.

The Real Time Information Group (RTIG) Overview

Introduction

3.106 In the UK the Real Time Information Group is a community group providing a focus for those involved in the public transport technology community. RTIG has a wide membership drawn from local authorities, public transport operators and system suppliers.

3.107 They aim to further the effective use of information and communication technology in the public transport sector by developing and disseminating standards, specifications and good practice.

3.108 RTIG was established in 2000 specifically to develop standards and good practice guidance for bus real time information, in a UK context. It has since built on that role by broadening its scope and remit, and now works in a number of areas with partners in other Member States.

Current Status

3.109 RTIG was involved in the development of the CEN Service Interface for Real-time Information (SIRI), with RTIG's exchange protocol being one of the key source documents. Several major implementations have taken place in the UK. RTIG has been involved in discussions on the CEN standard for the Identification of Fixed Objects in Passenger Transport (IFOPT) and the in-development standard NeTEx.

3.110 Through an industry forum RTIG has guided the development of a national IFOPT profile which has been used in planning for Olympics 2012 travel information. RTIG's bus-to-roadside communications protocol, for bus priority at traffic signals, is now widely used (e.g. across London's fleet of over 8,000 buses). However this architecture for bus priority is being challenged by a newer approach in which a central Automated Vehicle Management System (AVMS) server communicates directly to a central Urban Traffic Control (UTC) server. RTIG has developed protocols that facilitate this newer approach.

Future Plans

3.111 RTIG is a community initiative, and receives no funding from UK Government. Its plans are therefore driven by local government and industry priorities.

3.112 The Bus Services Act in England is a key part of the UK's plans to deliver its obligations under Priority Action A of the ITS Directive, since it provides for the generation and provision or relevant data. The details are still being worked out,

however, and RTIG's role in creating a practical compliant solution is yet to be clarified.

Transport for London's Syndication of Real-time traffic Disruption Data (www.tfl.gov.uk/info-for/open-data-users/)

Background

3.113 Since February 2010, Transport for London (TfL) has made its live traffic disruption data available as a syndicated data XML feed through the London Data Store. TfL recognised that there was a strong existing market providing real time traffic data and alerts to road users in London, and that that by openly sharing our traffic data, we could enhance these services with more information, and potentially reach a much broader base of road users across London.

3.114 The first iteration of the real-time traffic disruption data feed was substandard due to the limitations of the operational system from which it was generated. Third parties who wished to display the data on a website or web map were able to use the data, but those who wished to systematically integrate TfL data with other sources of travel information (for routing systems, for example), were unable to do so without manual interventions.

Solution

3.115 In 2013, the operational source system was replaced, providing an ideal opportunity to improve the quality of the live traffic disruptions data feed. The new system recorded information about traffic disruptions in a structured and systematic way, making the captured data more "machine readable". A revised version of the live data feed was re-created to capture a richer range of information about road disruptions, including improved spatial information, details of closures and more in-depth categorisation of the cause of a disruption. This was launched in May 2013.

Results & Benefits

3.116 There are now over 1,500 third party organisations subscribing to TfL's live traffic data. The new real-time traffic disruption data feed was been well received by subscribers and has been integrated into a number of third party services. Examples include Sat Nav traffic data (for example, Tom Tom's HD Traffic product), traffic information web sites (for example Elgin's http://roadworks.org which provides a comprehensive UK-wide public information service on road works) and operational systems (for example, the London Ambulance service are working on integrating the data into their in-house GIS system).

Next Steps

3.117 Recent feedback has been received from users asking TfL to consider a version of the live traffic disruptions data feed which conforms to one of the EU traffic data standards.

3.118 A thorough investigation has recently been completed which concludes that the work required to implement a DATEXII data feed from the current system is achievable. TfL will be progressing the next phase of improvements to the feed with the recommendations from this report in mind.

4. European Priority Area II: Continuity of Traffic & Freight Management Services

Variable Message Signs

Overview

4.1 Highways England deploys Variable Message Signs (VMS) at key decision points on the motorway and trunk road network. They are used to help manage the network by providing advance warning to drivers of emergencies and incidents. VMS are also used to warn drivers of events that may cause delays in the future such as road works and major events.

4.2 There are currently around 3000 VMS on the Highways England network. Of these 459 are located at key decision points around the network i.e. before major junctions such as the M5/M6 link.

4.3 Messages displayed on VMS are limited to those that help drivers complete their journey safely and efficiently. VMS cannot be used for advertising or any other unnecessary information.

4.4 There are a number of types of VMS in use on the Highways England network and they provide the capability to display a wide range of warnings, messages and other traffic information.

4.5 The Highways England is responsible for setting all the VMS on the strategic road network.

4.6 Messages are set in one of three ways:

- Regional Control Centres (RCCs) - There are seven RCCs which are responsible for the setting of tactical messages within their allocated region.

- National Traffic Information Centre (NTIC) - This single control room is responsible for the strategic operation of the HA road network. This includes setting messages for long distance diversion routes and also campaign messages.

- Automatic Signalling such as Motorway Incident Detection and Automated Signalling (MIDAS).

4.7 VMS are an essential requirement in allowing the Highways England to operate the network. Without VMS new initiatives such as Managed Motorways would not be possible.

4.8 The exact benefit from the installation of VMS to help drivers avoid congestion has not been quantified. Original business cases expected a Benefit to Cost Ratio (BCR) of around 3 to 1 however recent research has shown that this benefit is probably lower.

4.9 The MIDAS solution has been shown to reduce rear end accidents by around 7% and this has resulted in a 13% reduction in serious injuries related to such incidents.

Variable Message Signs, Tra

4.10 VMS are an important traffic management tool and core method of providing drivers with RTTI and SRTI. Transport Scotland's VMS are located at strategic points on the network. Site selection and development at key implementations have been undertaken across the Scottish Trunk Road Network including TEN-T road links.

4.11 VMS are including in the design and implementation of new road schemes and to fill gaps on the network. The implementation of VMS at gaps in the network has helped alleviate areas which suffered unnecessary delays and safety problems by giving Traffic Scotland operators a higher concentration of traffic management services at an appropriate level. Both fixed and mobile VMS are deployed on the Scottish network, with over £28M invested in VMS since 2007.

4.12 Pictograms capable signs have been deployed and can be used in circumstances relating to:

Hazards	Accident	Snow & low temperatures	Roadworks
Slippery roads	Breakdown	High winds	Congestion / queues

as detailed in the Transport Scotland Variable Message Sign Legend Authorisation documentation. Transport Scotland now have the power to design and approve their own VMS messages.

4.13 Earlier reports highlighted:

- 2008-2009 deployments in the Borders region

- 2010-2013 deployments on M74 and M80

- 2014 deployments as part of the M8/M73/M74 upgrade works

- 2016 deployments for Fife ITS, Junction 1A and the Queensferry Crossing

4.14 These contribute to over 250 VMS providing incident, event, travel time, weather and safety information on the network.

Future

4.15 VMS remain an important strategic tool to reach drivers on the road, with deployments planned on forthcoming road schemes and projects where appropriate. Work will also be progressed on development of new bridge VMS message sets.

Northern Ireland CCTV & Variable Message Signs (VMS)

Overview

4.16 DFI Roads already had an extensive network of CCTV cameras and variable message signs. New VMS were installed on the A1 and the A8 in 2011 .

Objective

4.17 To provide traffic operators with a more comprehensive CCTV and VMS facilities which can be used to benefit the travelling public by enhancing traffic control and travel information.

Interoperability/Compatibility/Continuity

4.18 Information will be used to provide enhanced services to the travelling public.

Evaluation

4.19 An evaluation was carried out to assess how the VMS installed on the Northern Ireland road network have provided benefits to the road network during incidents. The evaluation has shown that VMS encourage motorists to change their travel route to avoid areas affected by congestion. Avoiding road closures or heavy congestion enables the road network to operate more efficiently than if vehicles remain on the road affected by the closure.

Installation of MS4 Variable Message Signs on M2 Foreshore (Citybound) & M3 Lagan Bridge (Eastbound)

Overview

4.20 The M2 Foreshore motorway is a key link for the distribution of freight from the Docks to Belfast city centre and beyond. New MS4 variable message signs have been installed on this part of the network to provide enhanced information to drivers.

Objectives

4.21   To improve road safety and traffic flow by providing timely, reliable and credible information.

Update on Progress

4.22   8 MS4 electronic variable message signs were commissioned in March/April 2014

Interoperability/Compatibility/ Continuity

4.23   The signs are used for management of incidents, special events, and traffic information for the adjoining urban network.

Evaluation

4.24   Not yet undertaken.

Motorway & Trunk Road Network – "All Wales" VMS (2014- on going)

Overview – Network Management, Congestion Reduction, Road Safety, Information Provision

4.25   VSL has now been deployed on this section of the M4 for over 7 years, with a continued programme of configuration, monitoring and technology upgrades. This system until recently has not been enforced. The enforcement aspect of the system is now live. Which has seen, though analysis of data, improvements to both journey time reliability and a reduction to reportable incidents.

Results

4.26   The following objectives have been realised by this project:

- Less congestion and improved traffic flows
- More reliable, smoother journeys
- Better use of lanes and less lane changing
- Reduction in accidents
- Increased throughput of vehicles

Welsh M4 Motorway OptiSense, Acoustic Network Monitoring (2012 2015 (now complete)

Overview

4.28 The Welsh Government has fibre optic cables at the heart of its communication infrastructure along the M4 and A55 route corridors in South and North Wales as well as along key stretches of the strategic Welsh trunk road network.

4.29 Through the installation of specialist acoustic monitoring equipment on existing fibre optic communication networks, this project aims to evaluate Fibre Sensing Technology, focusing on three key areas:

- Incident Detection
- Traffic Flow
- Average Journey Times

4.30 Potential secondary objectives have also been identified and include:

- Security
- Copper Theft
- Asset Condition Monitoring

4.31 The acoustic monitoring equipment will monitor the network, providing alarm and notification of incidents and events as well as additional activity on the strategic motorway and trunk road network.

4.32 Acoustic monitoring is an extremely environmentally friendly way of monitoring incidents and events on the Motorways and Trunk Roads and has shown excellent results with the potential of replacing inductive loops in the future.

All Wales CCTV (All Wales Solution) (2011 - with on-going improvements and enhancements)

Overview

4.33 Delivery of an "All Wales" CCTV System. This project forms part of a wider initiative to upgrade the existing CCTV system in Wales. There are two phases to doing this, as follows:

- **Phase 1** – To specify, procure, install and commission a new All Wales back office system for CCTV. This is to be a single back office solution for adoption across All Wales.

- **Phase 2** – To add all CCTV cameras on the Motorway and Trunk Road Network, including all security cameras at maintenance depots, to the newly installed back office system.

Smart Motorways

Overview

4.34 The term "smart motorways" covers a number of interventions the UK is making on the motorway network which utilise data collection and traffic management technologies to make better use of existing road space, reduce congestion and add capacity where it is most urgently needed. This includes smoothing the flow of traffic using variable speed limits, dynamic use of the hard shoulder as a running lane at busy times, and on newer schemes, permanent conversion of the hard shoulder to a running lane. Radar or loop-based traffic detectors are used to monitor traffic flow, and mandatory speed limits are set in response to conditions on the road, either by an automated system or by control centre operators. Furthermore, more comprehensive general traffic information is made available to inform users and inform travel decisions.

4.35 The most visible element of smart motorways is the use of the hard shoulder to provide an additional traffic lane on a temporary or permanent basis. Emergency refuge areas are provided at frequent intervals, and overhead signs and signals, CCTV and enforcement cameras are used to create a controlled environment in which the hard shoulder can be safely eliminated.

4.36 The electronic signing is used to display reduced speed limits, direct motorists to use the hard shoulder, close lanes to protect an incident scene or create an access route for the emergency services, and provide supporting information to drivers about hazards, diversions and the cause of any restrictions.

Results

4.37 Smart motorways combine the benefit of an additional lane with improved value for money. Construction costs are on average 40% lower than for traditional widening schemes, with a reduced environmental impact and a faster delivery time.

4.38 The first smart motorway scheme was opened on the M42 in 2006, and was a success, improving journey times and reducing the number of personal injury accidents. Following this, a further six schemes featuring peak-time use of the hard shoulder have been delivered.

4.39 The experience gained from operating these schemes has been used to develop the improved 'all lane running' design, featuring permanent conversion of the hard shoulder and simplified signalling, which is being applied to all new smart motorways. All lane running schemes have the same objectives of reducing congestion while maintaining safety performance.

4.40 The first all lane running sections have now been opened on the M25, between Junctions 5-7 and 23-27. Further schemes are planned, see details below.

Smart Motorways Schemes, Cost & Benefit

4.41 Based on the latest outturn costs for the following completed schemes, in total these 6 schemes delivered at a cost of £943m, the following BCR's :

- M6 (BBox 1&2)   £146.1m (BCR tbd)
- M6 J5-8 (BBox3)   £111.5m (BCR 3.5)
- M4/M5   £86.8m (BCR 9.9)
- M62 J25-30   £134.9m (BCR 6.1)
- M1 J10-13   £323.1m (BCR 7.3)
- M25 J5-7 (Sect 2) – All lane running   £112.5m (BCR 5.2)
- M25 J23-27 (Sect 5) – All lane running   £174.1m (BCR 2.9)

4.42 Evaluation of early schemes has shown that they met the objectives of reducing congestion and improving journey times without negatively impacting safety.

Current Schemes & Cost

4.43 For schemes starting prior to March 2015, based on current estimates, we are expecting to spend £921m, comprising of:

- M1 J28-31 – All lane running   £205.8m
- M1 J32-35a – All lane running   £125.5m
- M1 J39-42 – All lane running   £120.0m
- M3 J2-4a – All lane running   £174.0m
- M6 J10a-13*   £87.4m

* Scheme a mix of dynamic hard shoulder and all lane running.

4.44 For schemes to be delivered up to 2021 we can estimate a total programme cost of between £3bn to £4bn, comprising of:

• M4 J3-12	• M3 J9-14
• M1 J24-25	• M27 J4-11
• M6 J13-15	• M23 J8-10
• M6 J15-19	• M20 J3-5
• M6 J21a-26	• M60 J1-4
• M5 J4a-6	• M60 J24-27
• M1 J13-19	• M62 J10-12
	• M56 J6-8

4.45 The next generation of smart motorways will achieve smoother, more controlled flow. Building on the success of smart motorways, we will develop innovative concepts to apply to our 'expressways' such as use of advanced incident detection technology to improve journey performance on some of our busiest A roads. We are also delivering the first motorway to motorway traffic management system where traffic lights on slip roads operate in conjunction with smart motorways, leading to improved journeys for our customers

4.46 Currently the average (adjusted) BCR for completed schemes equates to 5.8, and it is expected that new schemes will deliver a similar return on investment.

Transport Scotland: Managed Motorways and Major ITS Deployment

Overview

4.47 Transport Scotland are utilising ITS on the road network to improve road capacity, operations and safety. The use of enhanced ITS for managed motorway applications improves journey time reliability and journey times for prioritised users. Managed motorways make use of variable speed limits, VMS, ramp metering, hard shoulder running and average speed enforcement.

Progress

4.48 Managed motorway principals have been designed into the Queensferry Crossing:

- Fife ITS
- M9 J1a

4.49 Major ITS implementations have also been made on the:

- M8/M73/M74
- M74 Completion and
- M80 Stepps to Haggs

4.50 Featuring speed and lane signalling, variable message signing, incident detection, journey time monitoring and information, CCTV and roadside emergency telephones.

4.51 These schemes are connected by a fibre-based communication network to the Traffic Scotland National Control Centre.

4.52 Future projects include:

- Completion of the Queensferry Crossing, once finished the result will be a 22km managed motorway that regulates the traffic travelling across the Forth

- Variable Advisory Speed Limit (VASL) system trial on the M8

- Strategic Journey Time signing

- Aberdeen Western Peripheral Route (AWPR)

Transport Scotland: Management Dashboard

Overview

4.53 The Management Dashboard is a web based tool which can effectively handle multiple data sources and display information on multiple web enabled devices. It can be used on desktops, laptops, mobile devices or projected onto large display monitors for easy viewing of real time data utilising colours, icons and maps to aid interpretation. It promotes a shared view of information, by multiple stakeholders, to facilitate decision making.

Results

- Improves Transport Scotland / Operator oversight of network situation which allows them to respond and produce briefing quickly

- All information is easily accessible, data presented is user-configurable providing personalised

- Phased deployment to initially include RTTI datasets required for Commonwealth Games in 2014, and expanded to incorporate VMS, CCTV, social media, weather alerts, bridge status and Police safety information.

Future

4.54 New modules will be included for:

- Roadworks

- Events

- Road Traffic Counter Health Check

DFI Roads M1/A12 Westlink Variable Mandatory Speed Limits (VMSL)

Overview

4.55 The M1/A12 West link is a key route within the Northern Ireland public road network carrying approximately 85,000 vehicles per day. In April 2012, a traffic control system comprising VMSL linked to MIDAS incident detection was commissioned. The system was part funded by the European Union.

Objectives

4.56 The objectives of the implementation were to smooth traffic flow, increase the reliability of journey times, improve road safety and increase the throughput of vehicles.

Update on Process

4.57 The VMSL system is working automatically from information gathered from the MIDAS detection loops. Work is continuing on the fine tuning of the system parameters. There is no automatic enforcement of the system.

Interoperability/Compatibility/Continuity

4.58 The A12 West link is an all-Purpose road with several grade separated traffic interchanges with main urban radial routes. The VMSL system protects the back of queues exiting the West link for Belfast City Centre.

Evaluation

4.59 An interim evaluation using limited data has been undertaken, with the following results:

- On average there was a 1% increase in the 80th percentile flow (ie maximum throughput).
- Northbound average journey times decreased on average by 2%.
- Southbound journey times decreased on average by 4%.
- Overall journey time reliability improved.
- Estimated benefit from reduction in average journey time was £51.6m.
- Estimated benefits from increased journey time reliability was £30.3m.

Highways England – Use of the Internet Protocol (IP) in Roadside Telecommunications

Overview

4.60 The National Roads Telecommunications Service (NRTS) provides the telecommunications backbone that connects many thousands of roadside devices (emergency telephones, CCTV cameras, VMS etc.) alongside England's motorways to the HA's seven RCCs.

4.61 This network is made up of fibre optic and copper cables that transmit data and voice signals between the devices and the RCCs. The service was procured in 2005 as a [£650m] ten year Private Finance Initiative (PFI) including the upgrade of the previous telecommunications provision and ongoing management and improvement of the service.

4.62 Over recent years, a number of projects have been implemented under the NRTS PFI contract to enable use of the IP – an open, widely available, widely used, internationally interoperable communications protocol – to link roadside devices to RCCs. All new devices added to the Highways England network, since 2005, are fully IP capable and a project to enable approximately 22,000 older non-IP devices to link to RCCs over an IP connection through use of an IP Translator (IPT) is progressing well and will be completed by August 2014.

4.63 This enhanced capability will allow future systems located in any Highways England control centres to communicate with any roadside signal, message sign or MIDAS site.

Results

4.64 The use of IP enables a highly resilient, diversely routed, telecommunications network that can flex and expand to take advantage of developments in traffic management technologies and driver information provision in the future. An IP device may also be contacted remotely for maintenance purposes, reducing the need for visits to the roadside.

Cost

4.65 The NRTS contract is a 10.5 year PFI contract from Sep 2005 to March 2015 where current forecast spend over the term of the contract is £558m for provision of the NRTS telecommunications service and an additional £155m relating to provision of new call off services that support delivery of new major roads projects (smart motorways) and other regional schemes (e.g. pinch point).

4.66 The call-off services are included as part of the individual scheme business case and are paid for by individual schemes.

4.67 In the last three years spend has totalled £61.7m for 11/12, £62.1m for 12/13 and £63.1m for 13/14.

4.68 In terms of the coming five years spend this is forecast at £63.8m for 14/15 and £63.4m for 15/16. As the NRTS contract ends in March 2016 we are not yet in a position to detail future spend.

Benefits

4.69 The NRTS telecommunications service is a key strategic enabler, providing the telecommunications links between roadside devices (message signs, cameras etc) and the seven regional control centres as well as the National Traffic Information Centre.

4.70 High levels of Monthly availability ranges from 99.97% to 99.99% due to the quality and resilience of the NRTS network which allows RCC's the ability to manage and monitor the network efficiently. The NRTS service provides diverse telecommunication routes between RCCs and the roadside devices i.e. in the event of a power, equipment or cable failure telecoms service are re-routed instantly.

4.71 NRT is also a key delivery partner to smart motorway and pinch point projects delivering all telecommunications services through a single national contract which ensures speed and efficiency of delivery.

4.72 The NRTS contract uses a menu of fixed price services to allow Regional Schemes to "call off" local connections into the NRTS network. The prices remain fixed regardless of length of connection and ground conditions. This allows Scheme costs to be easily identified and removes the need for quantity surveyors and protracted claims to identify the final cost of NRTS works.

4.73 The financial benefits of NRTS are delivered through the efficiencies of operating one network and contract rather than twenty contracts and many networks. The NRTS BCR is 2.07 and remains on target.

Transport Scotland – Further CCTV Rollout

Overview

4.74 CCTV enhances the incident detection capability of the TSNCC, and helps reduce the impact of incidents on the network. The images are also a valuable resource to the public and third party information providers in planning journeys and viewing real-time network conditions.

4.75 Transport Scotland utilise both dedicated CCTV and CCTV deployed as part of weather station installations, the weather station units have improved the level of monitoring on the network particularly in more rural areas.

4.76 All CCTV images are relayed to the TSNCC via a Mosaic traffic control system, allowing multiple camera viewing at one time.

Interoperability/Compatibility/Continuity

4.77 Transport Scotland have invested in a central digital CCTV integrated platform, interconnecting existing systems

4.78 Maximising the use of existing resources with shared use of shadow tolling CCTV for operational purposes

4.79 Images are also displayed in the public online information services and shared with registered third party users via an ftp service.

Progress

4.80 There are now over 300 CCTV on the Transport Scotland network, with the most recent deployments covering:

- Fife ITS
- M9 J1a
- M8/M73/M74
- M74 Completion and
- M80 Stepps to Haggs

4.81 Transport Scotland have also deployed temporary event specific CCTV, these provide higher spatial resolution and continuous live feedback of the traffic conditions, and are used by both the event transport hub and TSNCC.

Future

4.82 Transport Scotland aims to increase monitoring capabilities and incident detection rates through further deployment of CCTV cameras on critical routes on the strategic trunk road network.

Transport Scotland – Delay Modelling Tool

Overview

4.83 The Delay Modelling Tool (DMT) supports Trunk Road roadworks scheduling and approval by predicting the delays associated with proposed works.

4.84 The DMT can utilise traffic count data from over 1,800 sites. Once the input parameters are entered, relevant traffic site data undergoes a series of algorithms and assumptions in order to provide validated and consistent traffic delays in both time and queue length.

4.85 The tool provides measured evaluation of all capacity reduction events and reduces the need for microscopic modelling for most simple roadwork. All stakeholders have access to the tool via a secure CMS, with configurable automatic notifications relayed to different user groups when a response or factoring into operational management is required.

Results

- Better modelled and scheduled roadworks helping to improved network management

- Adjusting the inputs and re-running the model allows for delay comparisons and minimisation of disruption

- Provides delay KPI outputs

- Graphical outputs to help visualise roadworks impacts

Future

4.86 The system is scalable and modular, with potential future enhancements including emissions modelling, cost modelling, special events modelling and more dynamic dataset feeds.

Transport Scotland – System Architecture Improvements

Overview

4.87 In recent years Transport Scotland has progressed to deploy a fully converged IP wide area network, replacing the proprietary Open Transport Network. This network is a resilient three tier collapsed core architecture, with the core/distribution layer connected to the access layer.

4.88 The network supports the majority of all roadside devices, including Voice Gateways, CCTV encoders, Multi-Purpose Controllers, and IP-enabled devices such as Traffic Monitoring Units, MSUs and VMS.

Interoperability/Compatibility/Continuity

4.89 In delivering this network, Transport Scotland have ensured they fulfil the Scottish Government's digital strategy - "Scotland's Digital Future", and High Level Operating Framework (HLOF). The HLOF in provides guidance to the public sector, and the industry working with the public sector, on how to design, develop and deliver future digital public services by:

- providing a set of architecture and design principles;

- promoting and supporting the use of commonly agreed standards and specifications;

- fostering an information assurance approach;

- supporting collaboration and integration; and,

- helping to eliminate duplication and avoidable spend through a focus on reuse before buy before build.

Results

4.90 The network architecture provides:

- A cost effective system operating to acceptable levels of performance and reliability;

- A modular and scalable design to facilitate expansion of the network coverage for additional road schemes and accommodate any need for higher device density on the network in future;

- Continuity in the design of a converged IP network supporting voice, video and data using a hierarchical arrangement of core nodes, distribution and access network switches.

4.91 Major recent developments and TEN-T schemes requiring expansion and modification to the IP network include:

- The Queensferry Crossing

- FRC major works - M9 J1a and the approach to the bridge and Fife ITS works along the M90 north of the bridge

- Relocation of the previous control centres (TSCC and Traffcom) to the TSNCC

- M8 completion

- Network improvements and Raith Interchange involving works on the M8, M73 and M74.

Future

4.92 A9 and AWPR schemes (on the TEN-T)

4.93 Extending the IP interface to roadside devices themselves

4.94 Adoption of new communication interfaces, such as moves to UTMC compliant roadside devices

4.95 General network expansion for traffic management and monitoring sites, such as signs and CCTV.

Northern Ireland Journey Time Measurements

Overview

4.96 DFI Roadsuse ANPR cameras to provide indications of travel time on some of the key transport corridors. Information is displayed on trafficwatchni website and roadside variable message signs.

4.97 The aim is to provide timely and credible information to enable the public make informed decisions on their time of travel, their route and mode of travel.

Interoperability/Compatibility/Continuity

4.98 Information is available to all road users for journey planning via the trafficwatchni website.

Evaluation

4.99 Some evaluation has been undertaken.

Northern Ireland Cross Boundary Information Sharing using DATEX II

Overview

4.100 DFI Roads and National Roads Authority (Republic of Ireland) share journey time data using Datex 2 to provide end to end journey times for the strategically important Belfast to Dublin road corridor.

Objective

4.101 To provide timely and credible information to enable the public make informed decisions on their time of travel, their route and mode of travel.

Interoperability/Compatibility/Continuity

4.102 Information is available to all road users for journey planning via the trafficwatch website.

Evaluation

4.103 Some Evaluation has been undertaken

Northern Ireland – Resilience and Business Continuity

Overview

4.104 DFI Roads has been considering the resilience of its traffic control and travel information services with a view to migrating to IP Protocols.

Objective

4.105 To provide greater resilience in the service being provided.

Update on Progress

4.106 Analogue lines used for the Northern Ireland UTC system have been decommissioned in 2016 and replaced with IP links resulting in revenue savings of 50%. An evaluation of the migration will be undertaken.

Welsh M4 Motorway Opti-Sense, Acoustic Network Monitoring (2012 – with ongoing improvements and enhancements)

Overview

4.107 The Welsh Government has fibre optic cables at the heart of its communication infrastructure along the M4 and A55 route corridors in South and North Wales as well as along key stretches of the strategic Welsh trunk road network.

4.108 Through the installation of specialist acoustic monitoring equipment on existing fibre optic communication networks, this project aims to evaluate Fibre Sensing Technology, focusing on three key areas:

- Incident Detection
- Traffic Flow
- Average Journey Times

4.109 Potential secondary objectives have also been identified and include:

- Security
- Copper Theft
- Asset Condition Monitoring

4.110 The acoustic monitoring equipment will monitor the network, providing alarm and notification of incidents and events as well as additional activity on the strategic motorway and trunk road network.

4.111 Acoustic monitoring is an extremely environmentally friendly way of monitoring incidents and events on the Motorways and Trunk Roads and has shown excellent results with the potential of replacing inductive loops in the future.

All Wales CCTV (All Wales Solution) (2011 - with ongoing improvements and enhancements)

Overview

4.112 Delivery of an "All Wales" CCTV System. This project forms part of a wider initiative to upgrade the existing CCTV system in Wales. There are two phases to doing this, as follows:

- **Phase 1** – To specify, procure, install and commission a new All Wales back office system for CCTV. This is to be a single back office solution for adoption across All Wales.

- **Phase 2** – To add all CCTV cameras on the Motorway and Trunk Road Network, including all security cameras at maintenance depots, to the newly installed back office system.

UTMC: sharing Open Specifications experience in Europe (Project POSSE)

Overview

4.113 UTMC is a non-profit, publicly-owned, community initiative that brings together public and private stakeholders to steer innovation and effective deployment of traffic management systems. Building on a previous DfT research programme (1997-2004), UTMC is now sustained by member subscriptions.

4.114 POSSE was an ERDF funded INTERREG IVC knowledge exchange project, in which UTMC acts (along with Germany's OCA) as a "lead knowledge exchange partner". There are 6 transfer sites from across Europe: City of Klaipeda (LT); City of Burgos (ES); City of Pisa (IT); City of La Spezia (IT); Norwegian Public Roads Administration (NO); and the Czech Transport Research Centre (CZ).

4.115 The objective of POSSE is the "Promotion of Open Specifications and Standards in Europe". The principal aim of the project is to bring UTMC and OCA experiences, both positive and negative, to other interested European cities and regions; and conversely to allow UTMC and OCA to gain an understanding of the different contexts in other cities and their Member States.

Results

4.116 The main outputs of the project were:

- POSSE (Promotion of Open Specifications and Standards in Europe), 2012-2014. POSSE was an ERDF funded INTERREG IVC knowledge exchange project, in which UTMC acts (along with Germany's OCA) as a "lead knowledge exchange partner". The POSSE project included transfer sites from across Europe: representatives of cities in CZ, ES, IT, LT, NO and UK.

- CIMEC (Cooperative ITS for Mobility in European Cities), 2015-2017. CIMEC was an H2020 coordination and support action, which created a practical Roadmap for implementing C-ITS in European cities. CIMEC involved cities from DE, ES, NO and UK.

- Finally, UTMC has contributed to European standards and regulation through participation in EC advisory groups (including for Priority Action B) and standards project teams (notably PT1701 on urban ITS).

Benefits

4.117 The delivery of cost effective and efficient network management systems is restricted across Europe due to the lack of widely used specifications based on open standards which would allow interoperability between systems and facilitate information exchange. Sharing experiences enables cities, in the context of their local policy and market environments, to:

4.118 Improve operational efficiency – the use of open standards enables such systems to be integrated through, for example, a common database. In order to achieve this, POSSE has helped cities to understand how to use open specifications and standards effectively within their policies and procurements.

4.119 Reduce cost – open specifications facilitate more effective competitive tender, including for system extensions – avoiding "vendor lock-in". This requires an active supply market to be fostered, implying a need for cities to engage with their peers at national level (or wider).

4.120 Streamline the development of new technologies – widely-supported open specifications enable suppliers to fast-track their system development, and to avoid having many variants which are costly to maintain. Through individual national workshops, national supply chains are being encouraged to address their role and opportunities.

Transport Scotland: Text to Speech App for Freight Users

Overview

4.121 The concept harnessed the latest text-to-speech technology, and recent advances in smart devices, to pro-actively deliver information to drivers without requiring them to touch or read from a screen. The technology was used to "read out" incident and VMS messages in the vicinity of users via an app.

Results

4.122 An initial demonstration of the concept was developed and then progressed to a trial in 2012 / 2013. The trial included a mobile application designed specifically for freight users and was distributed via the Transport Scotland Freight User Group. This allowed a controlled group to use the application and provide feedback. Following the successful trial the technology was rolled out on the Traffic Scotland mobile application in 2014.

4.123 Key benefits of the system were:

- Users access real-time information while on the move in a safe manner

- Location-aware feature allowing users to receive automatic alerts of events in their vicinity via audio file announcements

- Relatively low-cost solution

Future

4.124 The trial and subsequent developments have shown the potential to incorporate the technology into RTTI and SRTI traffic applications, and with the forthcoming Traffic Scotland mobile refresh this could be considered again.

Cloud based traffic management system in Portsmouth

4.125 The City of Portsmouth has installed a city-wide Bliptrack Bluetooth & Wi-Fi sensing based traffic management system. Portsmouth is located on an Island with three key roads into and out of the city. They have deployed a number of Bliptrack Bluetooth & Wi-Fi sensors at key points on the road network which feed data into a cloud based traffic management system.

4.126 Portsmouth City Council's Traffic Department can access journey time, average speed and traffic congestion information via standard web browsing technology to obtain real time information on how the city's road network is running.

Traffic Management

4.127 TM 2.0 – the next generation of traffic management systems and processes has been a topic of discussion and speculation for some time.. UK are a founding member of this programme, via Transport for London, and are strong supporters of the concepts and opportunities that should be forthcoming.

Transport for London freight route prioritisation

Overview

4.128 Providing accessible information and data for freight operators to enable pre-planning of efficient routes into and around London.

Background

4.129 TfL is acknowledged as a world leader in urban freight and has been a partner in a number of previous EU projects promoting the exchange, discussion and transfer of freight policy experience, knowledge and good practices.

4.130 TfL have the widest range of freight stakeholders of any city in the UK, including vehicle manufacturers, regulation and enforcement authorities, freight companies, business customers, local boroughs and residents groups. TfL have a long-term aim to increase the safety and efficiency of delivery and servicing activity across London and currently have a dedicated specialist team working with stakeholders to deliver the Freight Programme.

4.131 TfL cover strategy and policy development for freight; the safety and environmental performance of vehicles and drivers; increasing the efficiency of deliveries through reducing, retiming, re-routing or revising the mode of delivery; and communications and engagement activity to ensure the work TfL do is disseminated to the widest audience in the most appropriate way.

4.132 During the 2012 Olympic Games TfL provided information to freight operators to ensure delivery and servicing activity could continue to occur while many roads were closed or much busier due to Games events. This information was in the form of a Freight Journey Planner, that builds on the route approval for the overnight restriction for HGVs over 18t (the London Lorry Control Scheme – not a TfL scheme) and daily email updates of closures and incidents on the network. While 'non-technical' solutions, the uptake and continued support from freight operators has proven there is a growing market for these types of solutions.

4.133 Using TfL's experiences, TfL ensure the greatest uptake of the most appropriate ITS solutions that will deliver the widest range of outcomes: greater safety for vulnerable road users, reduced CO_2 emissions, better air quality and less

congestion, while ensuring delivery and servicing activity continues to support all of London's growing population and economy in a cost-effective manner.

Objectives

4.134 The objectives of the project are to:

- Reduce Killed and Seriously Injured numbers across London, especially vulnerable road users
- Share the limited urban highway kerbside with other road users: busses, cyclists and pedestrians
- Increase compliance with speed and kerbside regulation
- Smoother, more efficient traffic flow – less congestion
- Improved air quality
- Reduced CO2 emissions

Results

4.135 The project is ongoing. TfL are aware that providing a full journey planner is not the only solution as the critical issues for fleets is a) to pre-plan an efficient route and b) for the driver to be able to respond to issues when they are driving on the network. As a result we are developing two areas:

- Accessible data for app developers, software providers and operators to use in their planning systems. TfL is leading the way across London to ensure freight data is widely available (weight, width, height, loading bays, parking restrictions etc) and we can demonstrate to the 33 local boroughs the pan-London benefits of such accessible data.
- Pre-advice on events, roadworks and major disruptions to the road network. This is currently in the form of freight specific emails and real-time traffic feeds, although work is on-going to ensure a more automated, joined up provision.

5. European Priority Area III: ITS Road Safety and Security Applications

Transport Scotland: Incident Management Forum

Overview

5.1 Transport Scotland formed an Incident Management Forum in 2012 to maximise the potential for greater multi-agency cooperation, gain a better understanding of what happens during major incident clearance, better define the roles and responsibilities of those organisations taking part and to provide recommendations for improvement.

5.2 The forum is held annually and includes participation from Police Scotland, Traffic Scotland, Scottish Fire and Rescue Service, Scottish Ambulance Service, Road Haulage Association, Freight Transport Association, Scottish Business Resilience Centre and other partner organisations.

Results

5.3 One of the main initiatives coming from the Incident Management Forum to date has been the purchase to five 3D scanners to help Police Scotland investigate crash sites, at a cost of £250k. The technology allows them to undertake a full virtual survey of the site more quickly than using traditional manual surveying equipment.

5.4 Police Scotland provided an update this year at the forum indicating that they had used the scanners at 71 incidents across Scotland over the last year with timelines at the locus reduced and the quality of evidence available to the court enhanced by providing a virtual representation of the scene.

5.5 Another initiative trialled over the winter was the bridge wind forecasting service provided through our Met Office advisor working in our Traffic Scotland National Control Centre in South Queensferry. The aim was to make potential bridge closure timing information available to the travelling public and freight industry through the Traffic Scotland website and Twitter feed that is categorised for each vehicle type, and provides comment on the likelihood of such closures.

5.6 The forum identified last year that a further two sets of free standing incident screens should be purchased to improve incident management across the network and provide protection at more sensitive incident sites, at a cost of £70k. These screens are due to be delivered during the summer of 2017 bringing the following benefits:

- block the travelling public's view of an incident locus that is sensitive

- dignified protection/recovery of those killed/injured

- reduce the number of secondary incidents

- reduce the amount of carriageway needing to be closed for incident management purposes if the site can be contained around the incident

- screens are portable and flexible allowing quick deployment and erection

- can potentially reduce the number of resources required at an incident, and

- a safer working zone for Police Collision Investigations to be carried out.

Transport Scotland: Trunk Road Incident Support Service

Overview

5.7 The purpose of the Trunk Road Incident Support Service (TRISS) is to patrol designated strategic routes of the network to detect and respond to Incidents. The provision of the TRISS will include an Operating Company Control Room and TRISS vehicles.

Results

5.8 The service was introduced in May 2005 and has since been extended to cover Scotland's busiest trunk roads and motorways.

5.9 Eleven TRISS vehicles now pro-actively patrol Scotland's motorways and trunk roads, dealing with incidents and supporting the emergency services in clearing incidents.

5.10 TRISS is provided by various Operating Companies who manage areas of the network on behalf of Transport Scotland.

5.11 The service operates seven days a week between the morning and evening peaks. TRISS coverage includes the M8, M73, M74, A725, M80, M77, A720, A1, M9, M90, A92, A823(M) and A985.

Primary Aims:

5.12 Improve journey time reliability by managing and reducing the impact of disruption caused by incidents on motorways and trunk roads.

5.13 Improve safety and security for travellers by early identification and removal of incidents, resulting in a reduction of secondary accidents.

Objectives:

5.14 Under Police instruction, make incidents safe by deploying temporary traffic management.

5.15 Relieve congestion and remove hazards to safety by clearance of debris from traffic lanes and hard shoulders.

5.16 Where possible make repairs to damaged parts of the trunk road network.

5.17 Offer assistance to broken down vehicles including assisting in removing broken down vehicles to safe locations.

Transport Scotland: A9 Average Speed Camera Scheme

Overview

5.18 As part of a group of measures Transport Scotland have deployed an average speed camera system on the A9 between Dunblane and Inverness. This segment of the route consisting of both dual and single carriageway sections had higher than national average fatal and serious road accidents.

5.19 The system consisting of 50 camera locations overall was completed in October 2014 and was designed to support a number of other safety measures promoted by the A9 Safety Group.

5.20 The A9 Safety Group is a multi-stakeholder group established by Transport Scotland in 2012 with the remit of improving safety on the route.

5.21 A range of Key Performance Indicators were agreed and the data following the first two years of operation is demonstrating:

- Fatal and serious casualties down by almost 43%
- Incident frequency down by 38%
- Incident impact (carriageway restriction) down by 53%
- Speeding down by 95%
- Journey time reliability improved

5.22 This is part of a corridor strategy linking to the Scottish Governments plans to dual the entire length of the A9. This work will involve the deployment of additional monitoring ITS; such as CCTV and traffic detectors; and will future-proof the A9 for connected vehicles and infrastructure implementation. The total cost of the project was £2.9m

Welsh A55 Tunnel (x3) - Road Tunnel Safety Regulations (2013 – 2015)

Overview

5.23 The project is necessary to ensure that all tunnels on the A55 TERN route comply with the requirements of the Road Tunnel Safety Regulations (RTSR) and EU Directive 2004/54/EC.

5.24 The key objectives of the project are:

- To ensure compliance with the EU directive and RTSR.

5.25 Stakeholders: Welsh Government, WTTC, NMWTRA, Conwy Council.

Welsh Government Infrastructure and Security (2012 - with ongoing improvements and enhancements)

Overview

5.26   Every sizable infrastructure has issues and at some point all organisations face disruption, data loss and security breaches, therefore this project intends to identify current weaknesses, program their resolution, capture changes and focus investment on long term strategic objectives in order to build a strong, scalable and secure ITS infrastructure.

5.27   The key objectives of the project are to:

- Ensure security of the Welsh Government ITS infrastructure

- Ensure resiliency of the Welsh Government ITS infrastructure

- Improve overall value and quality of infrastructure investments

- Manage a program of identified and necessary improvement works

- Assume overall responsibility for Infrastructure Security, Resiliency and Performance - capturing information and reporting on all ITS infrastructure projects and maintenance works

- Improve sharing of information between stakeholders in order to reduce overall risk

Welsh Motorway and Trunk Road- Emergency Telephone System Upgrade (2014 – 2014)

Overview

5.28   This scheme delivers upgrades to all of the emergency telephone analogue voice gateways across Wales.

Targeted Roadside Enforcement using Weigh in Motion (WIM) and Automatic Number Plate Recognition (ANPR)

Overview

5.29   The Vehicle and Operator Services Agency (now replaced by the DVSA – Driver & Vehicle Standards Agency) has been utilising a combination of high-speed Weigh-in-Motion sensors (WiMs) and Automatic Number Plate Recognition (ANPR) cameras to catch potentially overloaded trucks and then send them to a nearby stationary weighbridge for a full inspection. The ANPR logs the number plate of the truck as it crosses the weighing sensor, and the current weight of the vehicle is checked against the vehicle's maximum weight threshold which is stored in a central database. Searches which are undertaken

simultaneously also provide information on when the vehicle was last tested, if it has valid insurance and is suitably taxed. Furthermore, such a search also relates the vehicle to the OCRS (Operator Compliance Risk Score) database which ranks operators based on their maintenance and history of compliance with legal checks. For foreign operators, given that such a database is not accessible, the axle and total weights are compared against national limits to look for an infraction.

5.30 The high-speed WIM is not accurate enough for prosecution, however, and so vehicles that are suspected of being so are intercepted by law enforcement and taken to a more accurate low-speed weigh station for a full reading.

Objectives

5.31 In order to improve the ability of VOSA to target overweight vehicles and ensure safety on Britain's roads, whilst not wasting time on vehicles which are not overweight, the system has to accurately select vehicles for testing which have a high probability of being so; which has previously proven difficult with WiMs alone.

Description

5.32 The integration of the ANPR and WiM datasets required the development of specialist software for this purpose. In particular, the information from the different datasets needed to be collated, checked against the central database and then transmitted to a VOSA officer seven miles down the road who could then instigate the stopping process, including an estimated time of arrival at the site for interception – within a matter of seconds.

5.33 This has been achieved in two different ways; through use of the Highways England fibre optic communications network and also through utilisation of 3G wireless cellular technology where fibre optic was not practical.

5.34 The system is not perfect. Whilst the WiM system identifies the weight and class of approximately 80,000 vehicles per weekday (65,000 on weekends), the ANPR system is only able to capture and pair (with their central database record) approximately 80% of these. On average there are 15,000 vehicles a week day which are HGV, Bus or Coach. Thus some vehicles remain unclassified and are not captured by the system.

5.35 This process is clouded by the requirement of the ANPR and WiMs systems having to be able to discern distinctions between very similar chassis types, in particular 2 axle rigid vehicles given the range of weight limits applied to this chassis type: (3.5T, 7.5T, 10T, 14T and 18T). Over the course of the project's installation, however, by feeding in data of actual weights of vehicles and comparing them with the weights assessed by the WiM system, the system could be calibrated to improve its effectiveness at distinguishing these different vehicles and ensuring the correct weight limit was applied.

5.36 The creation of this system relied on cooperation across government bodies and with the police. In particular:

- The Highways Authority – which enabled the infrastructure to be installed at the roadside and provided appropriate observation, stopping and checking points.

- VOSA – which operated the equipment and undertook the checks as required (and prohibited onward travel as appropriate).

- The Central Motorways Police Group which provided police support for stopping vehicles, as well as some infrastructure where necessary for observation, etc.

Results

5.37 Over 90% of all vehicles targeted by the pilot scheme since its inception have proven to be overweight, with a resultant overload prohibition order being issued. By way of contrast, the VOSA' national average is 24%, which indicates that the targeting of stoppages through pre-selection in this manner provides ample scope for better use of scarce resources.

5.38 In 2012/2013, 7,723 vehicles (both HGVs and coaches) were stopped in the UK, of which 80% were found to be overloaded. This high percentage is thought to be due to the roll out of the ANPR/WIM combination and the OCRS providing suitable targeting information. Whilst foreign-registered vehicles cannot be impounded, they can be immobilised until the overload is resolved and fines are paid. The details are then sent to the home country's regulators for their information.

Future

5.39 The scheme has since been expanded to cover more sites across the country, with the accuracy continuing to improve as a result of building on collected data.

6. European Priority Area IV: Linking the Vehicle with the Transport Infrastructure

Connected Vehicle Deployment in the UK

6.1   Many vehicles are already connected devices but, in the very near future, they will also interact directly with each other and with the road infrastructure. These Cooperative Intelligent Transport Systems (C-ITS) will allow road users and traffic managers to share and use information previously not available. This cooperative element – enabled by digital connectivity – is also expected to significantly improve road safety, traffic efficiency and comfort of driving, by helping the driver to take the right decisions and adapt to the traffic situation.

6.2   In accordance with the Commission's Strategy on C-ITS, the UK is developing a number of early C-ITS deployment schemes in order to support the harmonisation of systems and services, and to develop a local authority community.

The A2/M2 London to Dover Connected Vehicle Corridor

6.3   The A2/M2 Connected Vehicle Corridor, the national pilot for connected vehicles, has been established by the Department Of Transport in partnership with Highways England, Transport for London and Kent County Council, will pilot the infrastructure, data management and service delivery necessary for connected vehicle services.

6.4   This Corridor offers a variety of operating environments that make it attractive and unique as a pilot. Commencing in central London at Blackwall Tunnel with potential links to urban ITS applications; it provides interface between the trunk road (A2), motorway network (M2 and M2) and Kent local roads; and offers the possibility of responding to a range of freight issues, including the Port of Dover.

6.5   The Corridor will be a pathfinder for future investment and the blueprint for the wider roll-out of connectivity across the Strategic Road Network when it is fully operational in 2019. Importantly, it will provide an open test-bed where the UK motor manufacturing sector and after-market companies can develop new interactive customer services for C-ITS applications, in addition to the core traffic and safety services which are market-ready.

Action Points
○ Not Physical Location
● Physical Location

Action Lines
— Not Physical Location
— Physical Location

Action Polygons
▢ Not Physical Location
▢ Physical Location

Created using E - Submission from INEA
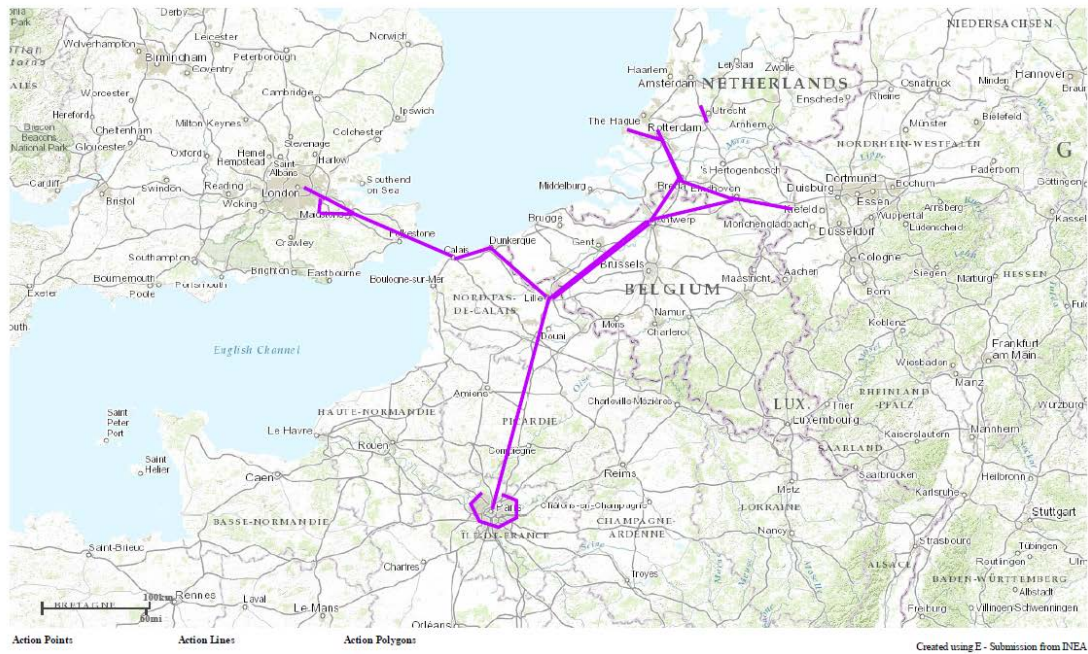
6.6 The UK recognises the need for interoperability and the need to be able to operate across boundaries. The UK is part of the Intercor ("Interconnected Corridors" – see figure above) proposal with France, Belgium and the Netherlands – to develop a network of Corridors which links in to the C-ITS Corridor (Vienna to Rotterdam) and the French projects (SCOOP@F).

6.7 The UK also signed up to the C-Roads Platform, at its launch in 2016, to link its C-ITS deployment activities, jointly develop and share technical specifications, and to verify interoperability through cross-site testing.

UK Connected Intelligent Transport Environment (CITE)

6.8 UK Connected Intelligent Transport Environment (UKCITE) is a project to create the most advanced environment for testing connected and autonomous vehicles and is a part Government funded CAV research and development project. It involves equipping over 40 miles of dual-carriageways and motorways around the Coventry area with a combination of three 'connected 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.

6.9 The project is expected to take a total of 30 months and is made up of the following consortium members: Visteon Engineering Services Limited, Jaguar Land Rover Ltd, Coventry City Council, Coventry University, Highways England Company Ltd, HORIBA MIRA, Huawei Technologies (UK) Co Ltd, Siemens PLC, Vodafone Group Services Ltd and WMG at University of Warwick.

Project aims

6.10 The project will be trialling:

- Mixed road types and speeds up to 70mph

- Functionality, Safety and Convenience

- Both DSRC 802.11p and LTE V

- Wi-Fi services on the move

- Road network efficiency and modelling

- Multipath broadcasting using multiple communications methods

- Whole journey experience - Interlink between the urban and Strategic Road Network

- Test site access. Access for vehicle manufactures and technology companies once operational
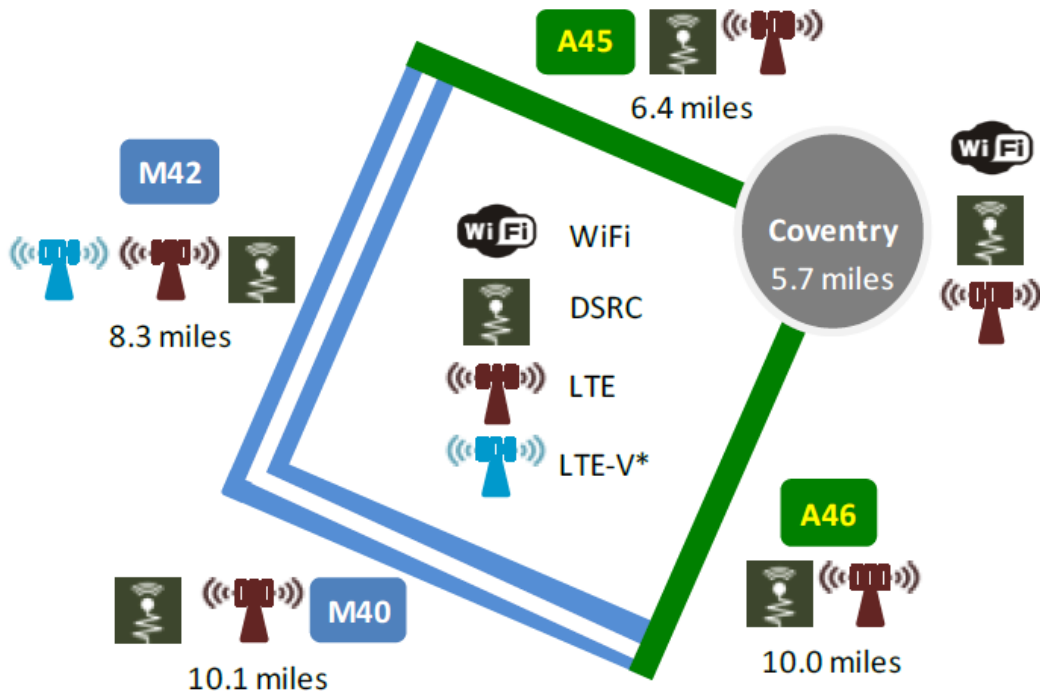
6.11 The following services will be tested:

- Roadwork Warning
- Traffic Condition Warning
- Emergency Vehicle Warning
- Emergency Electronic Brake Light

The route is anticipated to be operational and testing by May 2018.

C-ITS Smart Corridor Gosforth the Department for Transport Funded project

6.12 The Department for Transport has provided further funding to expand the original Compass 4D trials originally undertaken in the north of the city. This project extension will equip 18 junctions on Great North Road with Road Side Units and 35 ARRIVA express buses with OBUs.

6.13 The C-ITS technologies deployed will include Green Light Optimal Speed Advisory (GLOSA), Green priority and Idling support plus, additional air quality monitoring and modelling when compared to the Compass 4D project, along with upgraded RSUs, OBUs, and HMIs. There will be a greater focus on subjective evaluation of drivers' usability/ acceptance, Vulnerable Road Users (VRU) element, feasibility studies of cycle alert, disabled parking support and the implementation and subjective evaluation of Cycle Alert technology (in vehicle alert)

6.14   Newcastle City Council is also a partner in the new EU-funded CMobILE project, commencing in 2017, with other cities including Copenhagen, Barcelona and Vigo to progress deployment and trialling connected technologies while expanding the number and type of partners such as freight and taxi operators. They are also keen to investigate the potential for other VRU use cases, such as crossing aid for visually impaired on the C-ITS corridors identified within the city for future opportunities.

Middlesex C-ITS test bed

6.15   The Middlesex testbed was established, through Department for Transport funding, to study the interaction between urban and motorway traffic, vehicular safety and maintenance issues as well as to develop techniques for wide-scale deployment of C-ITS using the ETSI G5 band, such as the Day 1 and beyond services. The A41 motorway link site in London was chosen in a busy urban London environment to deploy 3 RSUs and 40 vehicle equipped OBUs with G5 capability.

6.16   Further aims and objectives of the project was to examine the key strengths and weakness of G5 communication in the light of other technologies such as LTE and G5.

6.17   The project also investigated seamless handover in the C-ITS systems, which involved providing a framework required for calculating the overlapping regions of the adjacent Road Side Units coverage range, in order to guarantee seamless handover ubiquitous connectivity.

6.18   A second test bed, also funded by the DfT is located, at Kings College London (KCL) along the Strand in Central London (see figure below). The testbed has been built and deployed to allow a large number of applications to be written and tested to understand communication needs in terms of bandwidth and latency in a highly mobile environment. The aim is to help develop standards for emerging communication technologies such as, LTEV, 5G, including other emerging technologies. The testbed is currently being used to study the diverse modes of transport such as driving, cycling, walking, the Tube or bus, etc., which will provide an integrated transport environment for the urban commuter.

6.19   Federated VANET Clouds Infrastructure between Middlesex University and KCL.

Pedestrian SCOOT (2013 – 2015)

Overview

6.20   At present, pedestrian signal facilities have no awareness of the volume of pedestrians waiting to cross, and they apply the same green man invitation to cross period regardless of the quantity of pedestrians, which can result in under or over utilised crossing times. The Pedestrian SCOOT project was instigated to see if the quantity of pedestrians can be assessed and whether SCOOT can

then automatically adjust the invitation to cross period appropriate to pedestrian demand.

Objectives

6.21 The objectives of the project are to:

- Evaluate technologies that can be used to measure pedestrian density.

- Trial pedestrian detectors at two busy London signalised junctions.

- Assess detector performance at accurately reporting pedestrian density

- Update SCOOT software to enable the green man invitation to cross period to be optimised based on inputs from Pedestrian Detectors

- Evaluate performance of the proposed solution, to ensure that it achieves the desired outcomes.

Results

6.22 Two vision based stereoscopic detectors were initially selected and trialled, and the performance assessed as appropriate for measuring pedestrian density. Green man invitation to cross periods were extended automatically and evaluated against images saved by the pedestrian detectors, which demonstrating that any extensions were valid and needed.

6.23 Two trial sites are currently under installation; these will enable a full and thorough evaluation to be undertaken and will be used to demonstrate that there is compatibility between the pedestrian SCOOT data and TfL's new IP based UTC system which share the same communications network.

7. Other ITS Activities

Autonomous Vehicle Testing and Deployment in the UK

7.1   The UK is one of the best places for car makers and others to develop and test these technologies because of our:

- permissive regulations
- thriving automotive sector
- excellent research base and innovation infrastructure
- Government activity

7.2   The Government supports the research, development, demonstration, and deployment of connected and autonomous vehicles. This includes:

- announcing the 4 cities driverless car projects to take place in Bristol, Coventry, Greenwich and Milton Keynes (see below)
- publishing the Department for Transport's (DfT) code of practice for testing driverless cars
- launching the Department for Business, Energy and Industrial Strategy (BEIS), formerly BIS, £20 million feasibility studies and collaborative research and development competition, the winners of which were announced in February 2016
- establishing the Centre for Connected and Autonomous Vehicles (CCAV) to help ensure that the UK remains a world leader in developing and testing connected and autonomous vehicles

7.3   A full list of the schemes supported and funded by the Government's programme of research, up to £200 million, is attached at Annex A. Some of the key projects include:

GATEway Project Greenwich

7.4   The GATEway (Greenwich Automated Transport Environment) is an £8 million research project, led by the Transport Research Laboratory (TRL), to understand and overcome the technical, legal and societal challenges of implementing automated vehicles in an urban environment. Taking place in the Royal Borough of Greenwich, the project aims to trial and validate a series of different use cases for CAV, including driverless shuttles and automated urban deliveries.

VENTURER

7.5   VENTURER brings together a partnership of public, private and academic experts in order to establish the South West as a world class test site facility for

CAV. VENTURER focuses on the users as well as the technology enabling CAV, in order to understand the blockers and drivers to wide scale adoption of CAV capability.

UK Autodrive

7.6 A consortium of technology and automotive businesses, local authorities and academic institutions who are working together on a major three-year UK trial of self-driving vehicle and connected car technologies. The trial includes a series of urban demonstrations on selected public roads and footpaths in the host cities of Milton Keynes and Coventry. As well as showcasing the latest technology, UK Autodrive is also investigating other important aspects of automated driving—including safety and cybersecurity, legal and insurance issues, public acceptance for CAV and the potential business models for turning automated driving systems into a widespread reality

7.7 Further projects, announced in February 2015 and the first to be funded from the government's £100 million Intelligent Mobility Fund, included:

FLOURISH

7.8 This project will help develop innovative new tools to improve the understanding of user needs and expectaCons of connected and autonomous vehicles. It will be based in the Bristol City Region and will test capabilities in both urban and suburban networked environments.

Insight

7.9 A project to develop driverless shuttles with advanced sensors and control systems and trial them in city pedestrian areas, with a particular focus on improving urban accessibility for disabled and visually-impaired people.

MOVE-UK

7.10 This project will be focused on accelerating the development, market readiness and deployment of automated driving systems

Pathway to Autonomous Commercial Vehicles

7.11 This project will develop an innovatative solution to monitor key information from the vehicle and predict safety risks based on analytics.

7.12 In April 2017, the Government also announced the winners of the second round of its connected autonomous vehicles competition, CAV2, with projects set to receive a share of up to £31 million, match funded by industry. Twenty-four projects demonstrated clear commercial value and identified technical solutions for CAV technology, including how these vehicles will work within the UK

transport system. Further successful projects from this competition round will be announced soon.

7.13 Funding was divided into 4 streams and included projects for cars and pods platooning, or going in formation, to transport passengers from Stockport train station to Manchester Airport, and to create vehicles capable of driving in a range of road environments and technology which could make any car operate autonomously.

7.14 The Government will launch its third CAV competition, CAV3, to fund further industry-led research and development projects later in the year.

The Government funded CAV testbed

7.15 The Government also launched its first competition to access funding from its £100 million investment programme supporting the creation of test facilities for connected and autonomous vehicles on 30 March 2017.

7.16 The test bed programme forms part of the Government's Industrial Strategy commitment to develop world-class CAV testing infrastructure. The programme will use some of the UK's existing CAV testing centres to create a concentrated cluster of testing facilities in the UKs automotive heartland in the West Midlands, including; Coventry, Birmingham, Milton Keynes as well as Oxford and London.

7.17 By creating a coherent national cluster, government and industry will be able to rapidly accelerate the development of CAV technology in the UK, grow intellectual capital in this field, attract overseas investment and create a national ecosystem that covers all testing requirements for CAV technology from computer program design to on road testing.

7.18 The programme, which is being match funded by industry, will take the total spend up to £200 million over 4 years and the first competition announced will allow bids for an initial share of £55 million of the test bed funding.

EU ITS Directive

7.19 The EU ITS Directive establishes a framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport. It provides legal powers to the Commission to develop specifications to make ITS interoperable across borders. The Directive is accompanied by an Action Plan setting out 24 areas for specifications (which will be legally binding) to be developed. Six of these actions are identified as priority actions in the directive itself and the key obligation on Member States will be to apply technical specifications for the following 6 priority action areas:

- The provision of EU-wide multimodal travel information services

- The provision of EU-wide real-time traffic information services

- Data and procedures for the provision, where possible, of road safety related minimum universal traffic information free of charge to users

- The harmonised provision for an interoperable EU-wide eCall

- The provision of information services for safe and secure parking places for trucks and commercial vehicles
- The provision of reservation services for safe and secure parking places for trucks and commercial vehicles

7.20 Four out of the six specifications have been formally issued by the Commission as Delegated Regulations.

7.21 The requirements in the DR apply from twelve months after the delegated regulation takes effect for new services and two years for existing services.

7.22 The Delegated Regulations for lorry parking information and the road safety related traffic information both require that Member States to set up a national access point and identify a national body to measure compliance.

National Access Point

7.23 The European Commission has been granted powers to adopt delegated acts in accordance with Article 290 of the Treaty for Functioning of the European Union. The general aim is to introduce technical specifications to implement delegated regulations to harmonise the approach to the deployment of Intelligent Transport Systems (ITS) across the European Union.

7.24 The Commission enacted the EU ITS Directive in 2010, which sets the framework for accelerating the development, deployment and interoperability of ITS across the European Member States. The Directive identified six priority actions to apply technical specifications, from which four have been adopted as delegated regulations by the Commission. These delegated regulations form key obligations on all Member States.

7.25 The delegated regulations on priority action (b), (c) and (e) require the setting up of a single national access point by October 2016. This will enable those interested in accessing the data to find it all in one place. Data owners in the public and private sector must make their data accessible via the national access point. Obligations upon data owners will differ depending on the types of data and stakeholders, i.e. road authorities, road operators, service providers.

7.26 Each national access point will offer a single window of access to the road and traffic data (and their corresponding description) of a given territory/network, which are available for re-use by any potential user, either free or in the case of data originating from the private sector, at a charge and/or under their terms and conditions. Through the discovery services any user will be able to effectively access the data and find out what data is available (in relation to a specific topic or purpose), where it is stored (and possibly who owns it), and how to use it (possible terms and conditions of re-use under specific contractual agreements).

7.27 The delegated acts mainly apply to the comprehensive trans- European road network, as well as motorways not included in the network, which in the UK includes most of the motorway network managed by Highways England, including the A299 in Kent.

7.28 The delegated acts only apply to existing/planned services, i.e. where a member state deploys any one or more of the ITS services depicted in the delegated acts. This is without prejudice to the right of each Member State to decide on its deployment of such applications and services on its territory.

7.29 Public and/or private road operators and/or service providers will be required to share and exchange the data (dynamic/static) they collect and make these data available in the DATEX II (CEN/TS 16157) format or any compatible machine-readable format via an access point.

7.30 Member States are required to designate an impartial and independent national body competent to assess whether the requirements set out in the relevant delegated regulations are fulfilled by public and private road operators and service providers and broadcasters dedicated to traffic information. The designated national bodies for compliance will report to the national authorities every year on the declarations submitted and on the results of their random inspections.

Progress

Priority Action B,C and E

7.31 The UK is ensuring compliance with this delegated regulation by making suitable provision on the existing Government data portal www.data.gov.uk , where the Highways England data in scope of the Directive is already available. Existing and new data in scope will very shortly be made available by the creation of new pages or updated tagging of existing pages, so that the Directive data is easily identifiable but no confusion is caused to the majority of potential data re-users, who may already use the site and who will be interested in the data for its re-use potential, whether it is in scope of the ITS Directive or not.

7.32 The overall objective is to take the opportunity offered by the Directive and use it to improve access to UK ITS data and promote its re-use, thereby creating improved and new services and adding value both to the data creation process and to the Directive implementation process. To this end, the Department of Transport has commissioned the Transport System Catapult to review the scope, capability and presentation of the NAP. This includes the provision of a business case for creating a national register of all transport data.

7.33 This creates an opportunity to showcase UK capability in this area particularly in the private sector. Most UK organisations creating these data are private sector contractors to the public sector or private sector companies acting in their own right. Most existing and potential re-users of the data are also private sector organisations, sometimes tech start-ups, app developers and other SMEs.

7.34 Which public and private road operators and service providers in the UK are in scope?

7.35 We have surveyed the UK ITS data sector and found that the following organisations collect data which falls within the scope of the Directive:

- Public sector: Highways England, Transport Scotland, Traffic Wales, Transport Northern Ireland

- Private sector: INRIX, TrafficMaster, Google, TomTom, HERE

Approach and methodology to discovering the data collectors in scope

7.36 ITS have been routinely used on UK roads since the early 1980s. The ITS data landscape is more fragmented than in many other Members States due to the devolved approach we take in the UK and hence there is extensive involvement of the private sector either as contractors to highways authorities or in their own right. However, by using ITS (UK), the UK's industry association for ITS, to determine which data collectors are in scope of the Directive, a comprehensive overview of who creates, processes and holds ITS data has been made possible.

7.37 ITS (UK) has used its network of Members and contacts in order to establish what relevant data exists and who owns it.

7.38 Schedule of public road operators and service providers who are in scope in the UK, which of the data categories they collect, what formats these are in, quality criteria and assessment methodology used to by their owners, frequency of updates, whether they are currently available for re-use and if so where and how.

Assessment of compliance

7.39 The Department for Transport has retained the UK Government's Vehicle Certification Agency (VCA) to assess the compliance of all the relevant organisations with the ITS Directive delegated regulations. VCA is the designated UK Vehicle Type Approval authority and with more than 30 years' experience supports industry by providing internationally recognised testing and certification for vehicles, their systems and components. A leading Management Systems Certification body, VCA also provides certification to ISO 9001, ISO TS 16949, ISO 14001,OHSAS 18001, Acorn (a phased approach to environmental certification) and ISO 50001 (Energy Management Certification).

7.40 Each data creator has to provide an annual declaration of compliance and this will be simplified by ITS (UK) providing each one of them with a partially pre-completed template which each data creator will complete in order to provide the declaration containing the required information about themselves and their data/services. The UK will also refer to approach taken by other member states for consistency.

7.41 The declaration will contain the following, and the list is not exclusive:

a) the event/categories/ real time traffic and travel information covered and geographical scope of the information service;

b) information on how they provide access to this data and its conditions of use, including how the data is accessible via the NAP;

c) the format of the accessible data;

d) the frequency of updates of the data;

e) details of quality criteria applied by the data creator/owner to the data;

f) and the means of dissemination of the information service, if any, to end users.

Immediate updating of these declarations when anything changes in the provision of data / service

7.42 Public and private road operators, service providers and broadcasters dedicated to traffic information are required under the delegated regulations to provide immediate updates to their declarations of compliance following any change in the provision of their service. We will make this clear to them and also issue periodic (six monthly) reminders. However, we will also make random spot checks in order to encourage compliance with this requirement.

Assessment and validation process

7.43 ITS (UK) will prepare technical validation files (TVF), one per data creator, detailing what data is linked to the NAP, its format, quality criteria applied, updating frequency, and the process of obtaining it. The TVF will also include the declaration of compliance from the data creator which will have been checked by ITS (UK) prior to inclusion.

7.44 The TVFs will be passed to VCA for their formal validation of the process and they will report to Department for Transport accordingly.

Quality criteria

7.45 The UK, through DfT, is actively participating in the collaborative work between Members States to agree a common set of useful quality criteria and assessment methodology for the data in scope of the Directive. We will include these in our metadata descriptions on www.data.gov.uk and other reporting once they are to hand.

Getting added value from this work (Priority Actions C and E)

7.46 DfT and ITS (UK), and the data creators themselves where appropriate, will use conferences, publications, social media and other channels available to promote the new and improved access to data in order to spread awareness and encourage the re-use of this data.

Progress on eCall – Priority Action D

7.47 The European Commission Delegated Regulation (EU) No 305/2013 of 26 November 2012, supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the harmonised provision for an interoperable eCall system set out the specifications for upgrading the Public Safety Answering Point (PSAP) infrastructure required for the proper receipt and handling of eCall.

7.48 The Delegated Regulation looked to ensure compatibility, interoperability and continuity of an eCall service, which it defined as "an in-vehicle emergency call to 112, made either automatically by means of the activation of in-vehicle sensors or manually, which carries a standardised minimum set of data and establishes an audio channel between the vehicle and the eCall PSAP via public mobile wireless communications network".

7.49 As part of the legacy of operating the longest established emergency call system in the world, the way emergency call handling works in the UK is almost unique in Europe. The UK has only one Public Safety Answering Point (PSAP), and only one number for its entire emergency call handling network, supplied and operated by BT, accessed via the national emergency call number 999 operating in tandem with the single European emergency call number, 112.

7.50 The UK's Department for Digital, Culture, Media and Sport (DCMS), which oversees the electronic communications sector in the UK formalised an industry and emergency authority (EA)-wide agreement that BT should operate as eCall PSAP by formally designating BT as such in December 2016.

Extending the obligation to carry eCall to Communications Providers (CP)

7.51 Ofcom's Digital Communication Review (DCR) in 2015 aimed to make sure digital communications markets continued to work for consumers and businesses. After publication of its initial conclusions in February 2016, Ofcom, the UK's independent national regulatory authority (NRA) consulted on changes to the General Conditions of Entitlement (GCE). GCEs are the rules that govern how communication providers must operate under the UK's General Authorisation licensing arrangements.

7.52 As part of that review Ofcom consulted on whether GC 4 "Emergency Call Handling" was sufficient and appropriate for extending the obligation on communications providers - and specifically Mobile Network Operators (MNOs) - to carry eCall. Ofcom concluded that eCall could and should be included under the emergency call handling provisions of the GCEs.

Working with the electronic communications and vehicle industries

7.53 Ofcom established an eCall Implementation Working Group which met for the first time pn 28th September 2016. It gathered representatives from government departments, telecommunications providers, including BT and others to set out a joint work plan to deliver eCall implementation. Technical working and commercial sub-groups reported into the implementation group. A separate subgroup met with the automotive industry through representatives of the Society of Motor Manufacturers and Trader (SMMT), the industry's trade association.

Enhancing the national PSAP

7.54 Separately BT carried out its own feasibility study to develop the business case that allowed the costs to be understood for its national PSAP to be extended to support eCall's technical requirements. Technical workshops with the mobile

networks began in November 2016, and discussions on cost recovery in the summer of 2017. In view of BT's PSAP infrastructure undergoing a full renewal by late 2019, it was agreed by the eCall Implementation Working Group that a tactical solution was reasonable to be deployed on current infrastructure to meet key requirements of eCall.

7.55 BT operating systems at two of their PSAP's six national call handling centres in Glasgow and Portadown can already support eCall testing and are ready for the live handling of any eCalls received after 31 March. The Minimum Data Set (MSD) transmitted by in-vehicle eCall devices can be received and translated into data that is passed on to Emergency Authorities via the existing Enhanced Information Service for Emergency Calls (EISEC) system.

7.56 DCMS will be discussing with BT how to progress through the PSAP auditing process.

Engaging with the MNOs

7.57 The four UK national mobile network operators (MNOs) were instrumental in implementing eCall too. While, at the outset, MNOs were at different stages of eCall readiness for technology or operational reasons, they were all able to introduce the necessary features prior to 1 October 2017to handle the 'eCall discriminator' in their networks.

7.58 BT developed an eCall test facility at its PSAP test centre at Adastral Park which it made available to both communications providers and the automotive industry to allow end-to-end testing of eCall systems and participation in eCall TestFest events organised by ETSI.

7.59 The Code of Practice for the Public Emergency Call Service between Communications Providers and the Emergency Services" ("the PECS Code") has been augmented with guidance and procedures for eCall. These allow management of the relationship between EAs, CPs and specifically in the case of industry, vehicle manufacturers, their suppliers and dealerships. The 999/112 Liaison Committee, a cross-industry body consisting of members of EAs, UK PSAP, relevant government departments and Ofcom maintains the PECS Code and makes sure it keeps up to date as a result of changes in best practice, technology or procedures.

7.60 Under the auspices of the 999/112 Liaison Committee, whose remit is to oversee the effectiveness of the operational interface between members of the public and the PSAP, BT has issued guidance to all EAs on handling eCall.

Final preparations for eCall "go live"

7.61 The extensive testing regime has identified some technical implementation issues. BT and Ofcom have engaged with counterparts in Europe to identify common issues and solutions found during eCall implementation. For example, it was found that the incorrect functioning of some mobile phone handsets generated eCalls due to the incorrect use of the eCall identifier in call signalling. The technical solution for this, common across Europe, has now been adopted by all four UK MNOs.

7.62 eCall capability is now established in the UK PSAP, in line with all the requirements of Article 3 of the Delegated Regulation No 305/2013. All network operators have the capacity and capability of receiving and carrying eCalls. Vehicle manufacturers are incorporating eCall equipment into new type vehicles, and a process by which these can be tested in both a test and live environment has been established. Statistics regarding eCall volumes and performance are being collected by the PSAP for review by the 999/112 Liaison Committee.

TN- ITS

7.63 The UK is a founding member of TN-ITS, which seeks to extend the Transport Network specification from the INSPIRE Directive to make it compatible with the useful for reference to the ITS Directive requirements around priority actions (b) and (c) and potentially action (a).

7.64 There are a number of work packages around specifications, tools and governance and the UK chair the working group 5 around communications and governance of the programme. Although not in direct scope of the TN-ITS programme it is sensible to ensure that any recommendations are in the right direction of travel towards connected, co-operative and autonomous vehicles.

7.65 It is also important that obligations already in place for the INSPIRE Directive are recognised and built upon to avoid duplication or divergence of effort and increased burdens on member states and other stakeholders.

TN-ITS implementation in England as part of CEF funded project

7.66 In February 2015, the UK Department of Transport (DfT) launched the Highways Network Project with the aim to create an accurate view of the entire road network. The £3 million mapping project is an important step towards TN-ITS implementation that will play an invaluable role in transforming road improvements and maintenance as well as in determining policy and legislation.

7.67 For the first time ever, the Highways Network Project brings together intelligence from two main sources of spatial road data in the UK: the Integrated Transportation Network (ITN) and the National Street Gazetteer (NSG). The combined road database is supplemented by other information available to the government to create a common authoritative road network database.

7.68 ITN, which is managed by Great Britain's national mapping agency Ordnance Survey, is the primary source for geographic information. Collected by one organisation using a single standard, the highly accurate information comprises two themes: Roads Network and Road Routing Information. Link-and-node structures with unique identifiers are mapped extensively. The data, which is published every six weeks, covers the whole of Great Britain.

7.69 NSG, managed by GeoPlace, collects street information from 174 Local Highway Authorities, Highways England and the Welsh government. It is the definitive source of street information with data sourced directly from Local Authorities, who are legally required to update their records. The information is

published monthly, exclusively to organisations with a statutory duty to coordinate street works activities. NSG coverage extends to England and Wales.

7.70 A highly accurate representation of the road network is crucial for the DfT to manage policies, produce statistics, allocate funding, support legislation and fulfil EU commitments. EU ITS Directive delegated regulations mainly apply to the Trans European Road Network (TERN) part of the TENT (Trans-European Transport Network). Approximately 68% of the entire motorway network in Great Britain is classified as TENT.

7.71 The new digital road map created by the cooperation between OS and GeoPlace is now part of the Public Sector Mapping Agreement (PSMA), which is a collective agreement between OS and the government allowing all areas of the public sector to access and share the data. The private sector may also be involved in the future as the project expands towards full TN-ITS implementation.

7.72 The intention is that the digitised data will be made available to map makers in TN-ITS format, which will embed all changes and information from Traffic Regulation Orders (TRO) placed by highway authorities. The UK recognisesgreat value in the digitisation and updates for the future of Connected and Autonomous Driving. A proof of concept demonstrating the value is currently being implemented in cities of Hull and Nottingham as part of the CEF programme.

EU ITS Directive- Delegated regulation requirements

Safety Related Traffic Information

Safe and Secure Truck Parking

Real time Traffic and Travel Information

Public/Private sector service provider

Data/Information broker (ITS (UK))

Independent Assessment of Compliance (VCA)

The Department for Transport

National Information Gateway

http://data.gov.uk/

European Commission Reporting

National/European Service Provider

VMS

RDS-TMC

Apps

Satnav

Web Portal

C-ITS

TN-ITS

Other

8. Glossary of Terms

AMI	–	Advanced Motorway Indicators
ANPR	–	Automatic Number Plate Recognition
APIs	–	Application Programming Interfaces
BCR	–	Benefits to Cost Ratio
CEN	_	European Committee for Standardisation
CENELEC	_	European Committee for Electrotechnical Standardisation
COBS	–	Control Office Base System
COMET	–	Siemens Advanced Traffic Management and Information System
DfT	–	Department for Transport
ETSI	_	European Telecommunications Standards Institute
ELGIN	_	Electronic Local Government Information (Website)
Euro NCAP	_	European New Car Assessment Programme
GPRS	_	General Pocket Radio Service
HE	–	Highways England
HGV	–	Heavy Goods Vehicles
HSR	–	Hard Shoulder Running
HTTP	_	Hypertext Transfer Protocol
IAM	–	Institute of Advanced Motorists
ICC	–	Interim Control Centre
ICT	–	Information and Communication Technology
IEC	_	International Electrotechnical Commission
IFOPT	–	Identification of Fixed Objects in Passenger Transport
IoP	–	ITSO on Prestige
IP	–	Internet Protocol
ISA	–	Intelligent Speed Adaptation
ISO	_	International Organisation for Standardisation
ITMC	–	Integrated Transport Management Centre
ITS	–	Intelligent Transport Systems
ITSO	_	Integrated Transport Smartcard Organisation

ITU	_	International Telecommunications Union
IVDR	–	In-Vehicle Data Recorders
IVIS	–	In-Vehicle Information System
MIDAS	–	Motorway Incident Detection and Automated Signalling
MS	–	Member States
NADICS	–	National Driver Information and Control System
NaPTAN	_	National Public Transport Access Node

Annex 1 - Current and Recent UK Connected and Autonomous Vehicle Projects Funded the Mobility Funds

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
UK Autodrive	DC01	ARUP	A twin-city programme in which Milton Keynes and the City of Coventry will work together with the UK's motor industry to help establish the UK as a global hub for the development of autonomous systems technologies and the integration of driverless vehicles into society. The programme will deliver two field-based demonstration projects (several road-going cars and a novel Low-Speed Autonomous Transport System), plus a series of feasibility studies and technical/social/economic papers which address the introduction of driverless vehicles and the attendant challenges.	Milton Keynes Council, Coventry City Council, Jaguar Land Rover, Tata, RDM, Ford Motor Company, MIRA Thales, Transport Systems Catapult, Oxbotica, AXA Insurance Limited, Wragge-Lawrence-Graham, University of Oxford, University of Cambridge, Open University
Gateway	DC01	TRL	Will create interoperable, scalable testing environments, protocols and standards guidance. Testing will include automated electric shuttle vehicles, M1 vehicles, a demonstration of tele operated driving and a simulated 3D model of the Greenwich peninsula. The project focus is understanding engagement and interaction with automated vehicles, their local, national and international implications, effectively disseminating the results and providing routes to exploitation.	The Royal College of Art, University of Greenwich, Royal Borough of Greenwich, Phoenix Wings, Telefonica UK, Royal Sun Alliance, Shell Global Solutions (UK), Commonplace, Gobotix
Venturer	DC01	Atkins Limited	Assess the responses of passengers, other road users and pedestrians to driverless cars in a series of increasingly complex scenarios; and derive requirements for their acceptance by the public. Road trials of a driverless car and	BAE Systems (Operations) Ltd, Williams Grand Prix Engineering Ltd. Fusion Processing Ltd, First Bristol Ltd, AXA Insurance Limited,

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			a Pathfinder pod in Bristol city centre. VENTURER will investigate attitudes to a bus equipped with innovative sensing technology and will also establish a realistic simulation environment of the same roads used in trials as a test bed for own and other's driverless car technologies, and for public acceptance studies.	University of West England, University of Bristol, Bristol City Council, South Gloucestershire Council
UK Connected Intelligent Transport Environment (UK CITE)	CAV1	Visteon Engineering Services Limited	This seeks to create a real-world-lab for companies to test how connected and autonomous vehicles (CAV) can interact with communications infrastructure. The project will install the relevant infrastructure along sections of the M42, M40, A45, A46 and Coventry city centre. CAV test vehicles will examine the impact of V2X on road safety, traffic flow and its ability to provide services like WiFi. This test environment will be available to other vehicle manufacturers or fleet users who wish to test V2X technologies.	Siemens, Horiba MIRA, JLR, Coventry City Council, Vodafone, Huawei, Coventry University, Warwick Manufacturing Group, Highways England
FLOURISH	CAV1	Atkins Limited	The project will enable delivery of CAV related benefits by helping to ensure that connected and autonomous vehicle are developed with the user in mind and are technically secure, trustworthy and private. Using older people and others with assisted living needs as an exemplar to develop an understanding of the diverse needs of a particular user group, FLOURISH will develop innovative products, processes and services that are directly transferrable to the wider community. FLOURISH will expand existing physical and virtual vehicle test capability and help deliver up to 10,000 jobs through the establishment of the Bristol City-	Age UK, Airbus, Aiseedo, AXA, Bristol City Council, Bristol Robotics Lab, Designability, Imtech, OPM, South Gloucestershire Council, Transport Systems Catapult, Transport Simulation Systems Ltd, University of Bristol, University of the West of England

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			Region as a world class independent test facility for connected and autonomous vehicles.	
INSIGHT	CAV1	Westfield Sportscars Limited	INSIGHT is a collaborative project to develop existing autonomous vehicles for safe, slow speed operation on pedestrian areas and pavements, with CONNECTIVITY not only to control and manage the vehicles, but ALSO for innovative data collection and presentation applications that INTERACT with users and other customers of the systems. The project will develop connected autonomous shuttles including sensors and control systems, trial them in city pedestrian areas, evaluate their use by mobility impaired people, develop & test vehicle interfaces for vision impaired people and demonstrate innovative applications for data collected from low speed urban shuttles	Heathrow Enterprises, Fusion Processing, Conigital, Creative Example, Birmingham City University, Birmingham City Council, Communication for Blind and Disabled People Ltd
MOVE-UK: accelerating automated driving by connected validation & big data analysis	CAV1	Robert Bosch Limited	The project will speed up the entry of automated, driverless car technologies to the motor market by allowing these technologies to be developed and tested more rapidly and at lower cost to manufacturers. Driverless systems will be tested in the real world, providing large amounts of data which will be fed into a unique data store. This data store will allow us to develop new, faster ways of improving and demonstrating the safety of the automated driving systems. The information will also be used to provide "smart cities" with new ways to improve services for residents and the environment; to help understand how data from cars can be used in the future to benefit drivers; and, to help the project	JLR, TRL, Direct Line, The Flow, Royal Borough of Greenwich

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			partners to understand the how driverless technologies will change their businesses in the future.	
Pathway to Autonomous Commercial Vehicles	CAV1	Tructyre Fleet Management Ltd	Tyres have a significant impact on vehicle safety, fuel consumption and CO2 emissions. Damaged tyres can cost fleet operators tens of thousands of pounds in repair costs, wasted fuel and fines from late deliveries. This project will develop a cloud based software model for a tyre data monitoring system on commercial vehicles, trailers and PSV's that will offer accurate predictions of tyre and mechanical issues by using real time data from the installed hardware. Tyre data from each vehicle will be linked with satellite communications and intelligent decision making to provide drivers, fleet managers, and tyre service providers with a real time system to prevent unnecessary downtime, such as roadside breakdowns and improve efficiencies in vehicle and tyre management. Tructyre will work with partners to develop predictive software with an automated data exchange capability between vehicle, fleet operator and tyre service provider.	RL Automotive, University of Portsmouth, Satellite Application Catapult

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
i-MOTORS - Intelligent Mobility for Future Cities Transport Systems	CAV1	Control F1	i-MOTORS will see the development of a vehicular cloud computing platform that fuses data from road vehicles with ancillary information relating to the road environment. The product will include dynamic maps that are transmitted back to vehicles to aid drivers and near real-time alerts which can be used to improve the management of the road network. The maps and alerts will also underpin an intelligent traffic management dashboard that will be available to stakeholders in traffic monitoring and management to aid in planning, reducing congestion and improving traffic flows. i-MOTORS recognises the difficulties in accurately positioning vehicles, therefore a novel concept of ubiquitous positioning through the integration of multiple sensors (GNSS, IMU, vision, LiDAR) through the development of an innovative Beyond Line of Sight device will allow precise and accurate positioning in wireless and mobile denied areas	Info hub, University of Nottingham, Head Communications, Huduma Ltd
INnovative Testing of Autonomous Control Techniques (INTACT)	CAV1	Richmond Design and Marketing Ltd.	Autonomous Control Systems of Driverless pods will require extensive testing and validation if they are to engender trust and be safe, security and robust. Reducing the cost of and optimising ACS is also essential in facilitating the large scale manufacture and sale of commercially viable Pods in the near term. However testing on public roads and in real-world driving situations can be very expensive, unrepeatable and potentially dangerous. Hence this project proposes the use of a novel simulator concept to enable the evaluation of an optimised ACS in a safe, repeatable and rigorous environment.	University of Warwick

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
Tools for autonomous logistics operations and management	CAV1	Immense Simulations Ltd	There is no fleet management solution capable of optimising large CAV deployments. In adjacent markets, optimisation delivers approximately 7.2% cost savings. If CAV deployment reaches the levels predicted this would result in a market valued at £396m in the UK alone. This project is a collaboration between leading transport modellers and a highly innovative games company that delivers scalable modelling infrastructure to a multi-billion pound industry. This translational innovation project will deliver a fleet management solution that not only captures this market but also improves the return on investment into CAV fleets significantly.	Improbable Ltd
Enabling Affordable Autonomy Using Hybrid Dense Vision	CAV1	Oxbotica Ltd	This proposal seeks to induce a step change reduction for AV sensors. Leveraging new Oxbotica IP in dense methods, we can produce high-rate, high-accuracy 3D data from a stereo camera coupled with a low-cost, low-resolution lidar. The project focuses on the feasibility of reducing sensor costs by dialling down lidar resolution requirements whilst increasing the complexity and processing power budget of our High Density Vision approach to find an optimum balance that yields improved performance at much reduced cost. The main objective of this project is to stretch the performance envelope of our High Density Vision (HDV) approach and evaluate it against	No other

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			alternative, laser-based localisation and detection strategies across a wide range of environmental and traffic-related scenarios. We plan to build a road-going concept demonstrator and collect and analyse data from thousands of miles of driving in several different vehicle types in varied environmental conditions.	
Efficient Computer Vision ADAS Hardware for Connected and Autonomous Vehicles	CAV1	Myrtle Software Limited	We propose a feasibility study into improving the time-to-market and efficiency of advanced driver assist (ADAS) hardware. The study will test whether original real time compiler technology can be used in a hardware environment to bring a step-change improvement to the process of ADAS hardware development. A successful study will see more advanced computer vision algorithms appearing in cars earlier, making them safer, and give the UK a clear competitive advantage, in the form of defensible IP, in this critical area of the autonomous car industry.	No other
A feasibility study into the use of radar technology for environment mapping on autonomous vehicles	CAV1	Navtech Radar Ltd.	A feasibility study into the use of radar technology for environment mapping on autonomous vehicles: The project seeks to understand feasibility of producing a scanning radar to be used in an environment mapping system developed by the University of Oxford's Mobile Robotics Group (MRG). Current mapping systems for autonomous vehicles use lidar technology, and this is the first time radar will be used in this application. The radar must have a very narrow beam width of just 0.5° and an elevation beam width of 90°, in order to collect small "slices" of the environment and build an accurate map based on this. Using traditional	No other

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			radar techniques to meet these specifications has resulted in a radar sensor far too large and bulky to be commercially viable. Navtech will utilise novel radar techniques in order to meet the specified requirements using a much smaller antenna.	
Atlas	CAV1	Ordnance Survey	Identify navigation and mapping requirements for Autonomous Vehicles to operate reliably and safely anytime, anywhere. Connectivity is essential to enable vehicles to operate appropriately within a context influenced by factors beyond the detection of on board sensors. Current solutions place greater emphasis on on-board sensor processing and matching versus comparisons between GNSS positioning and a geospatial framework. Scaling to anytime, anywhere operations requires a combination of on-board databases and connectivity to stream reference data on/off the system. Atlas will define: the data requirements (positioning, mapping); the balance of communication and processing demands; various scenarios (loss of sensors/coverage, unavailable data, cyber-attack); and close the data loop by addressing V2X communications needs in order to deliver a commercial autonomous vehicle mapping service together with sensor augmentation services.	Satellite Applications Catapult, GOBOTiX Ltd, Oxford Technical Solutions Ltd, Transport Research Laboratory, Royal Borough of Greenwich, Sony Europe Ltd
Virtual validation Environment for Driver	CAV1	AVL POWERTRAIN UK LTD	ADAS features are becoming increasingly complex, with greater influence to the vehicle control task. Thus, ensuring robust performance in all foreseeable use cases is becoming more challenging, detrimentally affecting the	No other

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
Assistance Systems (VEDAS)			resource and cost associated with validation. This project will assist in determining the feasibility of an advanced Vehicle-in-the-Loop validation environment by researching and developing a number of key building blocks needed in order to realise the benefits of such an environment. Specifically, an improved systems engineering approach will be developed. This will include elements such as automated and linked methods to generate validation plans from a requirements document, to implement into a virtual environment, and to determine the results of those tests. A virtual calibration process will also be investigated. Success in this project is expected to lead into the implementation and development of the validation environment itself, which is intended to be developed as part of a wider ADAS development collaborative project.	
Driver experience based learning system for autonomous cars	CAV1	The Floow Limited	The sensor and recording mechanism utilised in telematics insurance systems record driving data to analyse behaviour and risk according to individual mobility and external risk factors. This project will investigate whether such data, following anonymisation could also be used to inform automated driving algorithms in autonomous cars; i.e. by influencing automated behaviour when considering mass behaviour of other vehicles. It will also investigate the use of mass manual driver data to: 1) improve AV decision making capabilities and facilitate validation means of autonomous vehicle modelling and testing. This project is especially important for mixed transition environments (i.e. containing a mixture of autonomous and manual driving	The University of Sheffield, Tata Motors European Technical Centre PLC , Direct Line Group Limited

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			vehicles) to provide understanding of how autonomous vehicles 'fit-in' based upon normalised road and driver behaviour in order to both minimise and quantify risk.	
Connected Car Data - Creating new business models	CAV1	Thingful Limited	This project assesses the feasibility of real-time vehicle data sharing within a decentralised system of data producers and consumers, making use of data from the connected car. It will demonstrate a system for making vehicle data accessible to a variety of third parties through an IoT system that mediates access via a decentralised and trustless transaction management system, with drivers' explicit consent and incentivisation. This feasibility work will demonstrate that creating a vehicle data service for automotive aftermarket channels, app developers and other parties (that are affected by or have a direct interest in the automotive value chain) accelerates value creation in the industry and will show how a technology like Thingful enables and supports it	No other
Optimised Vehicle Autonomy for Ride and Emissions	CAV1	Emissions Analytics Ltd	This project aims to demonstrate the concept of optimising the driving style of autonomous vehicles (AVs) for passenger ride comfort, vehicle emissions and fuel consumption, and journey time. The results of this project will evaluate the impacts of customers interacting with AVs to specify a driving style to suit their requirements (e.g. minimise travel time, or maximise comfort) on AV fuel consumption and emissions and on traffic at the network level using simulation methods. New measurements of ride comfort and emissions will be used to develop models that	Imperial College London

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			can be used in further simulations of passenger-AV interactions. As part of this project, a ride comfort sensor will be developed to independently measure vibrations so that standard ride comfort metrics can be calculated. The ride quality sensor developed in this project will also be used to detect road degradation for highways maintenance.	
PAVE: People in Autonomous Vehicles in Urban Environments: Culham City	CAV1	RACE, UKAEA	PAVE will establish the feasibility of using the UKAEA's 200 acre fenced site at Culham as a CAV test sites called "Culham City". The fenced site, which hosts RACE, the UKAEA's robotics centre, has 10km of roads and 2000 working adults and will focus on intelligent mobility for urban environments. This FS addresses three questions: 1. What long-term test environments are needed in the UK for the UK to be at the forefront of CAV? 2. What gaps would Culham City fill in today's landscape? 3. Can Culham City become the corner stone of a 'smart' Culham Science Village integrating CAV into a real community?	Oxbotica Ltd, Amey Consulting Limited, Siemens plc, Westbourne Communications)
Road Accident 3D Reconstruction	CAV1	Roke Manor Research Ltd	Road Accident 3D Reconstruction: The objective is to advance dashcams with a novel data logging capability that reconstructs the 3D vehicle trajectory during a road accident, without using information from global positioning systems or any on-board vehicle instrumentation or control systems. The innovation will use dashcam technology combined with real-time image processing algorithms to strap-down a microelectromechanical system (MEMS) based inertial measurement unit (IMU). The combination of the advanced dash cam and unique analysis software will	No other

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			allow the calculation of 6 degrees-of-freedom position and orientation information, with accuracy similar to Differential-GPS (less than 0.5m), for a distance travelled of up to 2km and for any speed vehicle due to sampling rates up to a 400Hz, to record both the build-up and moment of a road accident.	
Pinpoint: Simple, low-cost, compact and precise localisation for highly autonomous vehicles	CAV1	Machines with Vision Limited	Highly autonomous vehicles need to know their location relative to the road but GPS is not accurate enough. Autonomous vehicles being developed and tested today use rich 3D maps of the environment to determine the vehicle position to within a centimetre or so but the technology is very expensive, bulky and power hungry. This project will measure the fine 3D geometry of a small patch of road surface below the vehicle and use this as a 'fingerprint' to uniquely determine the vehicle's location. It will introduce a novel laser scanner that can capture the road surface with enough detail to do this at vehicle speeds using a special type of camera known as a 'dynamic vision sensor' that can react 1000's of times faster than conventional cameras. The result is a novel localisation system that is cheaper, simpler, more compact and more precise than the current state-of-the-art. In this project we plan to build a prototype of the sensor, demonstrate the ability to localise a vehicle and develop the commercial value proposition and route to market.	No other

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
Autonomous Motorcycle Platform Feasibility	CAV1	AutoRD Limited	The project will develop and demonstrate the technical feasibility of an autonomous motorcycle platform combining innovative architectural features and an advanced control strategy. It aims to develop a prototype control system capable of stabilizing and controlling the trajectory of a motorcycle, use parametric simulation studies to inform platform design and construct an engineering demonstrator to demonstrate and evaluate the technical solution.	Empire Racing Cars, Imperial College London
A Low Cost Hardware and Software Platform for Situational Awareness of Autonomous Vehicles	CAV1	AptCore Limited	This project will assess the feasibility of providing a low cost hardware and software platform for provision of collision avoidance and situational awareness capability to autonomous vehicles. The system envisaged will comprise of a set of licensable hardware designs together with the necessary software applications and developer configuration tools, to enable non-experts to implement and configure a system suitable for their pod or other autonomous vehicle. This will greatly lower the barrier to entry into the autonomous vehicle market, bringing the benefits of increased competition and lower price	No other
HumanDrive	CAV2	Nissan Motor Manufacturing UK Limited	The project will develop a highly automated connected and autonomous vehicle with human like natural control and decision making developed using machine learning. Testing will be carried out physically on the Cranfield University MUEAVI test facility, and in a test programme on the public roads featuring rural, inter-urban and motorway driving.	Hitachi Europe Ltd, Secured by Design Ltd, Transport Simulation Systems Ltd, Cranfield University, University of Leeds, Transport Systems Catapult, Horiba MIRA, Atkins Ltd

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
StreetWise	CAV2	FIVE AI LIMITED	This project will develop and demonstrate the technology, safety, insurance and service models for delivering a highly automated mobility-as-a-service (MaaS) solution targeted at replacing the commuter car.	Arriva plc, Mclaren Applied Technologies, Transport Research Laboratory, Direct Line Group, Torr Vision Group - University of Oxford, Transport for London
DRIVEN: Insuring, Ensuring and Exporting Fleet Wide Level 4 Connected Autonomy	CAV2	Oxbotica Limited	The Project aims to remove fundamental barriers to real-world commercial deployment of autonomous vehicles, by addressing the need for real-time risk assessment frameworks to authorise engagement of Level 4 autonomous driving sessions and provide pro-active connected insurance. This integration of risk and dynamic authorisation into a L4 autonomous vehicle control system is transformative, underpinned by distributed data sharing, learning and connected real-time risk management to optimise overall autonomous fleet safety and operation. To realise these developments, Oxbotica, a market leader in the deployment of real-world autonomy solutions in the UK, will lead a consortium including Oxford Robotics Institute, XL Catlin, Nominet, Telefonica, Transport Research Laboratory, RACE, Oxfordshire County Council and Westbourne Communications. The ambitious trials programme culminates in 6 co-operative L4 CAVs performing mixed urban and motorway driving routes in a live-traffic environment between Oxford and London. DRIVEN demonstrates autonomy as a viable service, unlocking new service models that enable widespread autonomy for UK plc and accelerate market implementation in UK and globally.	University of Oxford - ORI, XL Catlin Services SE, Telefonica UK ltd (trading as O2), TRL ltd, RACE (UK Atomic Energy Authority), Oxfordshire County Council, Transport for London, Westbourne Comms company ltd, Nominet UK,

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
ROBOPILOT	CAV2	Charge Automotive Ltd	The project will develop & demonstrate autonomous driving functionality for our recently announced electric local delivery van. It brings advanced autonomous racing technology to the traditionally conservative light commercial vehicles market	UPS UK ltd, Thales eSecurity ltd, Loughborough University, Bristol Robotics Lab, South Gloucestershire council, Test and Verification Solutions ltd, AXA UK ltd.
5*StarS: Automotive Cyber Security through Assurance	CAV2	HORIBA MIRA Ltd	This project will deliver an innovative assurance methodology to assure that connected & autonomous vehicle (CAV) components, systems & vehicles have been designed for security & tested to the relevant cyber security standards throughout their whole development lifecycle.	Ricardo UK ltd, Axillium Consulting ltd, Thatcham Research, Roke Manor Research ltd
Smart ADAS Verification and Validation Methodology (SAVVY)	CAV2	AVL Powertrain UK Ltd	This project will deliver a novel, efficient and accelerated simulation and simulator based V&V process for ADAS technologies. This project will create the building blocks for the V&V of future technologies based on Field Programmable Gate Array (FPGA) using deep learning and Convolutional Neural Network (CNN) algorithms	Vertizen ltd, Myrtle Software ltd, University of Warwick, Horiba Mira
Multi-Car Collision Avoidance	CAV2	IDIADA Automotive Technology UK Ltd	1) Development of a novel level 4 collision avoidance system in which neighbouring cars cooperate. 2) For immediate real-world benefit, to also anticipate and avoid the trajectories of nearby non-equipped cars, accounting for their likely human driver behaviour and physical vehicle dynamics. 3) Develop test environments for automated vehicle systems both virtually (in simulation) and at vehicle level (on a test track) for comprehensive validation and live demonstration. 4) Identification of key V2V cyber-security requirements relevant for the MuCCA cooperative function.	Cranfield University, Cosworth Electronic ltd, Secured by Design ltd, Transport Systems Catapult, Westfield Sports cars ltd.

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			5) Innovate means to correlate identity of V2V respondents with vehicles "seen" by other sensors. 6) Development of data-logging tools that can be used in "replay" to refine control strategies.	
Self-organising Wide area Autonomous vehicle Real time Marshalling (SWARM)	CAV2	Richmond Design and Marketing Ltd.	The ultimate aim of the SWARM project is to deliver a real-world trial in the urban pedestrian environment of Milton Keynes, with a 10 Pod fleet, swarming collaboratively with minimal external supervision from infrastructure cameras or human operators.	University of Warwick
CAPRI	CAV2	AECOM	The CAPRI project will design & deliver a complete, market ready, mobility service deployable in urban scenarios on public roads and working with traffic signals using trusted secure PODs and systems supported with legal, regulatory, insurance recommendations for operation. The project will culminate in a series of trial deployments which systematically work towards demonstration of increasingly complex POD-based mobility services.	Westfield Sports cars ltd, University of Warwick, Fusion Processing ltd, Nexor, University of Bristol BRI V&V, Test and Verification Solutions ltd, Loughborough University, ESP Group ltd, Transport Simulation Systems ltd, University of West of England, Dynniq ltd, Cognital ltd, Thingful ltd, YTL Property holdings ltd, South Gloucestershire council, Heathrow Enterprises, AXA ltd.
Project Synergy	CAV2	Westfield Sports Cars Limited	This project will introduce innovative technologies to operate connected autonomous cars in a platoon formation from Stockport directly to the arrivals terminal at Manchester Airport. Concurrently, a platoon of three pods will transit passengers to and from a car park in the airport	Heathrow Enterprise. Manchester City Council, Stockport Metropolitan Borough council, Fusion Processing, Transport for Greater Manchester, Cognital ltd, Cisco International ltd,

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			to the passenger terminals. Project Synergy will facilitate inclusive accessible transport for the aged and the visually impaired.	Manchester Metropolitan University, Harper Adams University.
Connected Fully Integrated Driver Ecosystem (Con-FIDE)	CAV2	Ashwoods Lightfoot Ltd	This project will produce a disruptive connected-vehicle technology that can make ANY car a connected car; old or new. It will be the ONLY connected car technology that connects directly to the ECU to provide realtime, in-cab guidance that talks to & coaches drivers to stay within the engine's 'sweetspot'.	JFloat Ltd, Securious ltd, Institute of Advanced Motorists ltd, Revolve Technologies ltd and University of Bath
Anytime, Anywhere Low Cost Localisation	CAV2	Oxbotica Limited	Autonomous vehicles require precise & continuous localisation in different surroundings, terrain, weather and at all times of the day. Most CAV localisation tech currently relies on high cost/performance systems based on laser scanning (LIDAR, phase-shift), which are expensive for mass market adoption. Cameras are low cost but traditional image-based localisation techniques are brittle to changes in lighting, weather & scene structure, resulting in frequent localisation failures. Oxbotica's camera-only localisation system (Dub4) fuses a number of innovative image-based localisation techniques for robust performance under challenging conditions. Until now, the system has been run on high-end PC hardware. Instead, this project is about performing vast-scale, vision-only localisation on low-cost hardware. Our algorithms will be tuned & redeveloped for operation on a low-cost Odroid hardware platform using USB3 cameras, with no loss in performance. Ford announced the launch of an AV by 2021 & this project	Ford Motor Company

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			accelerates the tech transfer of a key enabling technology directly into a Ford-Oxbotica consortium. Trials with Ford UK will demonstrate the localiser within a full autonomy system, as well as for low-cost vehicle tracking, using 3G to transmit location data for fleet management.	
Vote3Deep - Transferring tech from lab to vehicle for high performance, real-time object detection	CAV2	Oxbotica Ltd	A key challenge for the nascent CAV market is how to achieve complete and accurate perception of people and objects (detection, classification & tracking) under all driving conditions. Implementation of related sensor innovations could save 2500 UK lives by 2030 through prevention of road traffic accidents (RTAs). Radar, lidar and camera sensors, are being developed, though none are ready for the commercial CAV market. While cameras achieve the highest accuracy in targeted object classification, lidar is the predominant method for model-free detection (seeing all objects, without identification). Lidar classification is less accurate due to the additional computational burden in analysing 3D point data. The Vote3Deep project aims to improve lidar classification performance using novel voting algorithms which leverage the native sparsity of point cloud data to identify areas of interest and apply a state of the art convolutional neural network (CNN) (aka deep learning) to accurately and efficiently classify objects. Server-based trials demonstrate a 40% performance improvement. Transferring this tech to a commercially viable system with third party Application Programming Interface (APIs) will open up a market opportunity of £60m for Oxbotica (OXB) and RACE over the next 10 years.	UK Atomic Energy Authority (RACE)

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
Non-Intrusive Vehicle Monitoring System ("NiVMS")	CAV2	AutoTrip	NiVMS targets improved vehicle management amongst fleet operators by leveraging machine learning techniques used in energy disaggregation to evaluate whether the same i) depth of insights (e.g. component level) can be discerned for cars; ii) predictive capabilities can detect faults ahead of impacting usage. An 18 month study will collect data from 50 rental cars (5 models, EV and Internal Combustion Engines ICEs) via 3 sensors; i) CAN bus reader, ii) GPS and iii) fuel tank/battery monitor. Analysis will determine insights available, machine learning implemented to discern data patterns. A prototype algorithm will be created for testing, alongside commercial research on optimal business model for exploitation. NiVMS is differentiated by being i) brand agnostic (most rivals are brand-only OEMs), ii) tailored to the needs of rental operators thanks to in-house expertise, iii) able to predict vehicle faults ahead of usage impact.	E-Car Club
Connected Autonomous Sensing Service Delivery Vehicles (CASS -DV)	CAV2	Amey Group Information Services Limited	Companies operating in the service delivery sector are facing multiple challenges in relation to the delivery of services efficiently and effectively in an environment of continued austerity and reducing margins. Local Authorities are looking at intelligent ways to gather information about the status of the assets they manage to manage them better. The Connected Autonomous Sensing Service Delivery Vehicles (CASS-DV) technical feasibility study will	United Kingdom Atomic Energy Authority (RACE)

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			apply developments in industry 4.0 (the automation of service delivery & data driven services) & innovative thinking to address these challenges through analysing and assessing how emerging road based autonomous vehicle (AV) and connected vehicle (CV) technologies can be deployed across a range of service delivery areas such as road/grounds maintenance and waste collection to undertake tasks currently completed manually. CASS-DV will integrate existing and new sensors on AVs to provide information about the surrounding environment. The 15 month project will deliver and trial a fully operational ground based CASS-DV prototype. Its requirements will be disseminated throughout the service delivery & vehicle provider industries to drive innovation and encourage a step change in the provision of task oriented service delivery vehicles.	
Using Machine Learning and AI to explore systems for costing and managing Mobility as a Service	CAV2	CGA Simulation Ltd	Transport and in particular city congestion are huge issues in the 21st Century, with gridlock and pollution costing global economies billions annually. Using data sets around congestion, pollution and road safety it is possible to calculate the real cost of driving, and its impact on the environment, pedestrians, cyclists and other commuters. The project will assess the technical feasibility of a Holistic Transport Costing (HTC) Model of intelligent "pay-per-mile" micro-transactions where vehicles have to pay more to access busy or dangerous roads but are rewarded for taking more environmentally friendly routes, or carrying more passengers. The system would use machine learning	University of Liverpool

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			(ML) and artificial intelligence (AI) to continually intelligently negotiate road usage costs between autonomous agents on behalf of the city and cars then later autonomous vehicles. The system would be capable of continual evolution to reflect priorities and behaviours in a single city, 'evolving' it to become less congested, more efficient, safer and cleaner. The platform would also be adaptable to multi-modal transport journeys, integrating different transport options as data around times, pricing and access became available. The project will establish CGA as providers of state of the art simulation and modelling software and will further UoL's related R&D work.	
Cambridge Autonomous Bus System Feasibility Study	CAV2	Richmond Design and Marketing Limited	The Greater Cambridge research campuses are growing rapidly and the resulting traffic congestion is creating challenges to the quality of life, the environment and the continued health of the region's economy. The Cambridge Autonomous Bus System Feasibility Study will examine the feasibility and potential impact of a system of fare-paying, connected, autonomous mini-buses. These would link several of the large research campuses in the Cambridge area with park & rides and rail stations. We will address unmet transport needs, the design of an appropriate vehicle, connectivity and automated ticketing, possible routes and use of segregated paths for the vehicles, as well as the new business opportunities. Such an automated system is possible because of the unique Cambridge Guided Busway, which can provide a controlled access, proving environment for the development of the	Cubic Transportation Ltd, Genome Research Limited, Cambridgeshire County Council

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			autonomous vehicle and its infrastructure-side support systems. Once proven, the mini-buses could provide much needed public transport along the Busway out of hours when the larger buses do not run. A second route would connect the Wellcome Genome Campus and the Whittlesford Parkway rail station. A new autonomous vehicle would take advantage of previous government investments to create a 'stretched' version based on the UK Autodrive pods currently under development.	
Advancing UK Autonomous Vehicle Radar Sensing Technology	CAV2	Navtech Radar Ltd.	Navtech will investigate the feasibility of producing a 360° scanning radar sensor to be used for vehicle automation. Sensors currently used for autonomous vehicles are LiDAR, flat panel radars or optical, and recent trials by the University of Oxford's Robotic Institute (ORI) have established that these sensors alone are not sufficient to plan a vehicles path in complex urban environments. Researchers found autonomous pods were effectively blind at junctions and could not see obstacles or pedestrians around corners or in poor weather. Existing automotive radars used for anti-collision and obstacle detection have a wide field of view but poor azimuth resolution, whilst LiDAR, a laser based rotating system, has been identified to be vulnerable in poor weather and environmental conditions. Navtech Radar will therefore work with ORI to develop a radar sensor that will provide the required data. Navtech will work to develop a radar based mostly on existing technology adapted for an automotive demonstrator for the environmental perception application. ORI will develop the automation control and perception algorithms and then the	Oxford Robotics Institute

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			two partners will then work together to test the demonstration prototype, analysing the data and developing code to test the suitability of the sensor.	
Secure CAN with Q-PUF	CAV2	CyNation Limited	We are proposing a project to evaluate the technical feasibility of developing a hardware-based security protocol for an automotive Controller Area Network (CAN) using a Quantum Physical Un-clonable Function (Q-PUF). The CAN is an industry standard protocol for in-vehicle communication between electronic components, and is used in the vast majority of modern cars. It has been shown on numerous occasions that CAN communication is vulnerable to hacking attacks with potentially catastrophic consequences. Our proposed solution uses a hardware quantum 'fingerprint' from a Q-PUF chip to generate a unique ID which is then used for encrypting messages on the CAN. This secure CAN protocol ("S-CAN") will be able to prevent spoofing and Denial of Service (DoS) attacks	Quantum Base Ltd, Nabla Ventures Ltd
5G Millimetre-Wave Connectivity to Cars	CAV2	Jaguar Land Rover	Connected vehicles can use wireless communications to exchange sensor data required for autonomous driving. As automation increases, vehicles must carry numerous sensors which generate high data rate streams. Current networks such as 802.11p and LTE do not support the gigabit-per-second data rates required for sensor data exchange between vehicles and infrastructure. Recently, millimetre wave (mmWave) techniques have been introduced as a means of achieving such high data rate streams. This project will deliver a practical demonstration	BT, Blu Wireless Technology, University of Bristol

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			of the concept of using mmWave technologies to deliver bi-directional communications to a vehicle in high-speed environments. This feasibility study is achievable at very low cost in this proposal thanks to the capability in wireless testing, mmWave and field trials brought by the industrial and academic project partners: Jaguar Land Rover, BT, Blu Wireless and the University of Bristol. We will investigate performance for different vehicle speeds and develop suitable beam selection and beam tracking algorithms to focus signals to and from the vehicle in order to overcome the high path loss at mmWave frequencies. The research findings will be disseminated to the widest possible academic, industrial and public audiences in engaging and relevant ways.	
Quantum-based secure communication for CAVs	CAV2	Crypta Labs Ltd	This project addresses the real life issue of cybersecurity in connected and autonomous vehicles (CAVs). Over the last decade automotive components and systems have become increasingly connected and digital in nature. This trend has significantly increased the risk of malicious interference with car components, vehicles and infrastructure, and cybersecurity defences have generally proven to be lacking. The trust in, and therefore success of, CAVs relies upon these security gaps being closed as soon as possible. Crypta Labs, with support and funds from DSTL, has developed a prototype Quantum Random Number Generator (QRNG) which produces true random numbers for encryption purposes. True RNGs need to replace Pseudo-RNGs, which are deterministic and thus vulnerable	Coventry University

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			to hacking, and are of crucial importance to cybersecurity. This feasibility study robustly tests our prototype to evaluate the technical and commercial suitability of QRNG technology to CAVs. Given the importance of CAVs going forward, this key enabling technology is expected to have major export opportunities across the globe and help the UK build a leading commercial and academic position in quantum applications and cybersecurity	
Project Alloyed	CAV2	Epitomical Ltd	Market Opportunity - Automobiles of the future will be able to monitor, in real time, their own working parts, safety conditions, interact with other vehicles and the infrastructure around them and provide new services, as they become part of a larger mobility ecosystem. A mass-market solution that enables seamless connectivity, standard in-car integration and means to provide new 'over-the-top' services presents an opportunity for emerging and established players in the nascent CAV market. Approach - The current market operates in silos and this project will study the technical and commercial viability of building a solution that (a) provides a network-agnostic layer that enables seamless V2X communications (b) integrates with in-car systems and (c) enables standard access to application and service providers for multiple use-cases. This would be analogous to the successful approach taken by leading Smartphone players. Outcomes - This project will study existing and emerging dynamics of the market, technologies and culminate in building a live demonstrator. The partners involved will have a clear roadmap for	Vivacity Labs, University of Surrey (5G Innovation Centre), Cranfield University (Advanced Vehicle Engineering, CH2M Hill, Sheridans TRL Limited, Steer Davies Gleave, Mclaren Applied Technologies, Cisco International Ltd, Transport for London (TfL), Direct Line Group, Guildford Borough Council, Axxeltrova, Siemens, Honda R&D Europe (UK) Limited

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			commercialisation of this solution that will open up future markets.	
Requirement Evaluation of CAV Location Performance and Platform Development (RECAPD)	CAV2	UbiPOS UK Ltd.	Location and sensing form two important components of CAV. Current sensing techniques have limitations when driving environments become "featureless" under bad weather conditions. The mass-market location techniques such as GNSS using code measurements and its integration with INS are unable to guarantee the required CAV location performance. RECAPD will focus on defining relevant parameters and R&D of an innovative location platform through identification of real-world location issues on a mix of UK roads. This platform will be empowered with an innovative processing engine that can switch intelligently between location solutions according to its working environments. It will also use the existing national digital infrastructure, GPS/Galileo, INS, pavement embedded beacons to provide a ubiquitous CAV location solution. An advanced survey vehicle that is able to produce cm positioning accuracy will be extensively utilised to generate "ground truth" trajectories for assessing the performance of the CAV location platform. RECAPD will investigate effective integration approaches with sensing techniques to enhance CAV autonomy. A feasible strategy will be developed with key stakeholders for its next stage development. The findings will also contribute to CAV standards.	The University of Nottingham

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
City-Compatible Commercial Automated Ride Sharing (the "CC-CARS" project)	CAV2	Addison Lee	The "CC-CARS" project will be led by Addison Lee, a leading transport player with a team of 1,500 UK based staff. Addison Lee is live in 100 UK locations and 700 worldwide. The business recognises that mobility services are evolving and plans to evolve its business model to adapt. This research will be used to support the roll out of automated ridesharing to international locations. The CC-CARS project will explore the feasibility of using live booking and allocation technology to pair journeys in the Royal Borough of Greenwich using SAE level 4 automated vehicle technology. The service would be designed to complement existing public transport infrastructure and would build on insights from the GATEway project led by TRL. The project will examine reducing total vehicle journeys and delivering quantifiable emissions and pollution reduction. Planning and design of ridesharing services will be undertaken by DG Cities and TRL, informed by real-world vehicle movement data, operational and commercial insights from Addison Lee. General Motors will provide automated vehicle design information and performance characteristics for Immense Simulations to simulate alternative ride-share business models. Transport Systems Catapult will evaluate and visualise the wider transport system impacts of CC-CARS operations.	TRL Ltd, DG Cities (subsidiary of RB Greenwich), Transport Systems Catapult, Immense Simulations Ltd, General Motors Ltd
Real Time NOx calculation in LCV and HGV diesel vehicles	CAV2	Tantalum Corporation	The contribution of road transport to air pollution has become of increasing concern fuelled by greater understanding of its health impacts and recent vehicle emissions scandals. There is a market opportunity for	Imperial College, London

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
using OBD real time engine data.			connected vehicle technology to help inform government (local, regional and central), business and consumers by giving accurate dynamic pollution emissions modelling from individual vehicles. Tantalum Corporation has developed a unique method for modelling dynamic CO_2 emissions and fuel use of a vehicle by obtaining real time engine data through the OBD protocol. Our next step, in partnership with Imperial College London, is adding real time NOx calculation for the UK vehicle parc through OBD protocols. The objective is to develop a cost effective telemetry system that can estimate and relay CO_2 and NOx emissions to data servers for monitoring vehicle movement, air quality and traffic flow. We have analysed the potential market in the UK with regards to the Government mandated Clean Air Zones and on the continent. Using connected vehicle technology to give real time emissions modelling – both CO_2 and NOx – could drive rapid air quality improvements.	
ESCIPODS (Electric Supercapacitor Integrated PODs)	CAV2	Westfield Sportscars Limited	The UltraPRT POD in use at London Heathrow Airport Terminal 5 has been a great success with it taking over 3 Million Passengers over 5 Million Kilometres. Unfortunately, the base platform of the UltraPRT uses out of date technology which has been sourced from abroad. The project is looking to localise components sourced from USA and Europe, to produce a novel hybrid battery system and to optimise the vehicle control unit for optimum energy efficiency. The system would make use of a hybrid Supercapacitor and Lithium-ion battery array, for use in the	Heathrow Enterprises Ltd, Zap&Go Limited, Potenza Technology Ltd, The University of Warwick

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			vehicle on pavement and guideway systems. The project is a follow on from the Niche Vehicle Network Feasibility study, which has confirmed findings that the use of a Supercapacitor and Lithium battery has the potential to optimise the vehicle and enhance range.	
Autonomous and Connected vehicles for CleaneR Air (ACCRA)	CAV2	Dynniq UK Ltd.	Five UK cities will implement clean air zones (CAZ) to improve air quality (AQ), specifically in relation to NO2 and 253 UK local authorities have declared Air Quality Management Areas for NO2. Vehicles which have an internal combustion engine and an electric only range can offer zero emission (ZE) operation but cities lack the ability to monitor and control the vehicles. Project ACCRA - a collaboration between Dynniq, Tevva, EarthSense, Transport Systems Catapult, Cenex and Leeds City Council - will address this problem. The project will develop and demonstrate a system that allows hybrid ICE/EV vehicles to become part of a city's urban traffic management control system; monitoring the vehicles' location and operational state, and able to control the ZE running strategy ensuring ZE through areas of poor AQ. Using mobile AQ sensors the system's decision-making engine will demonstrate the ability to respond to pollution violations and modify (on-demand) the ZE strategy of the vehicle via active geo-fencing. The system will be demonstrated in Leeds and the project findings used to assess the applicability and capability of the system to support the proposed 2020 Leeds CAZ. The partners will be able to exploit the	Transport Systems Catapult, Cenex, EarthSense, Systems Ltd, Tevva Motors Ltd, Leeds City Council

Project Name	Prog.	Lead	Synopsis (Public Releasable)	Partners
			developed technology as urban areas worldwide look to introduce zero emission zones.	

Annex 2 - Portfolio of Projects

Co-operative Intelligent Transport Systems

November 2017

Collated by the Transport Technology Forum on behalf of DfT

Cooperative Intelligent Transport System – Blackpool Council

Project Title

Blackpool tourism traffic flow and enhanced car parking guidance programme

Project Overview

Blackpool must manage its peak-time congestion and accommodate visitor growth. Roads cannot be expanded to meet the likely traffic growth as new developments are brought forward. Using SMART technology to improve traffic flow safely, increase productivity and reduce air pollution is the solution.

The programme being implemented will achieve the following:

- Providing in-car traffic information and car parking guidance using smart-phone app or satnav systems
- Establish network-wide traffic flow control
- Influence promenade traffic access outside the commuter peak
- Exclude private vehicles from priority areas.

Removing Promenade traffic outside of the commuting peak is a key objective, to create a pedestrian focused sea-front area.

Objectives

The following scheme outcomes are anticipated:

- Congestion costs on the Blackpool economy will be reduced
- An enhanced tourism gateway experience meaning return visits and GVA growth
- Reduced parking search trips means people will be out of their cars and spending sooner

- A resort operating with minimal congestion will attract potential inward investors
- The resort's Promenade showcase can be a pedestrian public realm area
- The pressure to increase road-space will be reduced
- Public transport information will be integrated within the system's data flow
- Polluting emissions will be ameliorated
- Economic diversification through inward investment will be promoted.

Milestones

The key programme milestones are as follows:

- Detailed Design: Quarter 4 2016/17
- Procurement: Quarter 1 2017/18
- Contractor Selection: June 2018
- Site Surveys & Investigations: Quarter 2 2017/18
- Manufacturing & Purchasing: April – Quarter 3 2017/18
- Installation: Quarter 3 & 4 2017/18
- Commissioning: February – March 2018

Progress to date

- Bluetooth beacons have been purchased in conjunction with the Local Growth Fund supported Integrated Traffic Management scheme (variable message signage) and will be installed quarter 3/quarter 4 of 2017/18. These will be making information available to drivers during quarter 4 and the system will be up and running for the start of the tourism season from Easter 2018.

- Design consultants for the project's bus lane enforcement elements will be appointed during quarter 3 2017/18, enabling this element to be delivered during quarter 4. This work is tying in with the programme to extend the Blackpool Tramway to Blackpool North railway station via Talbot Road, which has commenced during quarter 3 2017/18. The Wilkos hardware store adjacent to the railway station is now to be demolished and this makes a target delivery time for this project's final enforcement area at the transport interchange hub proposed for this newly regenerated area uncertain. However, the work is committed and will be delivered.

- Queue management systems have been installed and upgraded in partnership with Blackpool's Community Lighting Partnership and have enabled the resort to contend with high tourism traffic flow volumes during the 2017 season.

- On installation and commissioning of the works under this project, the council will be conducting a monitoring exercise against the bid cited benefit benchmarks. The scale of works being delivered in Blackpool, including bridge rebuilding, conference centre construction, tramway extension construction and urban public realm improvements, will make this a challenging task. However, it is anticipated that the systems installed will be of great value and can be rolled forward as further development is brought forward, particularly a proposed development on the current Central Station car park.

Deliverables

- Plymouth Road roundabout traffic control upgraded – quarter 2
- Bluetooth beacons installed - quarter 3
- Bus lane enforcement system designed – quarter 3
- Bus hub bus lane enforcement installed – quarter 4
- System commissioning, snagging and fine-tuning – quarter 4 ready for Easter season start.

Contact

David Simper – Group Leader (Transport Projects).
Telephone: 01253 4761746
E-mail: david.simper@blackpool.gov.uk

Connected Intelligent Transport Systems
Research Project Update

EBORACVM

signalling the future of roads

Project Title

York 'Eboracum' Co-operative ITS Project

Project Overview

Data from vehicles is becoming more and more available but to date has not been used for signal control to improve junction performance.

Eboracum aims to improve junctions on the A59 corridor in York in line with local policy objectives using vehicle data instead of fixed roadside technology.


Objectives

- Using commercial FVD data to improve signal performance
- Understanding how to practically migrate from fixed infrastructure to connected vehicles
- Exploring Wi-Fi, 5g and G5 radio performance in semi rural areas
- Linking to vehicles by OBD2 to identify vehicle performance
- Collecting data to help plan the future of York's transport
- Examining the evolution path for a typical UK Local Authority

Milestones

- Architecture design complete
- Data flow September 2017
- All roadside equipment in place October 2017
- Tests of SCOOT as a baseline December 2017
- New algorithm tests 2018
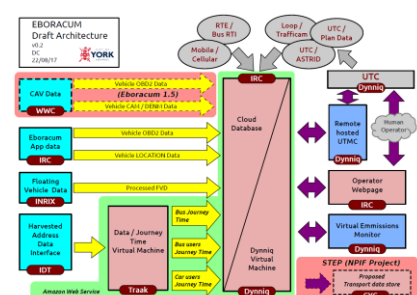
| **Project Title** | **York 'Eboracum' Co-operative ITS Project** |

Progress to date

- INRIX Floating Vehicle Data (FVD) feed in place
- 90% of IDT roadside units installed
- Amazon Cloud storage procured
- Detailed algorithms design continues by Dynniq
- Extension for 5g and G5 being completed
- Measures of success detailed
- INRIX Roadside Analytics used for before and after

Deliverables

- Architecture design complete
- Data flow September 2017
- All roadside equipment in place October 2017
- Tests of SCOOT as a baseline December 2017
- New algorithm tests 2018

Partners

CITY OF YORK COUNCIL

dynniq

IDT
Integrated Design Techniques Limited

INRIX

t traak™

WHITE WILLOW
TRANSPORT INTELLIGENCE

Middlesex
University
London

Ian Routledge Consultancy

Contact: **City of York Council Transport Systems Team**
E – cits@york.gov.uk

Connected Intelligent Transport Systems

Research Project Update

Project overview & aim

Develop a prototype system that utilises 3rd Party floating vehicle data analytics to trigger traffic management interventions in order to:

- Prevent build-up of traffic congestion on the local network

- Generate traffic management information that influences the flow of traffic through the network in fulfilment of local policy objectives, whether strategic, tactical, environmental, economic or community based

Information generated by the system will be published for display in-vehicle, via a mobile app, and on mobile roadside message signs.

Objectives

- Demonstrate how floating vehicle data can be utilised for an effective pre-emptive traffic management system

- Enable Derbyshire to own an evolving set of business rules that generate traffic management information - through operational experience this set of rules will increasingly be :

    o Pre-emptive of disruptive events

    o Responsive to community needs such as reducing vehicle emissions in sensitive areas and managing congestion around planned events.

- Achieve a high degree of decoupling of components in order to:

    o Ensure new and enabling technologies can be readily incorporated

    o Ensure competition in the supply of data and its quality

    o Preclude vendor lock-in

Outcomes

- A compact, versatile and portable traffic management system that does not lock the operator into a particular proprietary end-to-end solution that does not necessarily rely on dedicated roadside infrastructure

- Meeting and embracing the challenge of AI – working with industry to resolve conflict where they have their own information objectives.
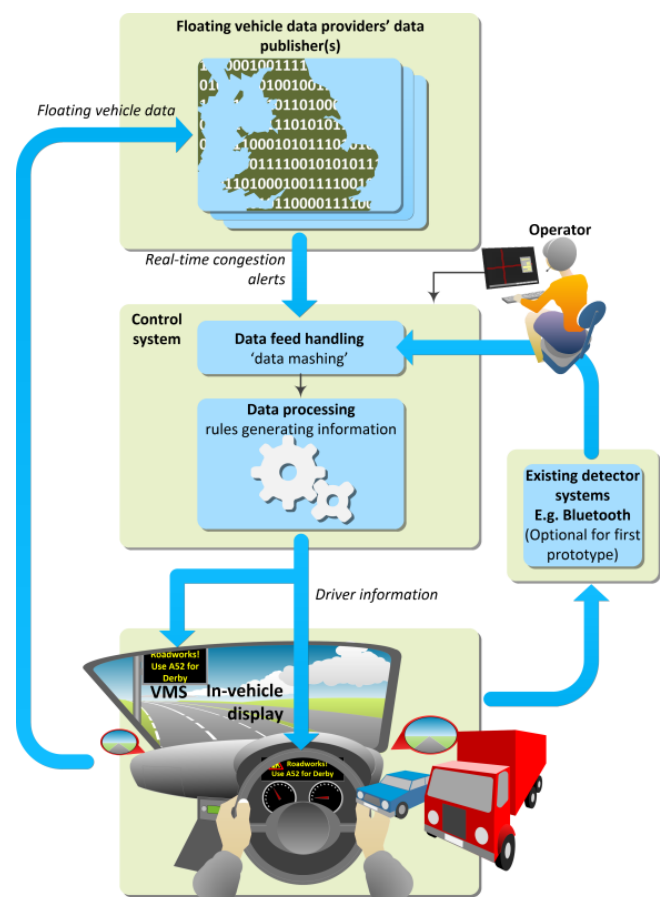
Milestones

- System architecture design
- Network model
- Strategy development
- Traffic data & VMS procurement
- Rules engine development
- Operator interface development
- In-vehicle App development
- System integration
- System testing
- System trial in 2018
- Monitoring and evaluation
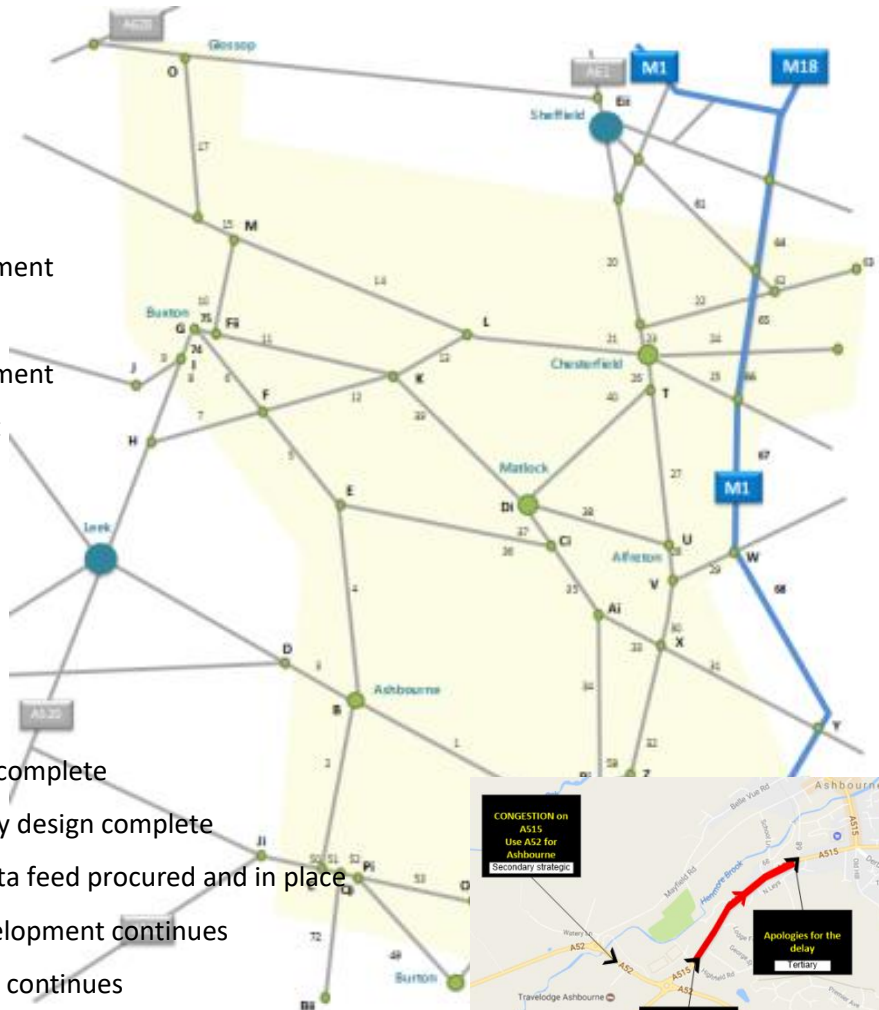
Progress to date

- System architecture design complete
- Traffic management strategy design complete
- TomTom floating vehicle data feed procured and in place
- Rules engine algorithm development continues
- User interface development continues

Deliverables

- Prototype traffic management system
- Prototype mobile Application
- Mobile variable message signs to display traffic information
- Trial of the system 2018

Partners

Contact

Transportation Data & Analysis Team, Derbyshire County Council

Email: neill.bennett@derbyshire.gov.uk

Department for Transport

Funding for Innovation:
Cooperative Intelligent Transport Systems

| Project Title	A31 Smart Collaboration
Project Overview	Dorset County Council (DCC) is introducing a prior congestion warning for road users accessing the A31/Ferndown area. DCC will collaborate with Highways England (HE) to develop an integrated network management approach using: Linked DCC & HE UTMC systems, Journey Time monitoring, VMS, CCTV & web/connected outputs. This will enable a step change in network management through improved monitoring and the real-time dissemination of information to road users, including freight vehicles. A connected approach will provide users with knowledge from which to make informed decisions on preferred routes and help balance traffic flows and prevent further congestion.
Objectives	Develop a collaborative relationship between DCC and HE, to improve operational procedures through UTMC. Provide a proactive traffic management approach using detection infrastructure and big data. Expand and enhance use of real-time information to road users and connected vehicles. Increase cooperative services to share the control of traffic signal junctions, easing congestion and providing re-prioritisation. Utilise additional data sources to influence traffic signal junctions. Create a platform for future UTMC/CTM strategy developments.

A31 Smart Collaboration
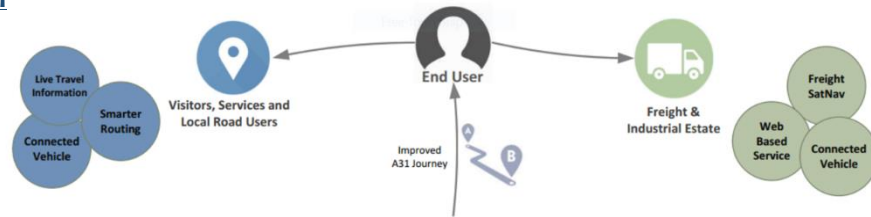
Milestones	Initial journey time units on site: August 2017
	Joint UTMC strategies to be complete: November 2017
	Online traffic portal construction: December 2017
	MoU and Principles of Collaboration to be agreed: Early 2018

Current Progress	UTMC testing complete.
	Traffic signal integration – control of HE junction from DCC UTC/UTMC.
	Vehicle classification / turning counts compiled.
	Journey time detectors installed (75% sites).
	Established relationship with neighbouring Bournemouth & Poole Borough Councils and Ferndown Industrial Estate - asset installation & data sharing.
	Design and functional requirements of online traffic solution.
	VMS/CCTV locations finalised.

Project Deliverables	DCC and HE shared traffic management network strategies.
	Online/Cloud-based traffic portal for user output – potential deployment to connected vehicles.
	Journey time coverage of key routes and surrounding area.
	On street VMS to inform non-connected vehicles.
	Shared use of industrial estate legacy infrastructure/assets including CCTV and ANPR.
	MOVA/Communication upgrade at signals adjacent to HE junction.

Partners

Project Contact	Dorset County Council Highways
	Traffic Team: DataITS@Dorsetcc.gov.uk

Central London Testbed Project

Middlesex University and Kings College London

Project Title   Central London Testbed Project

Project Overview   A Cooperative Intelligent Transportation System (C-ITS) will revolutionise the way we live. In order to understand this coming age, it is necessary to build new technologies, testbeds and applications that will give us insight into this brave new world. The Department for Transport (DfT), Middlesex University (MDX) and Kings College London (KCL) are building a Federated Connected Vehicle Testbed System as shown in Figure 1.
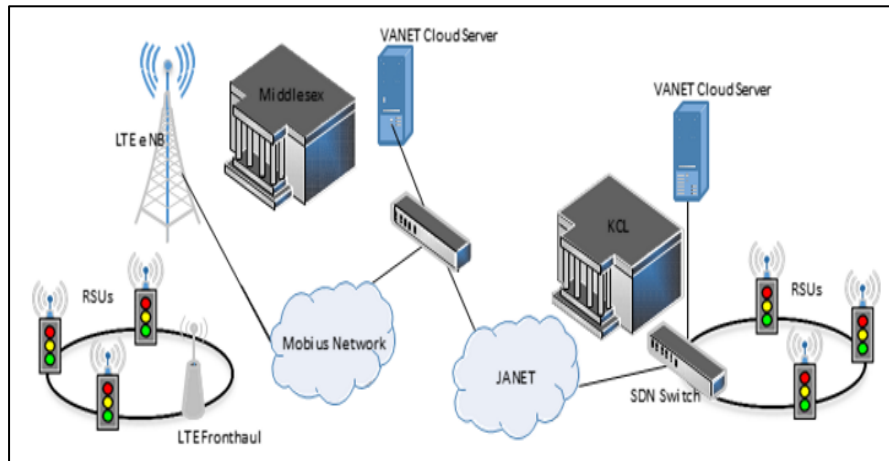

Figure 1: The Federated Connected Vehicle Testbed System

Project Goals

Figure 2: The Connected Vehicle Application Framework

The key objectives of the project are to explore the development of a C-ITS system by building two testbeds and to use data from the testbeds to investigate the building of applications for the Connected Vehicle environment using VANET/G5 technology as well as emerging 5G mobile networks, as shown in Figure 2.

Project Status

The Middlesex Testbed has been built along the A41 (Watford Way) and on the Hendon Campus as well as surrounding roads. The Kings College Testbed has been built at the Kings College, along the Strand in Central London. Both testbeds, shown in Figures 3 and 4, use VANET/G5 technology and are fully operational. Once they become available, 5G test modules will also be added to these systems.

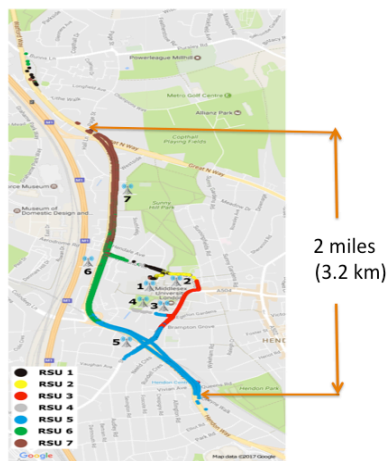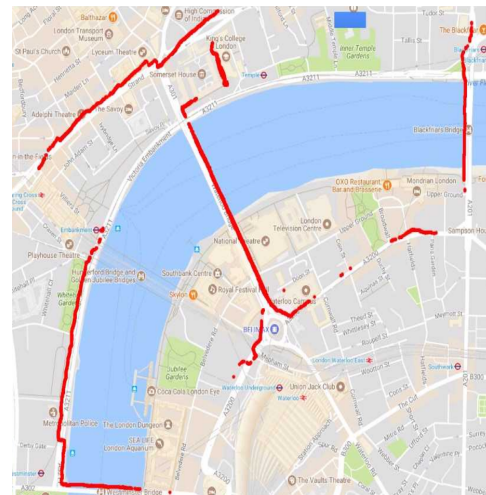

Figure 3: The Middlesex Testbed

Figure 4: The Kings College Testbed

Partners

Contact Information

Middlesex University London – Intelligent Transportation Systems (ITS) Lab

Dr Glenford Mapp, Head of ITS Research: g.mapp@mdx.ac.uk

C-ITS SMART CORRIDOR NEWCASTLE

C-ITS Smart Corridor—Update

The Newcastle Co-operative Intelligent Transport (C-ITS Smart Corridor) project is a partnership between Newcastle University, Newcastle City Council, Arriva and the Department for Transport.

The project tests equipment in order to make vulnerable road users safer and reduce the environmental impacts of congestion and idling at traffic lights.

This project builds upon the successful Compass4D deployment in Newcastle, which equipped 21 intersections in and demonstrated improvements in fuel efficiency and a reduction in the time taken for equipped vehicles to travel through an intersection.

How does this relate to Newcastle's strengths and objectives?

- Newcastle University is a world leader in evaluation of the impacts of C-ITS infrastructure, including of the pan-European Compass4D project, and will be evaluating the C-ITS Smart Corridor

- Newcastle Urban Observatory provides the largest set of publicly available real time urban data in the UK, including real time air quality monitoring for the C-ITS Smart Corridor and linking to the Urban Traffic Management system

- Newcastle City Council has a vision to work with partners to be one of the greenest, healthiest and most innovative cities in Northern Europe and to become a test bed for intelligent infrastructure

What have we done so far?

There are two main elements to the C-ITS Project;

- The Vehicle to Infrastructure Communications (bus to traffic signal communication)

- The Cycle Alert System

Work completed on the project up until now has included:

- Fitting roadside equipment and completing Site Acceptance Testing with an On Board Unit

- Fitting air quality monitors and collecting baseline air quality data

- Fitting buses and a number of cyclists with Cycle Alert tags, to raise awareness of cyclists' location in relation to buses

- Obtaining opinions from both bus drivers and cyclists about this equipment, as a baseline for the trial

- Collecting baseline fuel economy and mileage data for the bus fleet

- Procuring and delivering the units to fit on-board buses to communicate with the traffic signals

- Developing the final version of the visual display software, following workshops with bus drivers and amending to meet VOSA requirements

Baseline Corridor NO$_2$ from Urban Observatory

Energy Efficient Intersection On Board Unit
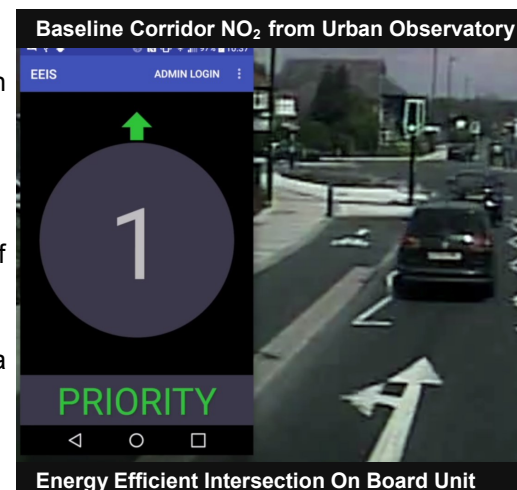
How will the trial work?

17 roadside units (RSU) have been fitted to traffic signals along Gosforth High Street. These units will provide information to 'black boxes' on-board Express Buses about the timings of the signals, and information will be returned recording the whereabouts of the bus. This information will be used to amend the priority of the signals as the bus approaches.

- If the signal is on green when a bus approaches, this green will be extended as long as possible to allow the bus priority.

- If the signal is on red when a bus approaches, an earlier green light will be requested to reduce waiting time.

- This information will be displayed to drivers on a visual display unit in the cab of the bus (similar to a sat nav), advising of the best speed to drive at in order to maximise green time and avoid stopping at red lights.

In addition to this, devices have also been installed along Gosforth High Street to monitor the impact on air quality. It is anticipated that smoother driving, combined with a reduction in waiting time at lights will reduce the emissions from buses and have a positive effect on air quality.

What's next?

The next steps of the project are;

- Equipment of all of the Express buses with on board units to begin the post-baseline phase of the trial and collect intervention data

- Continuing engagement with vulnerable road users to understand reasons for participation

- Training bus drivers and receiving their feedback, then comparing with baseline surveys to assess difference

- Ensuring compatibility between roadside unit standards and On Board Units

- Learning from other C-ITS authorities, including assessing the potential of interoperable On Board Units

- Continuing dissemination activities.
  These have included:
  Hosting the C-ITS Deployment Day at Newcastle University for 100 delegates in May 2017; Meetings with other UK C-ITS cities, Transport Systems Catapult, EU projects such as C-the Difference and the Technical University of Eindhoven; Presentations to Connected Corridors Birmingham, the ITS European Congress Glasgow and ITS World Congress Montreal

---
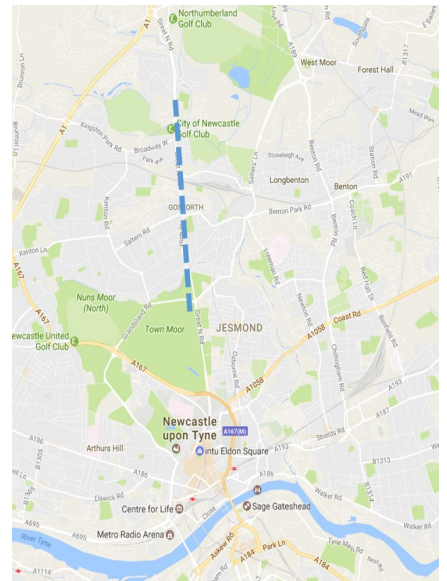
Useful information ….

- Newcastle is exploring how C-ITS can help support it achieve its ambitions in line with the UK Air Quality Plan

- The 'CMobILE' EU project has commenced as of the summer of 2017. Newcastle City Council and Newcastle University are partners in this project and it will provide complementary benefits to the C-ITS Smart Corridor

- If you'd like further information about the project email:

Transport@newcastle.gov.uk

Co-operative Intelligent Transport Systems Project Update

Project Title

Connecting Peterborough

Project Overview

The project will aim to utilise newly emerging digital technology to provide real time, two-way, journey information directly to visually impaired users, allowing easier access around Peterborough City Centre.

The project aims to provide staff and visitors to the new RNIB head office in the city centre safe, accessible routes from the main transport hubs (Rail and Bus Stations).

Objectives

- Create VR simulation of main walking routes in City centre
- Simulate eye conditions
- Simulate existing technology solutions
- Model emerging solutions
- Test holistic model with participants and benefits
- Deploy in environment
- Ultimate aim of the project is to improve accessibility for blind and partially sighted people in Peterborough city centre.

Milestones

- Stakeholder engagement and environmental audit.
- Phase 1: Building the VR simulation
- Refine simulations
- Phase 2: Deploy solutions in the environment and refine simulations
- Evaluate the real world technologies to confirm the benefit of pedestrian wayfinding.

Progress to date

- Stakeholder engagement and consultation complete.
- Environmental audit was carried out in Sept 2017
- Main routes identified and scanned using Lidar
- Phase 1, building of VR simulation is in progress.

Deliverables

- Create VR model in order to simulate various technologies
- Deploy technologies in the physical environment
- Share the model with others to create a rapid prototyping sandbox

Partners

Contact: Sohail.ilyas@peterborough.gov.uk

COOPERATIVE-INTELLIGENT TRANSPORT SYSTEMS (C-ITS) PLATFORM

PORTSMOUTH CITY COUNCIL

NOVEMBER 2017

PURPOSE

This document provides a high level interim project report to provide an overview of the objectives, methodology, and progress to date within the Portsmouth C-ITS Platform Project.

PROJECT OVERVIEW AND SMART CITY AMBITIONS

The innovative project establishes an on-street test environment within Portsmouth to prove the viability of available communication technology that will not only provide the Council with additional 'real time' information on how the road network is performing, but also give support to road users to enhance their journey experience and improve road safety.

This is a critical part of achieving the city council's vision of developing and implementing cutting edge technology that improves road safety, delivers more consistent journey times for all forms of transport and by harnessing 'big data', provide real time information enabling residents and visitors to make informed travel choices.

PROJECT OBJECTIVES

The key project objectives are:

- Explore the benefits and issues of using bluetooth sensors to calculate journey times and to reveal origin, destination & routing information of journeys made on the road network.

- Investigate the creation of a "big-data" platform to combine real-time information from sensors and other data-sources, which can then be accessed by a variety of applications.

- Small-scale trial of V2X technologies to demonstrate connectivity, compatibility and explore various use-cases by creation of a technology "test-bed", connecting to traffic signal controls.

- Use project findings to plan for further deployment of CITS technology throughout Portsmouth.

C-ITS PLATFORM OVERVIEW

HAZARD WARNINGS

V2V IN-VEHICLE

V2I HIGHWAY
RSU HIGHWAY

BLUETOOTH SENSOR

RSU STAND-ALONE

30 SPEED LIMIT ALERTS

ITS MOBILE STATION

RSU INTERSECTION

TRAFFIC MANAGEMENT

TELEMATICS

RADIO UNIT ANTENNA

WAN

SENSOR DATA

DATA PLATFORM

DATA STORAGE /BIG DATA

DATA ANALYTICS

APPLICATIONS

REAL-TIME & PRO-ACTIVE TRAFFIC MANAGEMENT (STRATOS)

SITUATIONAL AWARENESS

TRANSPORT PLANNING

INFORMED TRAVEL CHOICES

TRAFFIC MODELLING

PROGRESS

Significant progress has been made to date across the above objectives, and the project is on track to deliver in accordance with the close of the project in March 2017. Key highlights are shown below:

- Procurement of data platform
- Creation of a sensor network to create an origin-destination matrix, and capture journey times at a key entry point into the Portsmouth Network, as shown below
- 20 bluetooth sensors installed October 2017

NEXT STEPS

The following steps are planned, culminating in a report with our findings in March 2018:

- Initial testing of sensors and logic - November 2017
- Live data capture - December 2017 to February 2018
- Data platform options - December 2017
- V2X equipment procurement - December 2017
- V2X trials including signal control - January to February 2018
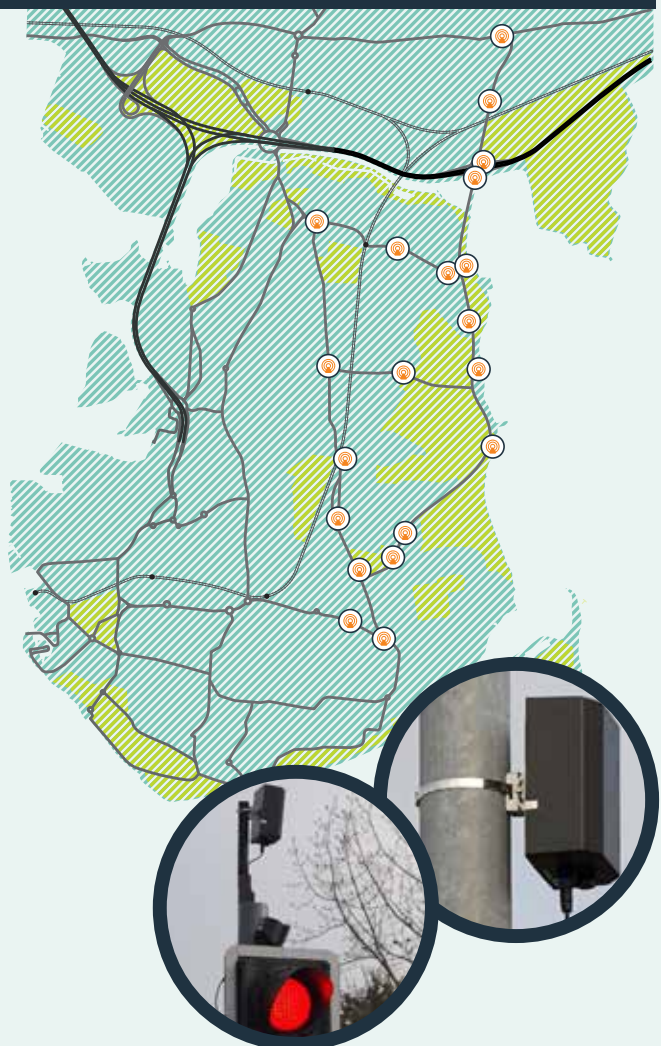
HINKLEY POINT ENERGY EFFICIENT INTERSECTIONS

PROJECT UPDATE NOVEMBER 2017

PROJECT DESCRIPTION

Hinkley Point C is one of the largest construction projects in Europe. Up to 750 HGV movements are expected every day. For each shift up to 5,600 construction workers will be transported from park and ride facilities to Hinkley Point 'C'. Traffic will be routed via one of the two designated routes, through Bridgwater. Route repeatability and journey frequency presents a unique opportunity to evaluate traffic Signal Phase and Timing technology, where construction traffic estimates suggest up to 3 million vehicle kilometres will be travelled, with 615,000 intersections crossed.

This EEI scheme aims to reduce the impact of these vehicle movements through more efficient control of vehicle start/stop cycles, by enhancing existing traffic signals and deploying Connected Intelligent Transport Systems technology in HGVs and PSVs.

OBJECTIVES

A corridor of Energy Efficient Intersections (EEI) will be deployed on the strategic route from freight park and park-and-ride facilities on the M5 J24, through Bridgwater to the nuclear construction site at Hinkley Point. HGVs and park-and-ride buses will utilise ITSG5 on-board units, communicating with traffic signals to provide advance traffic signal phase / timing information and 'extended green' priority.

Existing arrangements for traffic management and monitoring will be utilised to evaluate the impact of reducing start/stop cycles on fuel consumption, emissions, and journey times.

The findings will be used to support DfT objectives to facilitate the wider adoption of C-ITS services by Local Authorities, by demonstrating commercial and societal benefits through reductions in journey times, fuel consumption, and emissions.

DELIVERABLES

- Evaluation Plan
- Interim Report
- Final Report (inc BCR, Considerations, Recommendations)
- 'Exploitation, Ambitions and Barriers' Report
- Marketing Material

Hinkley EEI Progress November 2017
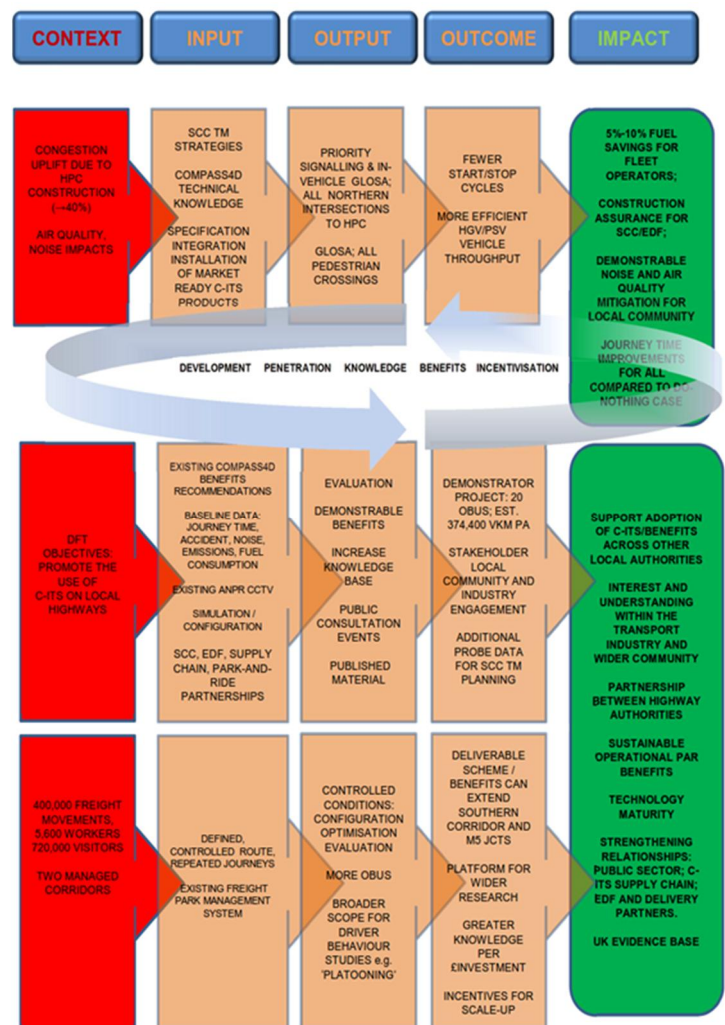
MILESTONES

- HGV/ PSV User & wider stakeholder agreements.
- Surveys & roadside / in-vehicle system design.
- Technology procurement & deployment.
- Configuration & testing.
- Operational evaluation & performance validation.
- Final report & marketing / dissemination.

PROGRESS TO DATE

- User agreements secured, communications plan in place.
- Equipped vehicles will be PSV only (20 of); HGVs not now due to route from J24 M5 until 2018.
- Architecture and functional system design complete.
- Technology options agreed, including algorithmic design by Siemens; procurement underway.
- Draft evaluation plan substantially complete.
- Requirements for ANPR, in-vehicle logging, UTMC, and vehicle tracking agreed; data available.
- Completion June 2018.

PARTNERS

CONTACT

Somerset County Council Transport Policy Team

DPMitchell@somerset.gov.uk

SMills@somerset.gov.uk

Connected Intelligent Transport Systems

Research Project Update

Project Title   Better Journeys in Southampton—Bluetooth

Project Overview   A citywide demonstration of how a Connected Intelligent Transport System—in this case collecting Bluetooth data on a MESH network on ten corridors —can be dynamically utilised to inform and manage traffic in Southampton. This data will enable Southampton City Council to provide real time travel information and junction control to influence people's travel choices, respond to incidents and improve air quality.

Objectives

- Using real time data to understand and manage live traffic conditions on Southampton's highway network
- Provide reliable real-time travel and real-time information to key stake-holders (Port and City Centre businesses) and travelling public to influence travel behaviours
- To proactively and effectively manage traffic to support a Clean Air Zone
- Develop long-term plans for traffic signals and other ITS to deal with planned and unplanned events

Milestones

- Bluetooth network identified
- Roadside equipment in place— October 2017
- Testing and verification— November 2017
- Enhanced VMS installed at 7 locations—November 2017
- Working with Third Parties—2018

Project Title	Better Journeys in Southampton—Bluetooth

Progress to date

- Assessment of back office requirements—CloudAmber, Juno and UTC server
- Supplier identified
- 25 Junctions assessed for installation of roadside units
- 34 Bluetooth Units procured and delivered with installation underway to form the basis for a city wide wireless MESH network
- DataEx2 link and server upgrade procured
- Enhance VMS at 7 sites including A33 procured
- Additional Air Quality & Pollution monitoring procured for A33

Deliverables

- Citywide wireless MESH Network
- Traffic plans based on real time information for large events (e.g. cruise or football days)
- Information provided to stakeholders and neighbouring highway authorities
- Real time traffic and air quality data
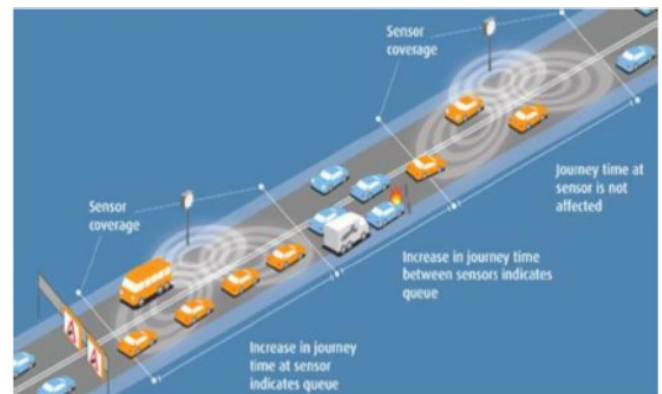
Contact   Transport Policy, SCC—iain.steane@southampton.gov.uk

BBLP ITS—daniel.ward@balfourbeatty.com

Partners

Stakeholders

COOPERATIVE INTELLIGENT TRANSPORT SYSTEMS

CONNECTING SWINDON

PROJECT UPDATE – NOVEMBER 2017

Project Overview

```
┌─────────────────────────────────────────────────────────────────────┐
│ Roadside monitoring equipment detects real-time traffic conditions –  │
│ traffic volumes and speeds                                            │
└─────────────────────────────────────────────────────────────────────┘
                                  │
                                  ▼
┌─────────────────────────────────────────────────────────────────────┐
│ Data is transmitted to central computer and is analysed by analytical │
│ software platform                                                     │
└─────────────────────────────────────────────────────────────────────┘
                                  │
                                  ▼
┌─────────────────────────────────────────────────────────────────────┐
│ Comparison with baseline conditions shows that network performance is │
│ below pre-determined threshold                                        │
└─────────────────────────────────────────────────────────────────────┘
                                  │
                                  ▼
┌─────────────────────────────────────────────────────────────────────┐
│ Message alerts sent to business users and to roadside transmission    │
│ equipment                                                             │
└─────────────────────────────────────────────────────────────────────┘
         │                        │                        │
         ▼                        ▼                        ▼
```
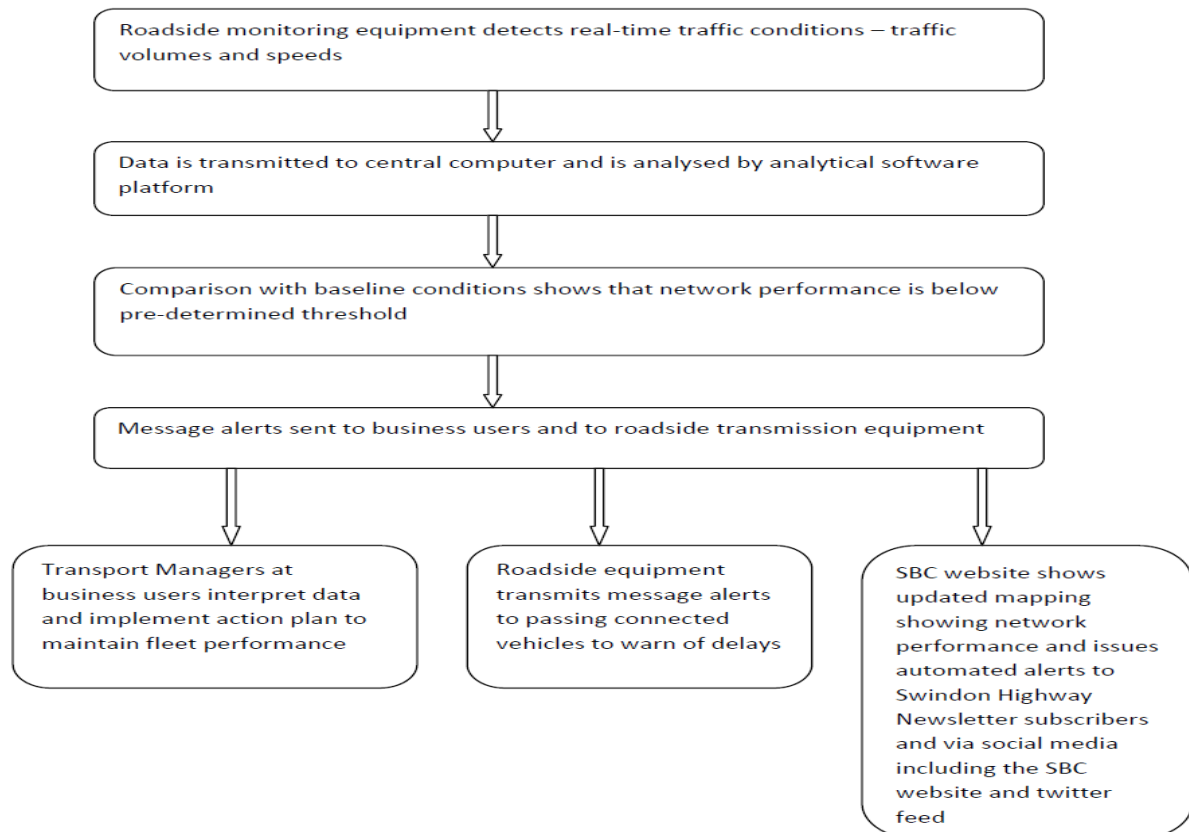
| Transport Managers at business users interpret data and implement action plan to maintain fleet performance | Roadside equipment transmits message alerts to passing connected vehicles to warn of delays | SBC website shows updated mapping showing network performance and issues automated alerts to Swindon Highway Newsletter subscribers and via social media including the SBC website and twitter feed |

Objectives

- **Improved network and traffic management capability within SBC utilising real-time traffic information.**
- **Reducing the impact of traffic congestion on road users and businesses by getting real-time information out to them more quickly.**
- **Testing new technology platforms in real-life conditions to enable technology partners to further develop the technology into the future.**

Progress

- **Monitoring equipment installed and operational at nine sites – ATC & Bluetooth**
- **Baseline traffic conditions being established**
- **Analytical software platform developed and ready for testing**
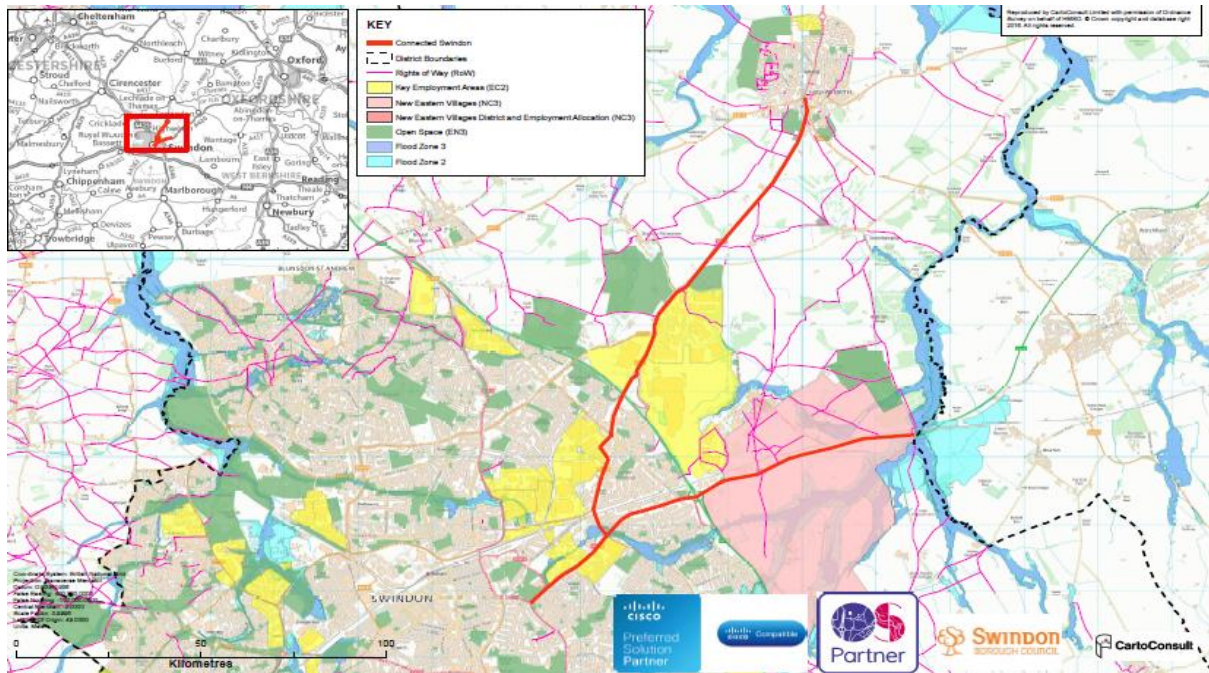- **Communications systems being developed ready for installation December 2017**

Swindon BOROUGH COUNCIL

COOPERATIVE INTELLIGENT TRANSPORT SYSTEMS

CONNECTING SWINDON

PROJECT UPDATE – NOVEMBER 2017

Project Scope

Focus on A420 / A4312 and A361 / B4006 routes in eastern Swindon – in red below.

Key clients – BMW / Honda / Stagecoach West / SBC Highways and Transport.

Deliverables

- **Technology options tested for accuracy and reliability**
- **Software systems fully tested for reliability and compatibility with existing systems**
- **Methods of disseminating real-time information tested and assessed**
- **Potential for further development and new applications reviewed**

Project Partners

Swindon Borough Council, Cisco, CartoConsult, Block, Davra

Contact: John Seddon (SBC Strategic Transport Commissioner)

Tel: 01793 465279 / 07342 024159   E-mail: jseddon@swindon.gov.uk

Connected Intelligent Transport Systems

Project Title

Warrington Integrated Transport System (WITS)

Project Overview

Warrington Borough Council (WBC) aims to create a Smart Travel City to support our economic growth ambitions, reduce delays and improve air quality. We aim to combine real-time journey time information and smart technology to develop network strategies to allow us to manage traffic more proactively. The developing system will also provide real-time information to businesses and the general public via on-street information displays, interactive webpages, social media and an innovative local mobile phone application for drivers.

Objectives

- Communication between drivers and Warrington's Urban Traffic Management and Control system (UTMC)
- Effective Network Management
- Capture real time journey information
- Implement 'coping' strategies in real time
- Inform users using on street Variable Message signs (VMS)
- Development of mobile application
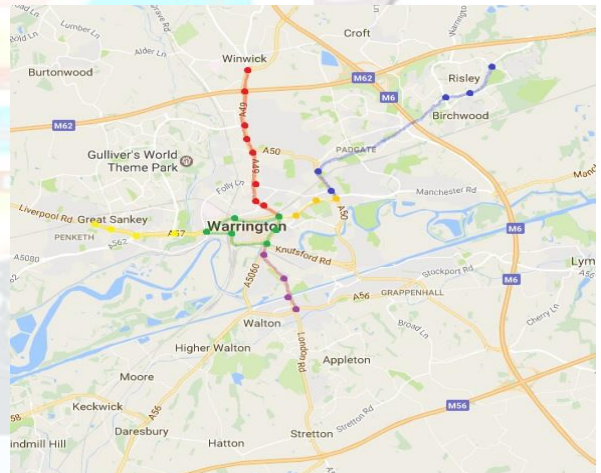
Milestones

- Base-map data used as the benchmark for the scheme
- Wi-Fi selected to capture data
- Key strategic corridors identified
- Detection locations identified
- Common database upgrade to Stratos
- Wi-Fi versus Bluetooth evaluation
- Stratos journey time monitoring interface development
- Mobile application development including desktop version
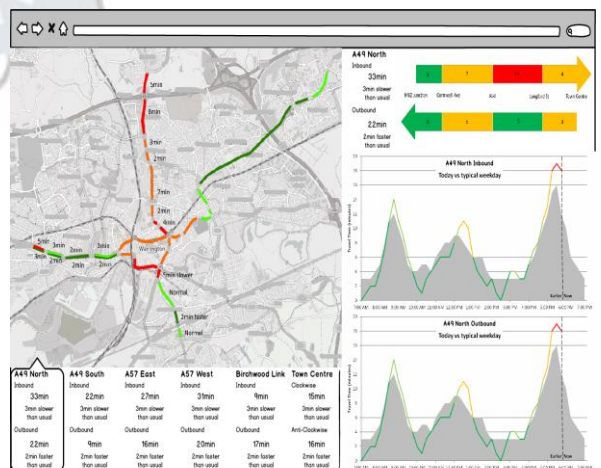
Connected Intelligent Transport Systems

Progress to date

- Stratos common database implemented
- 80% of Wi-Fi detectors installed
- Stratos JTM interface undergoing testing
- Mobile application developer appointed and in progress
- Base-map data collection complete
- Bluetooth units for validation procured and awaiting installation

8	7	14	4
M62 Junction	Cornwell Ave	A50	Longford St	Town Centre

8	6	5	3

Deliverables

- 100% Wi-Fi deployment December 2017
- Stratos JTM interface November 2017
- Mobile application 'go live' December 2017
- Bluetooth evaluation versus Wi-Fi January 2018
- Strategy development January 2018

Partners

SIEMENS

WSP

IDT
Integrated Design Techniques Limited

Contact

Warrington Urban Traffic Management & Control

UTMC@warrington.gov.uk

Co-operative Intelligent Transport Systems

Deployment Project Update

WM GLOSA

|	
Project Title	**West Midlands Green Light Optimal Speed Advisory**
Project Overview	Green Light Optimal Speed Advisory (GLOSA) systems provide drivers with speed advice that allows them to pass traffic lights during the green phase. Where this is not possible, a Time to Green (TTG) function provides a countdown for stopped vehicles, showing when the traffic lights will turn green. The project will test GLOSA using frieght vehicles, as they stand to gain the most from reduced stop-start, particularly in terms of fuel use.
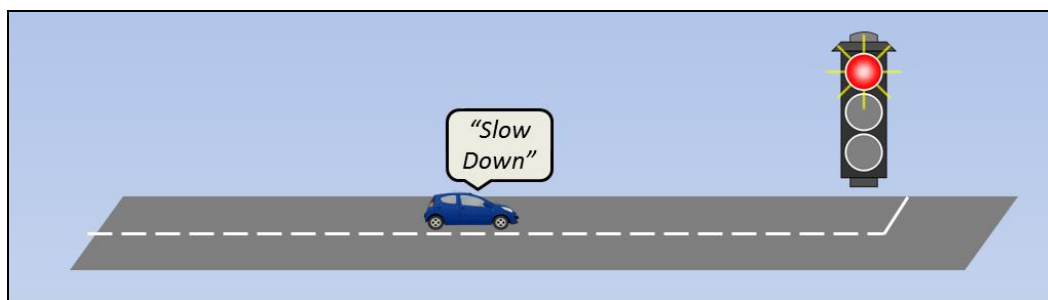
Objectives	- Implementing GLOSA in an adaptive control (MOVA, SCOOT and Signal Based bus priority) environment - Exploring 3g/4g and Wi-Fi-based communications - Development of web services from the UTC centre - Development of a prototype app to deliver the GLOSA messages to the vehicle - Testing the app using freight vehicles on council maintenance duties - Developing open source algorithms for future use
Milestones	- Architecture design complete - Test web site available - App and web service to be complete by Jan 2018 - Trials Jan/Feb 2018 - Results March 2018

WM GLOSA

Project Title	**West Midlands Green Light Optimal Speed Advisory**

Progress to date

- Test site operational

- Agreement on relevant standards to be applied (SPAT / MAP / GLOSA)

- App development progressing

- SCOOT issues resolves – MOVA and bus priority in progress
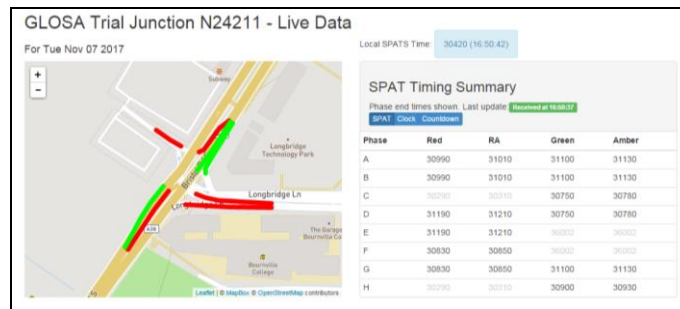
Deliverables

- Upgrade of 10 junctions on Coventry Road

- System Architecture Report

- Testing Plan

- Source Code

- Monitoring and Evaluation Report

Partners

Contact Andrew Radford

Andrew.radford@birmingham.gov.uk

Automated Incident Management

Worcestershire County Council - C-ITS Project 2017/18

AIM

Bringing together a range of partner data into a consolidated system with live highway condition information shared between

- **WCC Teams - Highways Control, Maintenance, Street Works and Intelligent Transport Systems and Traffic Control**
- **West Mercia Police & Hereford & Worcester Fire Service – Control room and Traffic Management officers**
- **Highways England – National/regional traffic control centre and Innovation Team**
- **The travelling public through VMS and media feeds initially and in the future direct to connected vehicles**

The corner stone of this project is investment in system design for time and location stamped critical issues feeds between partner control centres and on highway incident management staff. The system will have multi partner access to allow highway incidents to be dealt with in a co-ordinated and seamless way. On highway staff will be able to directly update the system from site. The system will be able to be viewed through interactive large screen displays with additional applications covering data feeds from traffic flow monitors, cameras, street works, road closures, highways maintenance, environmental conditions, intelligent traffic signal control, VMS (mobile and static) local and national traffic and travel updates.

AIM—Project Overview

Partnership Protocols

- *WM Police & H&W Fire Service*
- *Highways England*

Project Resources

- *DfT & WCC capital funding*
- *WCC dedicated ITS and Digital Transfor-mation staff resource*
- *Streetworks Permit Scheme revenue income stream*

Data Sharing

- *Direct feeds from new WM Police Control system SaabSAFE and H&W Fire Service control system*
- *Worcestershire Office of Data Analytics (WODA) – a jointly funded public sector organisation (NHS, Police, County, Districts, Fire, LEP)*
- *HE joint journey time management system, direct camera feed and VMS message setting agreement*

Live data

- *Connected staff & vehicles*
- *Citi Logik—Mobile Network Data*
- *Camera feeds*
- *Journey time and traffic flow data with emissions estimates*
- *Intelligent traffic signal control*

Information

- *Intuitive and interactive front end ITS Control room display*
- *Public information—VMS, social media, local radio and connected vehicles*

AIM—Overarching Objectives

OBJECTIVE 1: IMPROVE RATIO OF AVERAGE JOURNEY TIME: TRAFFIC FLOW (SECS/VEH)

METHOD

Intelligent Traffic Signal Control Strategies to Optimise Capacity and Flow	Public Information Feed—Live and Forecast Traffic Conditions for Journey Planning and Optimum Routing

DATA

Comprehensive historic traffic flow data from on highway detectors for forecasting traffic conditions during planned events for purpose of advising on optimum routing profiles, journey time prediction and signals configuration

Live traffic flow detection and on highway camera feeds for generating alerts

OBJECTIVE 2 : IMPROVE JOURNEY TIME RELIABILITY

METHOD

Reactive Traffic Signal Control Strategies to Manage Diverted Traffic and Manage flow	Fast, accurate and continually updated information feeds between emergency services, emergency maintenance teams and the public to minimise 'trapped traffic'

DATA

Live unplanned incident information data feed with continuous updates from WM Police Operational Control Centre and H&W Fire Service with details on location; time and date; incident type; estimated traffic impact; estimated time period of traffic impact; incident cleared status with time stamp

Live traffic flow detection and on highway camera feeds for generating alerts and monitoring highway network conditions

Partnership

ITS Control Room including Street Works and Highways Control and Maintenance

- **Live traffic flow and journey times on interactive display**

- **Camera coverage — live traffic conditions**

- **Automated link to live and forecast weather and environmental conditions**

- **Planned street works and diversions**

- **Intelligent Traffic Signal Control**

- **Automated link to incident data feeds from emergency services**

- **Traffic monitoring database analysis and forecasting**

- **Public information feeds**

- **Enable automated data feed from Control Room systems - SaabSAFE and HWFR**

- **Incorporate live observation updates from on highway connected staff**

- **Shared Journey Time Management System for Worcestershire Area - WCC local network and M5/M42**

- **Direct camera feed link to WCC GIS highways management system**

- **VMS setting and message cancel agreement between WCC and HE**

Worcester test area for assessing the potential for mobile network data to provide:-

- **Live traffic flow alerts (variation from normal)**

- **Traffic patterns during incidents (O-D variation from normal)**

Reading also received funding