Department for Transport

Intelligent Transport Systems in the UK

Progress Report

As required by European Union Directive 2010/40/EU

August 2014

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1. 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 2012. 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 EasyWay 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 2015. These outcomes will be reported at the appropriate stage.

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2. National Approach to ITS

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.

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.

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.

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

The UK Government is taking a number of actions to assist the UK automotive sector to develop ITS capability and to capture the potential growth opportunities:

- In 2013 the Government announced a £10m driverless cars prize fund. This seeks to establish up to three trials around Britain where this exciting new technology can be demonstrated in real traffic situations. This approach is amongst the first in Europe and will showcase the UK's creativity in helping our industries develop their technological capability.

- The Government is also undertaking a review of the regulations to remove unnecessary barriers that would impede the deployment of the new technology whilst ensuring public safety. This will report by the end of 2014.

- The Department for Transport has recently concluded a feasibility study on heavy vehicle platooning on the UK motorway network using vehicles with partial automation - but with drivers in each vehicle. Decisions on next steps are expected by autumn 2014.

The Government is 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 these projects and other developments to deliver ITS.

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.

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. As well as building on the extensive work of the national road provider (The Highways Agency) in rolling out smart motorways and using technology and traffic management to improve the flow of traffic, a new government-owned company will find ways to make better use of data and information, and take account of significant developments in vehicle technology and ITS, such as the emergence of low-emission, autonomous and connected vehicles, in considering how the network and services to road users will need to develop and evolve over the long term.

3. Technical and Legal Framework

3.1 Introduction

The UK has no overall ITS Architecture for the development and deployment of ITS but it has developed specific architectures where 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.

3.2 Legal Framework

The legislative framework for the development and deployment of ITS services varies across the UK. 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.

The Traffic Signs Regulations and General Directions (2002) 2002 (TSRGD)[1] prescribes signs that are placed lawfully on the 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[2.]

The managed 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.

3.3 ITS Architectures and Standards

The UK has world-leading capability, facilities and experience in the Intelligent Transport Systems sector. We have been an early adopter of systems, especially in the field of traffic and travel information. The development of these systems has required frameworks and standards to be adopted to ensure common standards and deployment.

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.

[1] UK Statutory Instrument 2002/3113
[2] Northern Ireland Statutory Rules 1997/386

- 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 giving 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 HTTP, GPRS etc.
- Local standards managed by the Highways Agency for highway mounted systems, especially covering safety issues.

Directive Priority Areas and Actions

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

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

4.1.1 Introduction

Accessible information on traffic and travel data is vital for 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.

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, including the National Rail, Transport Direct, Traveline and car journey planners probably exceeds one billion requests per annum. Further details of this investment, and the benefits it provides, were reported in the first National Report.

This area of activity has been significantly impacted by the growth of Open Data 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 restriction in terms of cost or terms and conditions.

4.1.2 The Open Data Agenda and traffic/travel Information

The UK Government has transparency and open data as a core policy driver and over the past four years has driven 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.

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.

In addition to the commitment to transparency in public finances and the operation of public service, 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 – weekly set of 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
- Accessibility data regarding the access for passengers with disabilities at stops and on services
- Registration details for every bus service operated in Great Britain

As part of this process, the Highways Agency 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 4.4.2). In December 2013 the Highways Agency real-time data feed was the second most popular dataset downloaded from the data.gov.uk website.

4.1.3 Progress since the National Report

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.

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 recent study by Deloittes 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 dataset by subject.

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, information that is both inputted by motorists and automatically generated by the apps tracking the GPS location of the phones.

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 demonstrated below.

4.1.4 Transport for London Open Data

In a linked but separate initiative the Mayor of London decreed that all 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

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.”

4.1.5 ELGIN – Open Data for Road Works

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 the Highways Agency 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.

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

4.1.6 Cycle Streets

Open data on traffic conditions can benefit all road users. Cycle Streets is providing a wide cycle journey planner system, currently in the testing stage, 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 streets.

4.1.7 Future Plans

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

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.

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

Transport Direct (TD) was 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.

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.

In the ten years since TD went live a number of factors have 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.

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 from Transport Direct it will not re-tender the contract and leave provision of services to the vibrant market that has emerged.

4.2.1 Developments since the last Report

Other areas of development since the last report 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.

4.2.2 Future Plans

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

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.

4.3 Smart & Integrated Ticketing

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.

4.3.1 Key National Activities

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.

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).

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.

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.

Beyond rail the UK Department for Transport is working closely with the major cities and conurbations (excluding London) in England to deliver smart and integrated ticketing in these areas through its **Smart Cities Partnership**. This work stream is looking to address a mix of issues including scheme governance arrangements, resource pressures, and the duplication of effort which have significant influence on progress towards the roll out of smart ticketing.

Finally the **Norfolk Managed Service Pilot** is testing how best to include smaller bus operators in any smart ticketing roll out and covers the provision of smart ticketing equipment, its installation and maintenance plus supporting back office services. It is testing different scenarios to understand what works well for all users and stakeholders.

[1] http://www.itso.org.uk/

4.4 Traffic England

The Highways Agency provides a traffic information website which makes details of, delays, closures, road works and other information publically accessible. This allows 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.

4.4.1 Highways Agency: National Traffic Control Centre (NTCC) Overview

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."

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.

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

With the replacement contract for the NTCC needing to be let a full benefit realisation review has taken place. The following benefits have been realised.

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

The NTCC was a 10 year Private Finance Initiative (PFI) contract let on 1 August 2001. The contract was to deliver better information to the driver via numerous information sources and strategically manage traffic on the HA network.

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 Agency’s network.

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

- Traffic England – The HA's 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.

4.4.2 Highways Agency: National Traffic Information Service

Overview

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 Agency's 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 HA 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.

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

- The Highways Agency's Traffic England website
- Email alerts
- RSS feeds
- Twitter
- Roadside variable message signs

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 Agency Rijkwaterstaat Model (CHARM). The NTIS system could provide a potential solution for CHARM.

Benefits

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

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**

Profile of Economic Benefit

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.

4.4.3 Highways Agency: Public Access CCTV

Overview

The HA 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.

The primary users of the traffic cameras are the HA's 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. The images are sent to the Highways Agency's Information Line (HAIL) which keeps the public informed.

The HA has developed policies and a technical interface that will 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.

This approach has allowed the Agency 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

Two benefit realisation reviews took place between 2009- 2011 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.

Interoperability/Compatibility/Continuity

The project was delivered in 2007, combining technical delivery, with policy and procedures, to allow the HA 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.

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; or in-trip to divert onto a new route.

4.4.4 New Information Plan

Overview

The Highways Agency is developing an information plan to focus on the delivery of traffic information. This plan will describe the ways we will improve our information services during 2014 – 2015. It will also explain our longer term vision for information services. As vehicles, technology, data services and customer expectations evolve, we want to make sure that our information services are attuned to both what customers need and what they should expect from us.

Research tells us that information delivered in the right way delivers a number of direct customer and economic benefits. Through the delivery of the plan and our future vision, we intend to maximise those benefits and support economic growth.

Through delivering the actions in the plan, we will:

- Engage with our customers; providing reassurance when all is well and accurate information when the unexpected happens.
- Provide accurate information about works we are planning, 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 SRN for our partners and other stakeholders.
- Provide a robust framework for our activity in the future.

Matrix

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		√				

4.5 Transport Scotland: Traffic Scotland Information Service

Overview

The Traffic Scotland Information Service (TSIS) provides real-time information about the Scottish road network to the travelling public. TSIS disseminates information across a variety of platforms, including, Variable Message Signs, desktop and mobile websites, smart phone applications, Really Simple Syndication (RSS) feeds, Twitter, a dedicated call centre, national, local and commercial media and via a streaming internet radio service. The purpose of TSIS is to help drivers make informed decisions about the timing, routing and mode for current and future journeys. TSIS shares information using DATEX II with the bordering regional roads authority, the Highways Agency, to help deliver a seamless cross-border experience for the traveller. Furthermore, TSIS works, alongside Transport Scotland Network Operations Branch, with partners responsible for special events, for example ‘T-in-the-Park’ and the British Open Golf in order to develop and deliver dedicated event web sites, thereby proactively helping manage events which impact on the strategic network. 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

- Personalisation “My Traffic Scotland” – 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 – information delivered to users based on their location and their key journeys. Additions in 2012/13 included Precautionary Treatment Plans, Weather Stations, Enhanced Weather Information and Met Office updates. Planned enhancements include the introduction of further weather related information including Snow Gate Closures, Bridge Status and Police Travel Advice.
- Journey times – Additions in 2012/13 included increased coverage in Central Scotland, strategic routes, Local Authority cross-jurisdiction projects, and more VMS journey times. The next period will see journey times on TSIS progressing towards full Trunk Road coverage and continued partnership with Local Authorities; disseminating journey times across a range of technologies.
- Integration of new road schemes – several new road schemes have opened on the past three years. TSIS updates have been made to accommodate new mapping, roadside ITS and real-time information services. In 2013 further schemes will be completed, most notably the Forth Replacement Crossing; which will also be integrated into TSIS.
- Traffic Scotland Internet Radio - the Traffic Scotland internet radio service provides frequent national traffic and travel information bulletins focussed on the strategic motorway and trunk road networks streamed over the internet. The service is available through the Traffic Scotland desktop and mobile websites as well as the joint Traveline Scotland/Traffic Scotland smartphone apps on iPhone, Android, Windows Phone and the latest BlackBerry platforms.
- Key standalone projects – upgrading mapping technology, Automated Diary Facility and Freight Scotland, utilising new technologies where applicable.

Interoperability/Compatibility/Continuity

- Cross Border Information Provision – One of the first agencies to develop full functionality of data exchange through DATEX II allowing improved site functionality and cross border information provision.
- Direct integration of intermodal travel planner Traveline Scotland. Guidance and information for Park and Ride sites.
- Developing relationships with large event organisers such as T-in-the- Park, the British Open Golf and the Glasgow 2014 Commonwealth Games 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.

Future

- Greater personalisation of Traffic Scotland services.
- Moving towards greater use of in-vehicle information and the role personal devices will play in the future of connected vehicles, V2V and V2I.

Measurement/ KPI

- In 2012 the Traffic Scotland website delivered 139 million page impressions while the smart phone app reached 262,000 users - in addition over 54,000 users currently follow the twitter service.
- In 2012 the website availability was over 99%.
- In 2011 and 2012 Transport Scotland invested over £1M annually in the TSIS.

4.6 Transport Scotland: Traffic Scotland Control Centre & Backup Facility

Overview

The Traffic Scotland National Control Centre (TSCC) is housed in a purpose built 1200m^2 facility. The two-storey building was designed to accommodate a Contact and Education Centre for the Queensferry Crossing construction works as well as the TSCC.

The building provides a permanent working space for Traffic Scotland's needs alongside a public environment designed to provide a flexible gallery and consultation space for Transport Scotland both during and after the completion of the Queensferry Crossing – which will be completed by the end of 2016.

The exhibition room public facility, with a capacity of around 100 people, will be used for community engagement and educational purposes.

The ground floor comprises of the publicly accessible reception, lifts, stairs, toilets, disabled toilets as well as private staff office, staff restroom and locker room, meeting rooms, server room and plant rooms. On the first floor, there is a public exhibition area, Traffic Scotland Control Centre, resilience room, office, and plant room containing a rainwater harvesting system.

The cost of the TSCC facility was £3 M (excluding VAT) fixed-price, design and build contract. A back-up facility has also been implemented in Glasgow to provide business continuity, minimise down-time, and improve reliability and integrity

Results

The Traffic Scotland Control Centre was officially opened on 18 April 2013 and provides a facility to monitor and react to any incidents on Scotland's trunk road network 24 hours a day.

The Traffic Scotland Control Centre facilitates:

- Improved journey time reliability.

- Reduced disruption caused by incidents and roadworks.
- Minimising of the effects of congestion by the provision of alternative route advice.
- Ability of travelers to make informed decisions concerning route, time and means of transport by the provision of credible and accurate travel information.
- Improved safety and security for travellers.
- Continuity of the existing service and consolidation of all functions including those still located within Glasgow City Council premises.
- The centre has led to the replacement and consolidation of existing facilities (some of which were >25 years old) becoming increasingly inadequate in terms of space, facilities and access.

The co-located radio broadcast desk within the Control Room also has sight of the 40 screen video wall and is used to inform radio traffic broadcasts. The room location also allows a broad view of the two road bridges to the north, namely the existing Forth Road Bridge and the under construction Queensferry Crossing.

Interoperability/Compatibility/Continuity

Significant additional benefits have also been delivered by combining the Forth Replacement Crossing Contact and Education facility with the new Control Centre. Previously Transport Scotland's resilience operations were located in Glasgow, coordinating the emergency travel response via the establishment of the Multi-Agency Response Team (MART).

4.7 Transport Scotland: Management Dashboard

4.7.1 Overview

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.

The system is based on a phased approach, initially integrating data streams required to support the Glasgow 2014 Commonwealth Games activities, then building to add historic data and publishing data to the public and third party services.

4.7.2 Results

- The new system was developed to replace the current outdated and inefficient systems which required time consuming manual updates.
- A key requirement of the Management Dashboard was that it had to utilise data held in existing systems and display this data in real time on an easily accessible interface providing comprehensive information in a consistent manner.
- The dashboard has been designed to allow personalisation by configuring

which modules are displayed and where, tailoring the layout to suit individual needs or interests.

- Initially the dashboard will consist of a core web based dashboard and five key data feed modules which cover Trunk Road closures, Trunk Road incidents, bridges, snow gates and police area stages.
- Phase 1 as part of an initial roll out of the dashboard was used to support the Glasgow 2014 Commonwealth Games. This effectively replaced the current manual arrangements and supported more efficient management during the Commonwealth Games.

4.7.3 Future

- Phase 2 will provide Transport Scotland with better situation control over incidents and emergency scenarios. These functions will provide a central logging system which can be easily updated by multiple stakeholders during incidents.
- Phase 3 will provide users of the Management Dashboard access to a full range of historic incident information plus a detailed actions log. This information could be used for post incident reporting, to support debriefing investigations and learning processes.
- Phase 4 will see information published to the public and other third parties via the Traffic Scotland Information Service (TSIS) via dissemination channels such as desktop computers and mobile websites, Twitter, RSS, DATEX, and Internet Radio. This will ensure the travelling public have access to the latest updates on any developing situations.

4.8 Transport Scotland: National Traffic Data System – The Next Generation Data Warehouse for Scotland

4.8.1 Overview

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 and Local Authorities. The first phase of the system was made available in April 2014, replacing what has been the long established Scottish Roads Traffic Database with a scalable, modular system residing on modern hardware that will be able to incorporate additional datasets and link to other systems as it continues to expand over time.

This new central data warehouse, linking data sets that were previously kept in silos, with a secure web-based, configurable reporting interface, will bring to all of its users the potential to interrogate data in new and exciting ways that can provide solid foundations for future smart initiatives and innovative projects, aiding important decision making and strategic thinking across all stakeholders.

4.8.2 Results

The system collects and loads traffic data from external sources, stores it in a common format, validates it and makes it available to users via reporting and data extraction subsystems. The modern, responsive (allows deployment on multiple platforms e.g. desktop, smartphone etc) graphical user interface includes:

- Interactive maps
- Charts
- Export to file

Benefits to stakeholders:

- Encourage and foster relationships with other bodies (internal and external)
- Support more comprehensive reporting
- Support TS AIP Unit and SCP's amongst others
- Support Intelligent Mobility Future

4.8.3 Future

- The NTDS is fit for the future and will be easily expanded to include new data sets and outputs.
- Air Quality data - as the monitoring expands across Scotland under a programme of targeted emissions gathering.
- The Transport Scotland Delay Modelling Tool (DMT) – a direct interface will be created with the NTDS for up-to-the minute traffic related information for scheme and maintenance planners within the Operating Companies.
- The Traffic Model for Scotland (TMfS) – data collected under this framework can be stored, analysed and reported on within NTDS for use by those on such commissions as the LATIS framework.
- A Roadmap that sets out the vision for the NTDS will ensure that the full potential and benefits of the system will be realised by all of the above and many others including Local Authorities, Safety Camera Partnerships and other stakeholders within Transport Scotland.

4.9 Transport Scotland: Journey Time System Expansion

4.9.1 Overview

- An effective Journey Time System (JTS) is core to the Traffic Scotland Control Centre, allowing the Operator to effectively manage Scotland's Trunk Road Network. Scotland's National Transport Strategy published in December 2006, emphasised the need for improved and reliable journey times on the road network.
- In line with Transport Scotland's ITS implementation strategy, during 2007-10, the JTS enhancements project included the extension and enhancement of the Journey Time System including fusion with the M77 and M8 Automatic Number Plate Recognition (ANPR) system, TMU (Traffic Management Unit) journey times and Passive Target Flow Measurement (PTFM) data, development of a journey time prediction algorithm and increased use of historic profile data.
- Since 2010 the JTS expansion has been enhanced through the use of Bluetooth technology, additional coverage on key strategic routes, and partnerships with Local Authorities to provide seamless journey time information.

4.9.2 Results

- Enhancements to the JTS allowed improvements to be made in how congestion, reliability and journey time reliability were measured on the trunk road network.
- Provision of real time journey time information to users via Traffic Scotland.
- 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.
- In 2010 journey time monitoring began on the A9 between Perth and Inverness using Bluetooth technology.
- In 2011-2013 additional infill journey time monitoring was also implemented on the M80 and M74 schemes.
- Local Authority 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.
- A network management website and reporting facility for viewing current journey time conditions and interrogating historic data will also be developed. Fused journey time data is provided to enhance the level of information available to Traffic Scotland operations staff giving them the ability to manage and monitor large parts of the Scottish trunk road network.
- By providing a higher quality of information to network managers Transport Scotland aims to improve the efficiency and accuracy of strategic routing decisions and in turn reduce travel times and congestion on the network. The traveller will be more informed of the expected travel time by car when planning a journey and will be able to switch to more sustainable modes if the option is available, increasing travel choice and reducing travel times and congestion. This will help alleviate all sections of TEN-T that suffer unnecessary delays and safety problems.
- In 2011-2012 Transport Scotland invested more than £350k on journey time monitoring equipment and associated required system enhancements.

4.9.3 Future

Additional deployments working together with Local Authorities; Aberdeen and a second phase with Dundee; to better connect the trunk and urban road networks.

Completion and validation of the national trunk road journey time system for improved network operations and dissemination to the public. The proof of concept for this work has been completed in 2014.

4.10 Transport Northern Ireland – Enhancements to Trafficwatchni.com

4.10.1 Overview

The traffic watch website is a key means of disseminating information on traffic and travel issues. Recent enhancements include the inclusion of social media facilities of twitter feeds and SMS text messaging.

4.10.2 Objective

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.

4.10.3 Interoperability/Compatibility/Continuity

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

4.10.4 Evaluation

Not yet undertaken.

4.11 Traffic Wales Website Improvements (2010 – with ongoing improvements and enhancements) – All Wales Road Network

4.11.1 Overview

The Traffic Wales website and associated social media are key tools for communicating Welsh Government strategic road network information to the public. This project aims to continually improve the user experience by delivering enhancements to the website and defining the service's engagement with users via social media.

This project aligns 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

4.11.2 Future

Specific developments and enhancements required will be identified with the Welsh Government.

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.

4.11.3 Welsh National Traffic Data System (2012 – with ongoing improvements and enhancements) – All Wales Road Network

4.11.4 Overview

The focus of this project is 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 combines 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. Limited procurement of commercial sector traffic data will also be undertaken, serving to validate the information gathered into this all-Wales 'data fusion' system.

4.11.5 Future

The outcome of this project will be 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:** this will be a key feature, notably important for businesses reliant on Wales' main arterial routes from day-to-day. The scheme also provides Wales' network managers and travelling public with a similar level of information to their Scottish and English counterparts, aiding the Welsh economy as a whole in terms of encouraging inward investment.
- **Accurate and timely information provision facilitates incident response and empowers the public to make better travel choices**: signs and signals warning road users of conditions are displayed more immediately and with greater accuracy by traffic management centres; the emergency services are alerted more quickly, faster mobilisation becomes possible, secondary incidents are reduced and the time for restoration of the network improved. Up-to-date information delivered by Traffic Wales service apps, website, telephone line and links to third party broadcasters also contributes significantly by warning motorists of incident areas.
- **Availability of information for future schemes:** ready availability of traffic data reduces time and cost for design, implementation and assessment of schemes and future investment can be targeted more accurately by the Welsh Government.
- **Cross-organisational collaboration reduces public expenditure:** close working and sharing of infrastructure with the police (which is a key element of this scheme) on ANPR installations aids each party in achieving its own objectives as well as reducing criminality and reduces the overall public expenditure associated with ongoing maintenance.

This scheme is fundamental to achieving the dynamic road network management that innovative technologies can help us to achieve.

4.12 Transport Scotland: Environmental Data & Air Quality Monitoring

4.12.1 Overview

Currently, the major threat to clean air is posed by traffic emissions. Petrol and diesel-engine motor vehicles emit a wide variety of pollutants, principally carbon monoxide, oxides of nitrogen, volatile organic compounds and particulate matter.

To progress on the field of road emissions and their impacts Transport Scotland is taking forward the Collaborative Sensor Rotation Programme (CSRP) which involves procurement, installation, operation and data analysis throughout Scotland for Transport Scotland and other stakeholders.

The CSRP involves a series of short local air quality and noise assessments at agreed trunk road locations; linked to Local Air Quality Management Areas.

The data is collected using low cost, re-deployable sensors. Local traffic data is also collected for the same period; all data collected is analysed and reported. This evaluation measures roadside air and noise quality levels and links these to flow and fleet characteristics. Data and analysis is shared with Local Authorities and other stakeholders.

Transport Scotland is exploring real-time environmental incident management using air and noise quality metrics, models and algorithms that could be integrated into traffic management systems through the CSRP.

The project will build a collaborative community with stakeholders interested in air quality monitoring (i.e. Local Authorities, academia, government, consultancy, suppliers, manufacturers); remove anecdotal evidence surrounding low cost environmental monitoring, define the relevant metrics to measure, support before and after scheme assessments and provide evidence of fleet change and the impact on air quality.

4.12.2 Results

Lower cost, portable air quality monitoring equipment has been purchased and deployed on sections of the trunk road network intersecting with the urban road network. Traffic and meteorological data for these areas has also been collected and, working with the relevant Local Authority, this data is reviewed and analysed.

As part of the CSRP Transport Scotland have developed an Air and Noise Quality Monitoring Supersite with Transport Scotland on the trunk road network to facilitate environmental sensor development and evaluation. At the Supersite Transport Scotland have been working with the Scottish Environmental Protection Agency (SEPA) in a joint data collection and comparison exercise.

This project has also developed strong links between Transport Scotland and the University of Strathclyde, the Technology and Innovation Centre, Newcastle University, equipment suppliers and manufacturers and other air quality stakeholders in the UK. The project has helped to identify similar innovative transport and air quality work being undertaken in other parts of the world.

4.12.3 Future

This project will build a an important traffic and environmental dataset to help define the metrics most closely related to transport emissions, build a better understanding of the relationships between emissions, traffic and weather data and help inform the network operators and travelling public on traffic related air quality issues.

It is anticipated this project will feed into the Low Emissions Strategy for Scotland that is currently under development.

In the longer term, and based on the work of the CSRP, Transport Scotland may seek to develop a performance specification for a low cost air quality measurement system; as a component of the Environmental Incident Management System.

4.13 The Real Time Information Group (RTIG) Overview

4.13.1 Introduction

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.

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.

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.

4.13.2 Current Status

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.

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.

RTIG's over-air protocol for vehicle-to-centre communication, focusing on vehicle identification and location, is now widespread in the UK. Early discussions are underway on carrying the UK experience into other EU Member States. RTIG is addressing newer integration challenges through a series of working groups. This includes:

- How to provide relevant information to disabled and mobility-impaired passengers.
- How to provide useful information during service disruption. Increasingly RTIG is working with organisations involved in connected disciplines, for example:
    - With rail bodies, to establish how bus and rail information systems could be better aligned for intermodal journey planning/management.
    - With highways management bodies, to streamline services beyond traffic signal priority

4.13.3 Future Plans

RTIGs future plans involve developments in response to new technology opportunities, operational priorities and project integration needs.

RTIG now works closely with Passenger Focus, the UK national body responsible for championing passenger interests. The key lesson from this engagement is the need to avoid focusing solely on new technology – for example many passengers cannot (or choose not to) use smartphone apps, and still need at-stop signs.

A new opportunity has recently arisen to work with the Environment Agency, in order to make use of information on flood risk. This includes both topographic/modelling data for planning purposes, and real time flood warnings for alerts to both operators and passengers.

RTIG remains closely associated with CEN, where it acts as convener for the standards group responsible for on-vehicle system integration. This activity has been closely associated with the EU's European Bus System of the Future (EBSF) project, and RTIG is actively exploring how to take this into a demonstration phase.

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

4.14.1 Background

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.

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.

4.14.2 Solution

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.

4.14.3 Results & Benefits

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).

4.14.4 Next Steps

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.

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.

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

5.1 Variable Message Signs

5.1.1 Overview

The Highways Agency (HA) in 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.

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

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.

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

The HA is responsible for setting all the VMS on the strategic road network. 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).

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

5.1.2 Results

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.

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.

5.2 Transport Scotland – Variable Message Sign Deployment

5.2.1 Overview

Transport Scotland continued its multi-year investment into VMS in line with the EasyWay 2 work plan (2011-2013) and Transport Scotland ITS Action Plan.

Developing the VMS coverage increased Transport Scotland's traffic management capability and the level of on trip information disseminated to the travelling public. Site selection and development and key implementations have been undertaken across the Scottish Trunk Road Network including Trans-European Transport Network (TEN-T) road links.

Transport Scotland continued to infill gaps in the VMS network in Scotland to provide real time traffic management and guidance or travellers and hauliers.

The implementation of VMS at gaps in the network 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.

5.2.2 Results

Developments in 2008 included the installation, for final inception during 2009, of ten VMS in the Borders Region of Scotland. This enhanced the capability of Traffic Scotland operator control of the network. Furthermore, progression to Internet Protocol (IP) infrastructure allowed control from the existing Network Control Centre and enhanced this capability still further.

Between 2010 and 2013 significant deployment and investment in VMS has been made on the M74 and M80 completion works and the new Queensferry Crossing.

As part of the construction of the new Queensferry Crossing, currently on track to be delivered in 2016, and related Fife ITS and Junction 1A projects, the following VMS equipment will be installed:

- 57 MS4 VMS
- 1 Bus Shelter VMS
- 10 Local VMS (Advanced Direct Signing)
- 2 Rotating Prism VMS
- 2 Local VMS

Furthermore, in 2014 as part of the M8/M73/M74 Motorway Improvement Programme, estimated to begin construction in 2014, 20 strategic VMS (MS4 6x23 cantilever) will be installed, as well as 35 gantries with VMS equipment.

Increased network efficiency in Scotland as VMS implementation contributes to network efficiency and therefore benefits the European network by reducing congestion and consequently road related emissions. In 2011-2012 Transport Scotland invested over £7.5M in VMS deployment (including dynamic lane and speed control signs).

5.3 Northern Ireland CCTV & Variable Message Signs (VMS)

5.3.1 Overview

TransportNI already has an extensive network of CCTV cameras and variable message signs. Work is underway to establish call-off contracts for these facilities.

5.3.2 Objective

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.

5.3.3 Interoperability/Compatibility/Continuity

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

5.3.4 Evaluation

Will be undertaken in due course

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

5.4.1 Overview

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.

5.4.2 Objectives

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

5.4.3 Update on Progress

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

5.4.4 Interoperability/Compatibility/ Continuity

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

5.4.5 Evaluation

Not yet undertaken.

5.5 Motorway & Trunk Road Network – “All Wales” VMS

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

The primary objective of the project is to successfully deliver the design, procurement, construction, installation, commissioning, testing and handover of the VMS and CCTV sites to form an “All Wales” Solution.

The M4 motorway, the A55 and other strategic trunk roads are not fully signed which leaves a number of junctions without the means of supplying visual road information to the travelling public.

Approximately fifty locations for new VMS sites in North, Mid and South Wales have been identified where the installation of electronic signage would assist with the strategic diversion of traffic during an incident or where tactical signing would improve driver comfort/safety by providing traffic information and journey times in response to incidents.

In addition a number of CCTV sites have been identified that would improve the CCTV coverage in areas of the motorway and trunk road network that are currently not provided. The scheme will comply with the Wales Transport strategy by improving the actual and perceived safety of travel.
Stakeholders: Welsh Government, WTTC, NMWTRA, SWTRA.

5.6 Smart Motorways

5.6.1 Overview

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.

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.

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.

5.6.2 Results

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.

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.

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.

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.

5.6.3 Delivered Schemes, Cost & Benefit

Based on the latest outturn costs for the schemes completed in the last three years, in total 6 schemes have been delivered as a cost of £943m, comprising:

- 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)

Evaluation of early schemes has shown that they met the objectives of reducing congestion and improving journey times without negatively impacting safety. Evaluation is ongoing for more recent schemes.

5.6.4 Future Schemes & Cost

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
- M62 J18-20 – All lane running £208.3m
- M6 J10a-13* £87.4m

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

For schemes to be delivered between 2015 and 2021 we can estimate a total programme cost of between £3bn to £4bn, comprising of:

- M4 J3-12
- M1 J24-25
- M6 J2-4
- M6 J13-15
- M6 J15-19
- M6 J21a-26
- M5 J4a-6
- M1 J13-19
- M3 J9-14
- M27 J4-11
- M23 J8-10
- M20 J3-5
- M60 J24-27
- M62 J10-12
- M56 J6-8

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.

5.7 Transport Scotland: Major ITS Deployment

5.7.1 Overview

Transport Scotland are utilising a variety of ITS based approaches, and are committed to applying these approaches, such as variable speed limits, ramp metering and hard shoulder running, across the most congested parts of the trunk road network.

Within the current programme, managed motorways principles using ITS are being designed into the M74 Completion, M80 Stepps to Haggs and the Forth Replacement Crossing.

Key recent ITS deployment projects include:

- Fife ITS and M9 J1a
- M74 and M80 completion

Ongoing and future projects include:

- Queensferry Crossing
- Aberdeen Western Peripheral Route (AWPR);
- M8/M73/M74 Upgrade

5.7.2 Progress

Fife ITS - The scheme delivers a series of Scottish “firsts” including the use of Variable Mandatory Speed Limits (VMSL), bus hard shoulder running with associated “through junction running” and dynamic incident detection/management. ITS features include mandatory speed and lane signalling, variable message signing, incident detection, journey time information, CCTV and roadside emergency telephones. Much of the technology is mounted above the carriageway on eighteen gantries which are strategically placed on the network and connected by a fibre-based communication network to the new Traffic Scotland National Control Centre, in South Queensferry.

M9 J1a – Overhead signal gantries along this corridor provide lane control, variable mandatory speed control and traffic information to drivers via VMS. ITS controls a southbound hard shoulder bus lane from the M90 to Newbridge, allowing southbound buses to avoid queues on the slip road.

M74 Completion - Provision and installation of 22 gantries, including foundations an associated maintenance lay-bys. The gantries support ITS equipment and direction signing (advanced message indicators, APGVMS). Associated with the gantries is the provision of hard landscaping, ducting, cabling and carriageway traffic detectors.

M80 – The new 18 kilometres of motorway, equipped with ITS (CCTV, VMS, monitoring infrastructure), was completed in August 2011, ties in with the existing M80 at Junction 2 (Robroyston) and north of Haggs.

5.7.3 Future

Queensferry Crossing - Provision and installation of approximately twenty gantries, including foundations and associated maintenance lay-bys. The gantries support ITS equipment and direction signing. The project also includes the provision for co-modal information and services, 142 Lane Control Unit (LCU) Standard units; and 44 LCU Enforceable units.

AWPR - The Aberdeen Western Peripheral Route is a major transport infrastructure project which will significantly improve travel in and around Aberdeen and the North East of Scotland. ITS will be deployed as part of this project to help improve safety, reduce congestion and increase journey time reliability. Prior to construction a significant traffic monitoring and data collection will be carried out to support scheme before and after studies. This upgrade will reduce congestion and improve journey times and journey time reliability through the Central Scotland motorway network.

M8/M73/M74 Upgrades - work is now underway to upgrade the core of Scotland's motorway network, which will boost Scotland's economy by improving connections between the commercial centres of Glasgow and Edinburgh and beyond.

5.8 Northern Ireland M1/A12 Westlink Variable Mandatory Speed Limits (VMSL)

5.8.1 Overview

The M1/A12 Westlink is a key route within the Northern Ireland public road network carrying approx 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.

5.8.2 Objectives

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.

5.8.3 Update on Process

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.

5.8.4 Interoperability/Compatibility/Continuity

The A12 Westlink 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 Westlink for Belfast City Centre.

5.8.5 Evaluation

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.

5.9 Wales M4 Variable Speed Limit (VSL) Automatic Congestion Operation (2011 – with ongoing improvements and enhancements)

5.9.1 Results

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

5.10 Wales Rural Trunk Road – Average Speed Enforcement (2011 – 2013, with ongoing improvements and enhancements)

5.10.1 Overview

The 14km A465 stretch between Hirwaun and Dowlais has been identified by the Welsh Government as a stretch requiring speed enforcement to ensure speed limit compliance.

5.10.2 Objectives

The objectives of the project are to:

- Design and deploy a fully operational Average Speed Enforcement System
- Reduce Killed and Seriously Injured numbers for this road
- Increase in speed compliance
- Smoother, more efficient traffic flow

5.10.3 Results

To ensure has been shown to have reduced the KSI casualties and has harmonised traffic speeds to reducing congestion, particularly during the duelling roadworks.

Further value is being currently achieved through the sharing of data, and kit, e.g. ANPR data to Police, Speed Enforcement POD deployment to other enforcement sites.

5.11 Welsh Motorway – M4 Variable Speed Limit (VSL) Automatic Congestion Operation (2011 to on-going)

Overview

The general aim of the project is on-going improvements and enhancements to manage ensure:

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

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

5.12.1 Overview

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.

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.

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 HA 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.

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

5.12.2 Results

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.

5.12.3 Cost

- 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).
- The call-off services are included as part of the individual scheme business case and are paid for by individual schemes.
- In the last three years spend has totalled £61.7m for 11/12, £62.1m for 12/13 and £63.1m for 13/14.
- 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.

5.12.4 Benefits

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.

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. 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.

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.

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.

5.13 Transport Scotland – Further CCTV Rollout

5.13.1 Overview

CCTV cameras were installed at key trunk road locations on the M74, M73 and M8 in order to infill gaps in the network during 2007 – 2009. The additional information available enhanced the incident detection capability of the control centre, and helped reduce the impact of incidents on the network.

Since 2009 deployment of CCTV was progressed at weather stations to improve the level of monitoring on the network primarily in more rural areas. Up to date CCTV images from these new locations have been made available on the Traffic Scotland website and relayed to the Traffic Control Centre via a new Mosaic Traffic Control System allowing multiple camera viewing at one time.

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 in line with the ITS Deployment Strategy. The primary objective of this project is therefore to deploy monitoring infrastructure for the collation of data and at an appropriate level on the Scottish trunk and TEN-T routes which is fit for purpose, and helps enable traffic control centres to exchange data.

5.13.2 Results

- To maximize investment, in 2011 and 2012 additional CCTV cameras were also collocated with existing VMS on the network.
- The deployment of CCTV to infill gaps in the network contributed to increased monitoring across Europe and increased the level of information available to the traffic control centre.
- As part of the M8/M73/M74 Motorway Improvement Programme, estimated to begin construction in 2014, 21 CCTV cameras will be installed.

- As part of the construction of the Forth Replacement Crossing, currently on track to be delivered in 2016, and related Fife ITS and Junction 1A projects, 74 CCTV cameras will be installed.
- In 2011-2012 Transport Scotland invested over £550k on CCTV and associated integration work.

5.13.3 Interoperability/Compatibility/Continuity

- Transport Scotland have invested in a central digital CCTV integrated platform, interconnecting existing systems.
- The objective of this activity is to deploy monitoring infrastructure for the collation of data which is fit for purpose, and to enable traffic control centres to exchange data with the common aim of achieving an appropriate level of service throughout TEN-T. Particular emphasis will be placed on congested, safety critical spots and weather critical sections of the network.
- Project activity focused on:
- Increasing data exchange between regional and national control centres;
- Infilling gaps in the network of European Traffic Management Centres.
- Identifying information needs for transport network information databases.
- Providing the basis for coordinated action between different bodies active in traffic management, in response to events.

5.13.4 Future

In preparation for the Ryder Cup 2014 five additional CCTV cameras have been installed on the A9 between Greenloaning and Perth to monitor increased road network demand at the time of the event. The investment spend on these cameras is £200k.

5.14 Transport Scotland – Delay Modelling Tool

5.14.1 Overview

The need for a method for delay modelling which could be applied by all Transport Scotland's Operating Companies emerged with the development of the Fourth Generation Operating Companies Contracts. Operating Companies need to 'assess the impact of proposed road works or any other activity being undertaken which shall reduce the operational capacity of the Trunk Road network'.

5.14.2 Results

For this purpose Transport Scotland have developed a Delay Modelling Tool (DMT) which uses the necessary inputs to model anticipated delay and help determine if more detailed evaluations of potential works may be required.

The DMT is integrated into the existing Traffic Scotland Content Management System (CMS). The Tool allows Operators to:

- Model roadworks based on historic data
- Create delay models for links on the Trunk Road Network
- Select specific monitoring sites on links – historic traffic count and speed data for these sites is used as inputs to the models
- Set up works types and works dates and times for the delay models

When the model is run the DMT uses an algorithm based on the operators' inputs to predict a number of Key Performance Indicators (KPIs). In particular the maximum delay expected and whether that delay is acceptable. The DMT allows operators to visually assess model runs. Examination of graphical outputs allows the operators to alter their inputs and re-run the model so as to meet criteria for acceptable delays.

5.15 Transport Scotland – System Architecture Improvements

5.15.1 Overview

The upgrade and development of the communications infrastructure across Scotland's trunk roads included the migration of the existing infrastructure towards a new network with IP connectivity.

The IP network provides long term support to ensure continuity between existing and future systems, future compatibility and future roll out of ITS in Scotland. Work done in 2007 included the outline designs for the IP network and the submission for design review. Work done in 2007 supported the ongoing relocation of the National Network Control Centre (NNCC) to the Integrated Transport Management Centre (ITMC) including the provisional move to the Interim Control Centre (ICC).

Work undertaken in 2008 included the design of IP architecture for the key M74 and M8 TEN-T route. Compatibility testing of the new IP infrastructure including small scale deployments was also progressed.

Work in 2009 included the deployment of more efficient communication hubs on the network and further implementation of fibre optic cabling to improve data transfer and produce a virtual ring for fast, secure information exchange to the control centre.

Transport Scotland's key objectives for this project were to increase the efficiency and capacity of all aspects of information exchange on the TEN-T where the implementations have occurred by securing better information exchange between the network monitoring infrastructure and the network management and traveller information tools.

5.15.2 Results

Progression to an IP architecture enhanced the capability of Traffic Scotland to monitor, evaluate and manage the entire trunk road network and enhance the effectiveness of all ITS implementations. Improvements provide European added value by improving safety, reducing congestion and reducing emissions.

5.15.3 Interoperability/Compatibility/Continuity

An efficiently connected ICT Infrastructure is a prerequisite for the deployment of ITS services, providing the end user with relevant and high quality information from systems that monitor the road situation. A connected European ICT infrastructure will enable cross-border interoperability and continuity of services through the exchange of harmonised data.

The connected ICT Infrastructure consists of three dimensions:

- Systems for collection of data (monitoring systems)
- Systems and protocols for communicating data (e.g. between Traffic
- Management Centres and to and from vehicles)
- Issues relating to the quality of data (accuracy, timeliness)

The objective of this activity is to deploy monitoring infrastructure for the collation of data which is fit for purpose, and to enable traffic control centres to exchange data with the common aim of achieving an appropriate level of service throughout TEN-T. Particular emphasis is placed on congested, safety critical spots and weather critical sections of the network.

Although monitoring infrastructure development does not directly contribute to the policy goals, traffic management and traveller information services could not be established without access to information regarding the network situation provided by monitoring systems.

Project activity focused on:

- Increasing data exchange between regional and national control centres.
- Identifying information needs for transport network information databases.
- Collecting the required data (deployment of travel time, traffic status, road weather and air quality monitoring).
- Providing the basis for coordinated action between different bodies active in traffic management, in response to events.
- Establishing a network for the exchange of traffic information, including design and implementation of the necessary information management tools in Traffic Management Centres.

5.16 Northern Ireland Journey Time Measurements

5.16.1 Overview

TransportNI use 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.

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.

5.16.2 Interoperability/Compatibility/Continuity

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

5.16.3 Evaluation

Some evaluation has been undertaken.

5.17 Northern Ireland Cross Boundary Information Sharing using DATEX II

5.17.1 Overview

TransportNI 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.

5.17.2 Objective

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

5.17.3 Interoperability/Compatibility/Continuity

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

5.17.4 Evaulation

Some Evaluation has been undertaken

5.18 Northern Ireland – Resilience and Business Continuity

5.18.1 Overview

TransportNI is currently considering the resilience of its traffic control and travel information services with a view to migrating to IP Protocols.

5.18.2 Objective

To provide greater resilience in the service being provided.

5.18.3 Update on Progress

Business Cases being prepared.

5.19 Welsh M4 Motorway OptiSense, Acoustic Network Monitoring (2012 – with ongoing improvements and enhancements)

Overview

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.

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

Potential secondary objectives have also been identified and include:

- Security
- Copper Theft
- Asset Condition Monitoring

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.

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.

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

Overview

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.

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

5.21.1 Overview

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.

POSSE is 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).

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.

5.21.2 Results

The main outputs of the project will be:

- A review of the effectiveness of UTMC and OCA activities in their home countries (now published).
- Good Practice Guidelines for the benefit of the project partners and other interested cities and regions (due end 2014).
- Implementation Plans for all cities and regions within POSSE setting out how they will look to implement or further develop Open Specifications and Standards following the project (due end 2014).
- An Exploitation Plan summarising the effectiveness of the Knowledge Exchange project, and outlining how it could be built on.

This has been complemented by a wider exchange of knowledge across Europe through a Forum involving the EC and numerous other member states including NL, FR, RO and others. Links have also been made outside Europe, with the City of São Paulo being particularly keen to engage.

5.21.3 Cost

- The entire POSSE project has a budget of €1.8m
- The UTMC input has a total budget of €211k
- UK Department for Transport is providing the national co-financing, via Reading, of €53k

5.21.4 Benefits

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:

- 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.
- 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).
- 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.

5.22 Transport Scotland: Text to Speech App for Freight Users

5.22.1 Overview

Following on from a successful demonstration of text-to-speech capability, Transport Scotland are keen to expand on the technical knowledge gained and develop a trial mobile application to test the concept with a user group. For the trial it is proposed that the application is developed for the freight community in Scotland as this will provide a controlled user group to test the new application.

The concept harnesses the latest text-to-speech technology, and recent advances in smart devices, to pro-actively deliver information to drivers without requiring them to read from a screen.

5.22.2 Results

The system provides a number of benefits to users, most notably ensuring that they can access real-time information while on the move in a safe manner.

The service will incorporate a location-aware feature allowing users to receive automatic alerts of events in their vicinity via an audio announcement.

As users travel along, the service will track their position and run periodic searches for any events coming up in their area. The service will convert the event information to an audio file and read it aloud to users.

Camera icons can be placed on the map allowing camera images to be viewed in the same way as event information. These images in relation to event information can be reviewed prior to driving to aid in deciding which route to take.

Since the trial version of the app was launched in March 2013 it has been downloaded 2989 times creating 18864 files audio files; user feedback is an important part of the project and this currently being collected for evaluation and to direct future enhancements.

This is a relatively low-cost solution, building on new technology and engaging with different users of the Traffic Scotland Information Services.

5.22.3 Future

The app was originally a trial linking to the Freight User Group Transport Scotland have built connections with. This has been extended to all users and additional functionality and features have been added (CCTV LEVs ERTs, increased range), with additional enhancements planned.

5.23 Cloud based traffic management system in Portsmouth

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.

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.

5.24 Traffic Management

TM 2.0 – the next generation of traffic management systems and processes has been a topic of discussion and speculation for some time. At the recent 2014 European ITS Congress in Helsinki the TM 2.0 programme was launched to set some structure to these discussions and to co-ordinate development and actions. 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.

In line with this an inaugural UK Traffic Management Summit was organised by DfT and TomTom in October 2013 and a White Paper on the future of Traffic Management was produced as the major output from the summit. The organisers are proposing that this becomes an annual event focusing on this important area of policy and systems development.

5.25 Transport for London freight route prioritisation

5.25.1 Overview

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

5.25.2 Background

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.

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.

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.

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.

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.

5.25.3 Objectives

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

5.25.4 Results

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.

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

6.1 Transport Scotland: Incident Management Forum

6.1.1 Overview

Transport Scotland have formed an Incident Management Forum 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.

The forums are held regularly and include participation from Police Scotland and other partner organisations.

6.1.2 Results

A recent initiative coming from the Incident Management Forum is the purchase to five 3D scanners to help police investigate crash sites, at a cost of £250k.

It is anticipated the technology will reduce the amount of time roads are closed after a crash. The scanners rotate 360 degrees while capturing the scene at a million points per second, allowing officers to record the site more accurately and quickly than traditional methods. Officers can then view the site as a virtual image on a laptop and view it from any angle.

The technology will allow police to undertake a full virtual survey of the site more quickly that using traditional manual surveying equipment.

When the data is captured and the investigation complete, officers will present the images at court in their final format. This will enhance the quality of evidence available to the court, and will provide a virtual representation of the scene that will make it easier for those involved to visualise the crash scene.

The technology will be of particular use in more rural areas where there are fewer diversion routes available when incidents take place.

6.2 Transport Scotland: Trunk Road Incident Support Service

6.2.1 Overview

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.

6.2.2 Results

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

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

TRISS is provided by Operating Companies Bear Scotland and Scotland TranServ as part of their contract with Transport Scotland.

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.

6.2.3 Primary Aims:

- Improve journey time reliability by managing and reducing the impact of disruption caused by incidents on motorways and trunk roads.
- Improve safety and security for travellers by early identification and removal of incidents, resulting in a reduction of secondary accidents.
- PSAP1 (Public Service Access Point) is close to being “eCall ready” for the pan-European System.

6.2.4 Objectives:

- Under Police instruction, make incidents safe by deploying temporary traffic management.
- Relieve congestion and remove hazards to safety by clearance of debris from traffic lanes and hard shoulders.
- Where possible make repairs to damaged parts of the trunk road network.
- Offer assistance to broken down vehicles including assisting in removing broken down vehicles to safe locations.

6.3 Transport Scotland: A9 Average Speed Camera Scheme

Overview

As part of a group of measures Transport Scotland are deploying an average speed camera system on the single carriageway A9 between Perth and Inverness. This section of road has higher than national average fatal and serious road accidents.

Construction on the new camera system will see columns, cameras and infrared lighting masts erected at 27 sites along the single carriageway sections. The network is expected to go live in October 2014.

Stakeholders in this project include the Scottish Government, Transport Scotland, Police Scotland and the A9 Safety Group.

The camera system will back up a number of measures that have been introduced on the A9 to help improve safety in recent years

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.

Currently the average speed cameras have been installed on the Perth to Pitlochry section of the A9.

Although the cameras are not operational yet they have reduced speeding from one in three drivers to one in ten.

Transport Scotland hope to emulate the success of other average speed enforcement schemes across the UK which have seen an average of 61% reduction in fatal and serious accidents.

The total cost of the project is anticipated to be £2.5M.

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

6.4.1 Overview

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.

The key objectives of the project are:

- To ensure compliance with the EU directive and RTSR.

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

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

Overview

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.

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

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

Overview

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

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

6.7.1 Overview

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.

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.

6.7.2 Objectives

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.

6.7.3 Description

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.

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

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.

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.

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.

6.7.4 Results

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.

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.

6.7.5 Future

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.

6.8 Transport for London: ITS Road Safety and Security Applications

6.8.1 Overview

TfL is committed to employing the latest technologies and innovation in improving road safety in the Capital. Intelligent Transport Systems (ITS) have a key role to play in preventing deaths and serious injury on the roads, and TfL continues to identify new ways of using this technology to deliver casualty reduction savings.

In 2013 TfL published Safe Streets for London; an ambitious and comprehensive plan to make the Capital's roads safe. One of the Mayor and TfL's top priorities is to reduce by 40 per cent the number of people killed or seriously injured on London's roads by 2020 and action is being taken to prioritise the safety of the most vulnerable road users: pedestrians, cyclists and motorcyclists. The plan identifies the role that Intelligent Transport Systems have in meeting this challenging target.

6.8.2 Cycle Safety

TfL's commitment to improving cycle safety includes trialling and implementing cycle-specific traffic signals, enabling the separation of cycle movements from those of other vehicles at junctions. This includes the use of smaller, low-level signals, which show green, amber and red cycle symbols and are mounted at cyclists' eye level. We have trialled these off-street and have entered into a phase of on-street trialling, beginning with the installation of low-level signals at Bow Roundabout. The impact of these is being closely monitored. TfL has applied to DfT for authorisation of further trial sites in London.

6.8.3 Speed cameras

TfL has pioneered the use of average speed cameras for collision reduction along the A13, a major urban road. Following the success of this pilot four further trial sites have been identified, installation will begin later this year.

6.8.4 Pedestrian Countdown

Pedestrian Countdown timers, that give pedestrians a clear indication of how much time they have to safely cross the road, have been installed at 200 sites across London. Over the next two years we plan to expand the use of Pedestrian Countdown technology to more than 400 sites, roughly 10 per cent of all pedestrian crossings in London.

6.8.5 Digital speed limit map

TfL has recently launched an updated 'Digital Speed Limit' map for London, to help spur the development of the next generation of in-vehicle technologies and mobile phone apps for the road. Making such information freely available, and keeping it accurate, means existing services such as Sat-Nav and GPS providers can offer drivers the correct information on the speed limit of the roads they are travelling on, giving them greater certainty, helping them to keep safe and avoid speeding penalties.

6.8.6 Intelligent Speed Assistance

The speed limit map will also help to pave the way for a range of future driver assist trials in London including the forthcoming Intelligent Speed Assistance (ISA) on London Buses trial, planned for 2015 (subject to further discussions and technical approvals).

The trial aims to understand the potential role of this technology on buses in promoting adherence to speed limits across the road network.

TfL will be carrying out ground-breaking trials of innovative collision detection software on London Buses this summer. The innovative trials will build on research previously carried out by TfL on detection equipment and will look to test the effectiveness of radar and optical technology for reducing collisions with cyclists and pedestrians. TfL is also funding a project into Blind spot safety technology, which can be fitted to Heavy Goods Vehicles (HGVs) to help reduce the risk of collisions between HGVs, pedestrians and cyclists

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

7.1 Transport Systems Catapult

The Transport Systems Catapult was established by the United Kingdom with a focus on accelerating the application of technology and innovation driven measures with the specific aim of addressing the challenges facing the transport system. With the objective of promoting and enabling Intelligent Mobility – the effective and efficient movement of people and goods – the Catapult's collaborative approach brings together the best ideas from academia, the private and public sector. This enables partnerships to be established that explore and develop innovative proposals up through the Technology Readiness Levels.

The Catapult's activity is currently centred on a limited number of core themes:

- Enhancement of the customer experience – with particular emphasis on bringing together datasets to improve our understanding of transport networks on a system basis, thereby enabling more efficient use of existing transport infrastructure.
- Improving the overall resilience of the transport system – with particular emphasis on the importance of data integration to assist in maintaining continuity of services across the transport system.
- Developing opportunities presented through the application of vehicle-to-vehicle and vehicle-to-infrastructure technology as a means of improving the efficiency of existing transport infrastructure.
- Delivering a UK technology demonstrator for autonomous vehicles through the construction and testing of autonomous 'pods'

The Catapult's approach focuses on the end user of the transport system ensuring that technology and innovation are applied equally to people and goods.

At the heart of the Catapult's mission is the importance of developing knowledge and capability that can be applied not just in the United Kingdom, but more widely across the rest of Europe and beyond. In this regard, the Catapult is actively engaged in European networks – such as ALICE and ERTICO – and actively seeks to be a member of, and support, European consortia established to foster new thinking.

7.2 Government activity on Cooperative Systems and Autonomous Vehicles

The UK is actively considering how it can influence the future direction and stimulate innovation in the use of advanced autonomous systems for road transport. There a several initiatives currently pursued the key areas are as follows.

7.2.1 Low-carbon Urban Transport Zone (LUTZ)

The LUTZ programme was announced in November 2013 and is being developed by the UK Automotive Council. It is expected to be a 5 year programme based Milton Keynes – a large town in central England. It is intended to be a testing ground for innovative transport systems based in an urban environment, specifically to realise the potential for autonomous vehicles (likely to be driverless 'pods') and on-demand transport services.

7.2.2 Regulatory Review and £10million Prize Fund for Driverless Cars

The Government recognises the move towards these driverless technologies for road vehicles more widely and is seeking to ensure the UK captures the opportunity to assist in the innovation landscape. It was announced in the financial Autumn Statement (in December 2013) that '*to ensure that UK industry and the wider public benefit from the development of driverless cars'*, the government will conduct a review to be completed by the end of 2014 to '*ensure that the legislative and regulatory framework demonstrates to the world's car companies that the UK is the right place to develop and test driverless cars'*. The Terms of Reference for the review were published on 30 July 2014.

In conjunction with this review it was further announced that the Government will create a £10 million prize for a town or city to develop as a testing ground for driverless cars. The programme details were announced on 30 July.

7.2.3 Platooning

Platooning (sometimes referred to as convoying) is the electronic coupling of vehicles to run in close formation. By allowing vehicles to run closer together the Government recognises the potential fuel savings and reduce carbon emissions, reduced congestion by creating more efficient use of the network and reduce road casualties by eliminating driver error from accidents. The department for transport has recently concluded a feasibility study on heavy vehicle platooning on the UK trunk road network using vehicles with partial automation - but with drivers in each vehicle. Decisions on next steps are expected by the autumn of 2014.

7.2.4 Oxford Driverless Car Trials

The Mobile Robotics Group at Oxford University led by Professor Paul Newman are trialling a Nissan Leaf electric car on public roads near to their laboratories in Oxford. The technology on this car is different to the 'Google' car as the researchers are using radar technology that is more suited to high volume produced vehicles (less expensive). The trial uses a single vehicle under tightly controlled cooperating conditions.

7.3 Pedestrian SCOOT (2013 – 2015)

7.3.1 Overview

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.

7.3.2 Objectives

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.

7.3.3 Results

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.

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.

7.4 Cooperative Systems in TfL

7.4.1 Introduction

A Cooperative Network is the next step in the evolution of ITS, one where TfL is exploiting developments in the mobile and sensor world and gradually removing the existing dependency on costly equipment purchase and installation. A Cooperative Network opens the possibility of exploiting existing pervasive alternatives, such as using mobile phones or other discreet devices, to capture information about our roads. In addition, an increase in data granularity through the use of a huge number of mobile sensor points provides TfL with an improved, up to date view of what is happening on the network.

TfL's understands a cooperative system as a system where all nodes, such as vehicles, infrastructure, and people, are connected together in real time using mobile and pervasive technologies and where Information is shared between nodes and informed decisions are made.

There are two main requirements behind the drive towards a Co Operative System:

- Improve situational awareness of the TfL network and increased data granularity as to its performance.
- Reduce the dependency on on-street equipment where alternative, mobile based devices provide data sets that match or improve on existing ones.

At times, these two drivers will be in conflict. For example, increasing the level of intelligent infrastructure may at times be necessary to provide improved visibility of the TfL road network where mobile alternatives are not available.

Developing a fully functional co-operative road system where all nodes and surface modes on the network are interconnected in real time. It will deliver a step change from traditional traffic management procedures (and fixed assets) and significantly increase operational capability using a variety of real-time data sources.

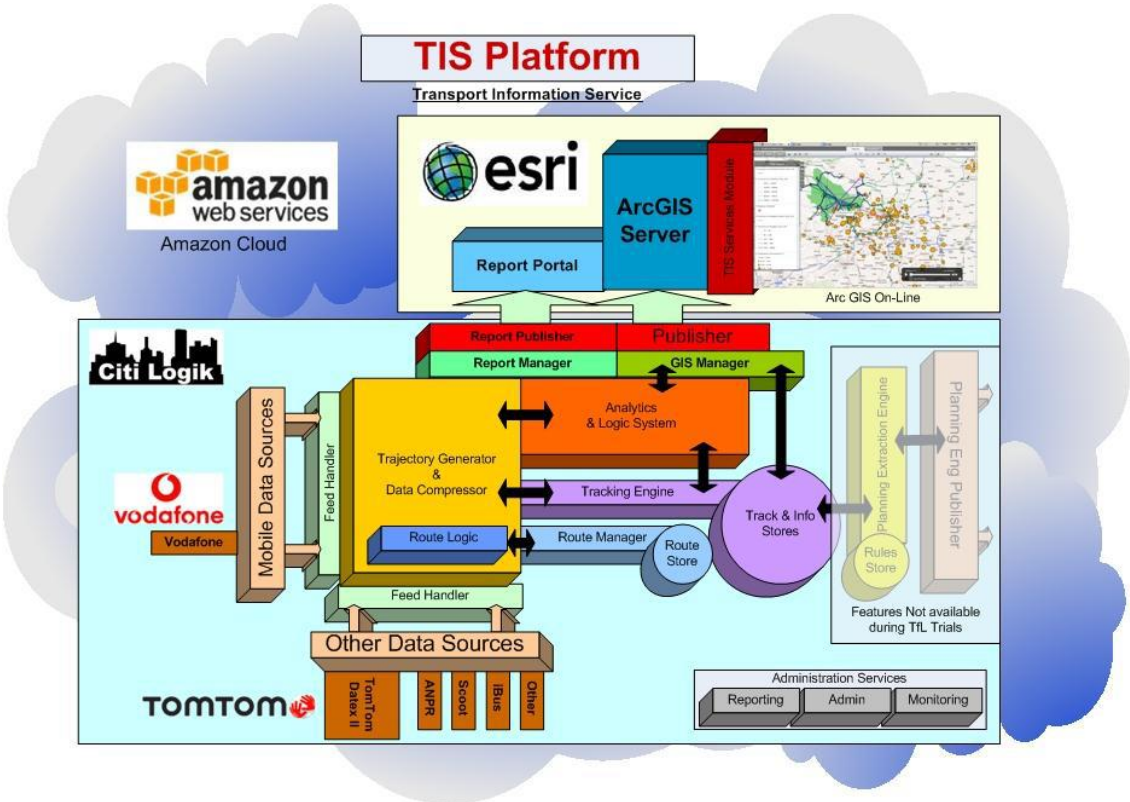
7.5 Examples of three pieces of work

Background

Esri UK, Citi Logik, Vodafone, TomTom and TfL worked together to prepare and operate a service for the Co-Operative System Trial. The explicit aim was to explore cooperative methodologies to reduce infrastructure costs, improved data granularity and increase data availability; and to put the traveller at the centre of the journey.

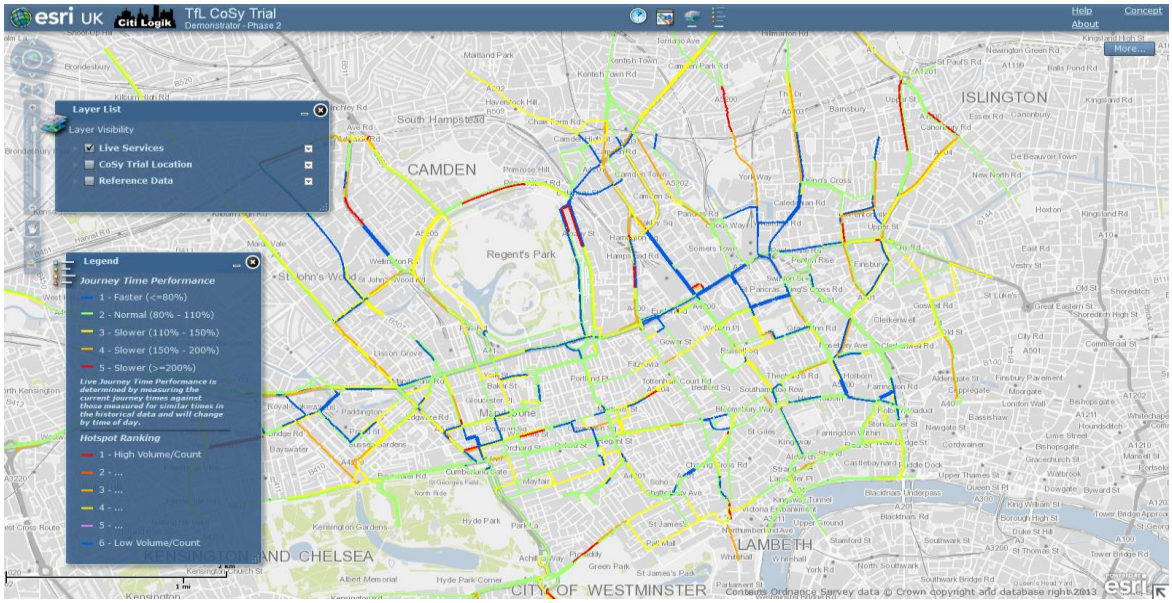
During the trial they 'demonstrated the ability to capture and share real time information on the status of the road network focused on the KPI of Journey Time Reliability' by deploying our collective technology expertise and domain knowledge.

7.5.1 Delivery Agents



It requires no roadside infrastructure or significant capital investment, making use of new technology to gather the raw data feeds, process and present situational awareness for pedestrians and vehicles in real time.

Visualisation and Analytics:



Measurements:

Total data feed processing	23 Billion + Data updates
Peak Data feed processing	20,000 updates per second
Total journeys recorded	1.2 Billion Journeys

7.5.2 Outcomes:

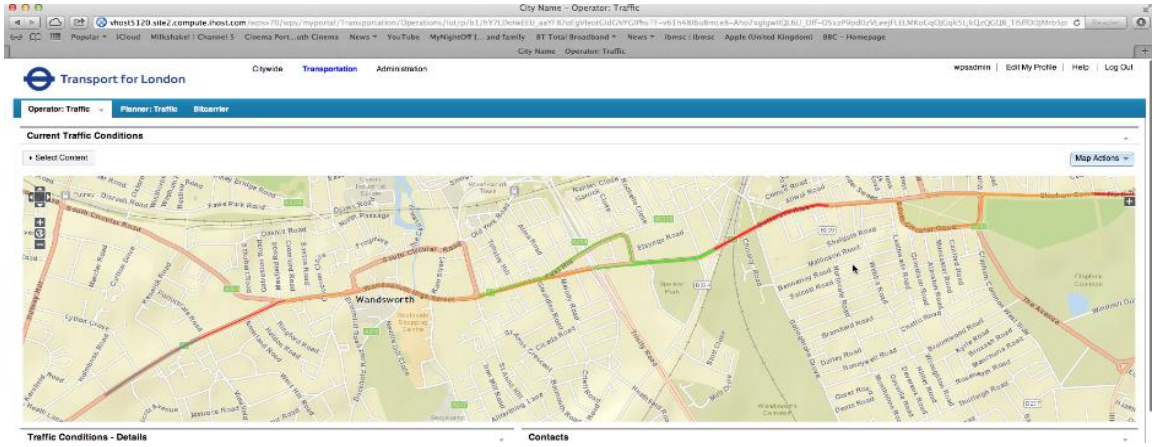
- Improving *situational awareness* through improved data granularity, requiring reduced infrastructure coverage to deliver real time information dissemination.
- Reduce the time interval between events happening on the network and TfL being aware of them through faster real-time situational awareness.
- Greatly increased the available sensor network by aggregating the use of both SatNav and mobile phone sensors. Data volumes and traced routes delivered through the system ran into the millions on a daily average.
- Minimising the level of prospective configuration in order to demonstrate the benefits of a COTS solution; as a means of reducing the operating costs associated with legacy on-street equipment.
- Cloud based deployment with expansion and ease of deployment without significant time and costs in environment configuration.

7.6 IBM: Delivery Agents

The IBM CoSy (Cooperative Systems) solution contains a number of discrete components, including:

- A new Bluetooth sensed environment that was deployed on a stretch of the A3 at Wandsworth Town using Bluetooth/Wifi sensors supplied by our partner Bitcarrier to measure journey times.
- A Cloud hosted, browser based collaboration platform (IBM Intelligent Transportation) that allows different user roles to view the same data both in real time and with historical perspectives.
- A Data Fusion engine running on a cloud service, which splices different data types to provide a common answer for journey time reliability to the collaboration platform, as shown below.
- Integration of M2M data carried over a GSM network provided by Mobius networks. This demonstrates how a secure, stable, end-to-end managed network can be integrated into a data fusion engine.

7.6.1 Visualisation and Analytics



The IBM CoSy trial collaboration platform

7.6.2 Measurements

Over the whole period of trial, **13 million data sets** were recorded and disseminated On one link of the A3 corridor in one week CoSy processed 220,000 detections. NB: this is one junction, with two sensors and two SCOOT loops.

7.6.3 Outcomes

The key focus for this trial engagement was to prove that:

- Bluetooth sensor technology can be rapidly deployed and provide greater granularity and timeliness of data than current technologies.
- Data fusion has value in terms of optimising journey time prediction through the processing of multiple data sources and that this analysis can help TfL make more informed sensor deployment decisions.
- A complex processing engine can be rapidly deployed in a cloud hosted environment and can consume multiple data feeds in a reliable and scalable manner.

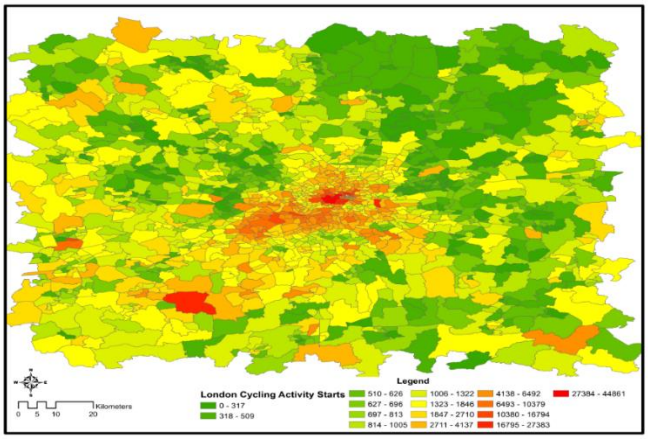
7.7 Strava

7.7.1 Background

Strava lets people track their rides and runs via iPhone, Android or dedicated GPS device and helps analyse and quantify performance. Strava is currently engaged with TfL to provide accurate information about the movement of cyclists through London.

Strava Metro is a product that is now being trialled for TfL. It aggregates enormous cycling data feed to GIS map systems for the purpose of analysing temporal cycling paters in metro areas. During the trial they 'demonstrated the ability to capture and share real time information on the status of cyclists on the network and patterns of behaviour over a twelve month time frame.

7.7.2 Visualisation and Analytics



Strava are providing both a web front end as well as raw data that can be mapped to any part of the network. A working example is shown above

7.7.3 Measurements

Strava had provided over **1 billion data points** for 2013, linked to journey type, dispersion from junctions, classification of journey, and origin and destination information.

7.7.4 Outcomes

- The ability to generate accurate cycling information, including Origin and Destination information based on mobile devices.
- The ability to identify the impact factor on changes to road network and time of day etc.
- The ability to capture the volume, journey time, classification, variation for millions of cycling journey in London.
- The ability to present and analyse intersection behaviour and dispersion patterns as well as average stop time and distribution.
- The capability to use non-fixed sensors to understand the behaviour and flow of cyclists across London.

7.8 Cloud based deployment with expansion and ease of deployment without significant time and costs in environment configuration.

The IBM CoSy solution contains a number of discrete components, including:

- A new Bluetooth sensed environment that was deployed on a stretch of the A3 at Wandsworth Town using Bluetooth/Wifi sensors supplied by our partner Bitcarrier to measure journey times.
- A Cloud hosted, browser based collaboration platform (IBM Intelligent Transportation) that allows different user roles to view the same data both in real time and with historical perspectives.
- A Data Fusion engine running on a cloud service, which splices different data types to provide a common answer for journey time reliability to the collaboration platform, as shown below.
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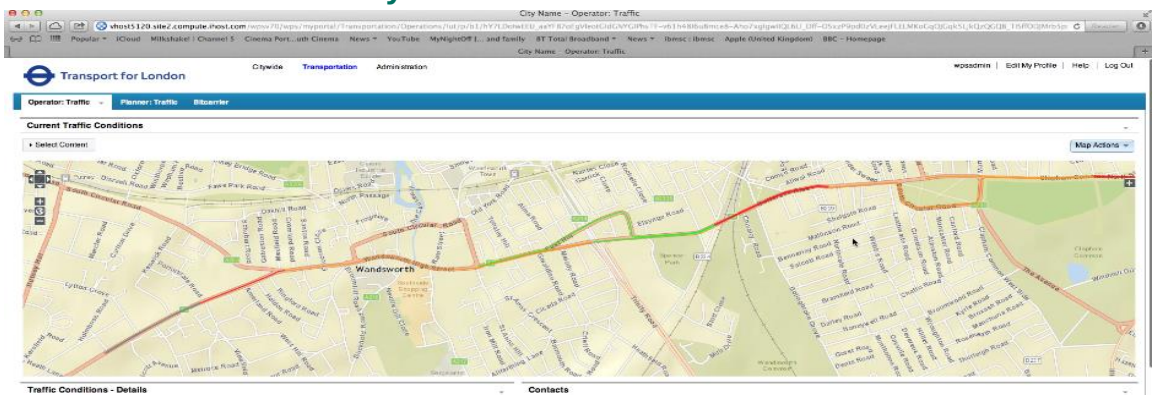

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- Bluetooth sensor technology can be rapidly deployed and provide greater granularity and timeliness of data than current technologies.
- Data fusion has value in terms of optimising journey time prediction through the processing of multiple data sources and that this analysis can help TfL make more informed sensor deployment decisions.
- A complex processing engine can be rapidly deployed in a cloud hosted environment and can consume multiple data feeds in a reliable and scalable manner.

8. Other ITS Activities

8.1 EU ITS Directive

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

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

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

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.

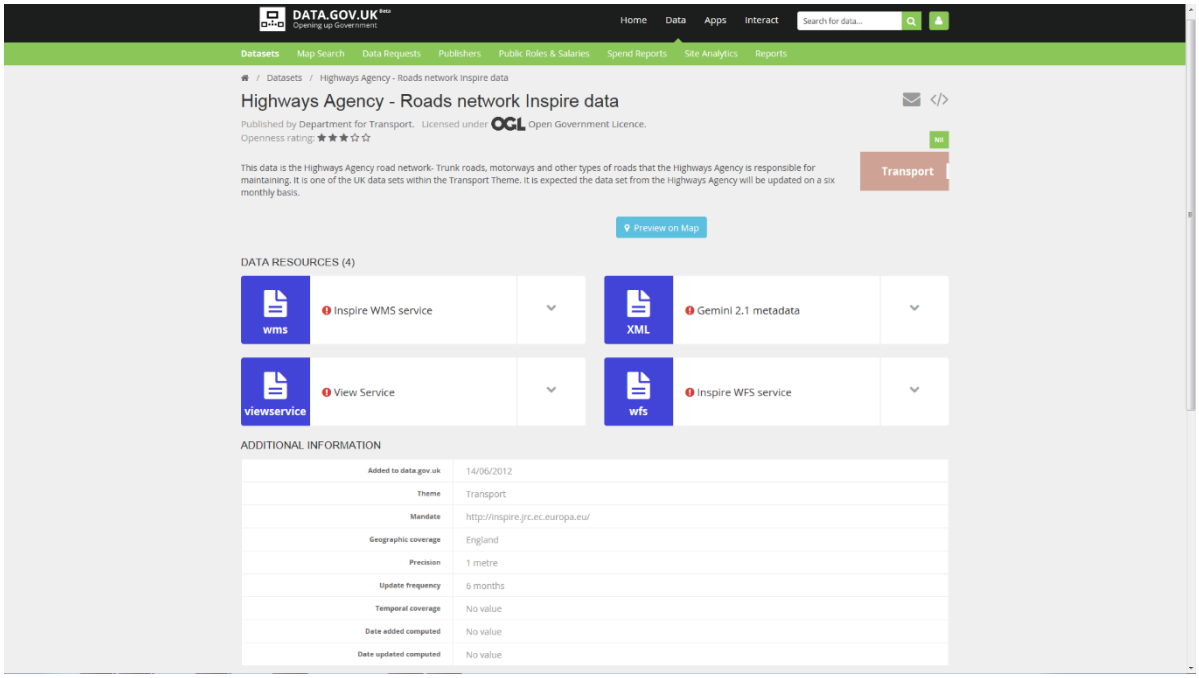
8.2 National Access Point

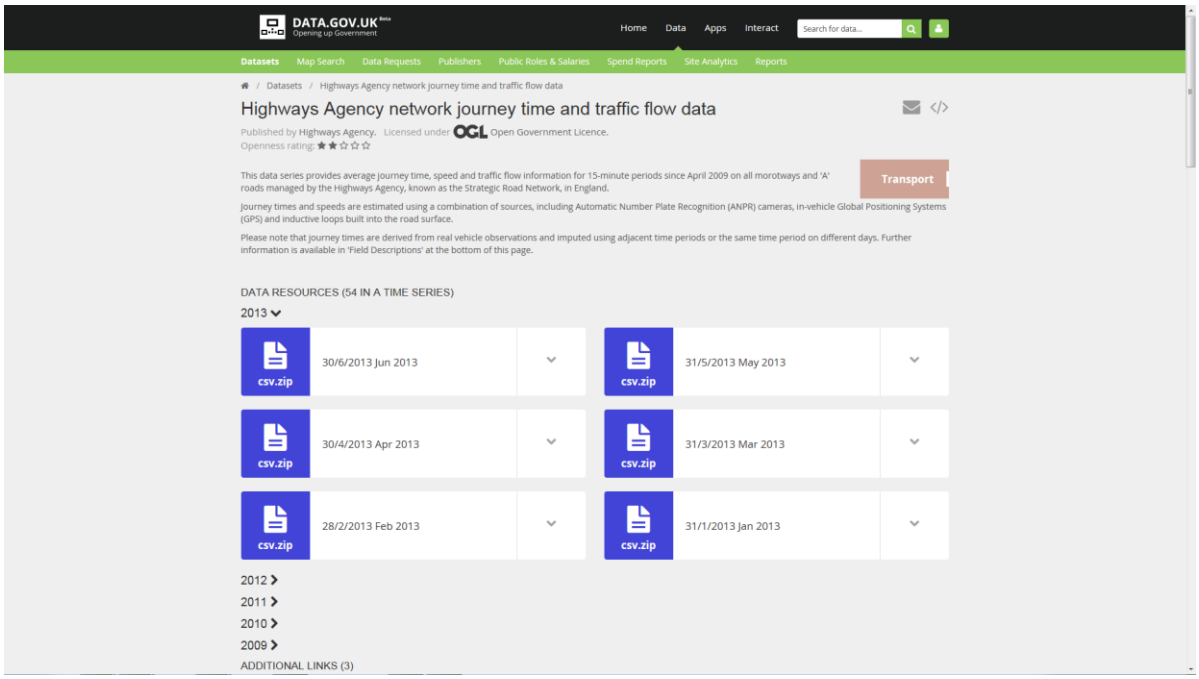
A number of priority actions in the ITS Directive require the creation of a national access point so that discovery, view and download of the relevant data and services are enabled in a user-friendly and co-ordinated manner.

We propose to use the existing UK Government metadata search and discover facility that is part of data.gov.uk and which is already used in a similar manner for discovery, view and download of the relevant datasets in the INSPIRE directive that covers spatial data.

This is a metadata repository, the data being hosted in native directories and has comprehensive search capability. This is administered by the UK Cabinet Office and is available to the whole UK public sector as well as to private organisations that wish to register their metadata for access by third parties. Transport datasets already form a major sector of metadata and in recent months transport datasets have comprised 7 out of the 20 most popularly viewed metadata records. The access point will be a single window for the UK, however this could also link to data repositories for the devolved Governments and bodies such as Transport for London should that be the desired architecture.

Datasets such as those already published by the Highways Agency already have metadata records on data.gov.uk and will be in scope for Priority Action (b) and also (c) but they will be enhanced with metadata tags referring to the ITS Directive and also have an identifying icon associated with their records.





8.3 TN- ITS

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).

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.

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.

9. 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 System	–	Siemens Advanced Traffic Management and Information
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
HA	–	Highways Agency
HAIL	–	Highways Agency Information Line
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