Transport Telematics

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CVIS reaches its climax

A four-year programme which set out to create a single unified technical solution allowing all road vehicles and road infrastructure to maintain continuous communications is now in its final months.

The €40 million-plus, February 2006-June 2010 CVIS (Cooperative Vehicle-Infrastructure Systems) project comes to an end on 30 June 2010. Co-funded under the EU's Sixth Framework R&D Programme (FP6), and project managed by ERTICO-ITS Europe, it set out to start a revolution in mobility for travellers and goods.

It sees the key as the complete re-engineering of the ways in which drivers, vehicles, goods and transport infrastructure interact. Its 60-plus partners across Europe bring together a mix of public authorities, road operators, technology suppliers, vehicle manufacturers, research institutions and affiliated organisations.

Its experience and results form a major component of the first European Cooperative Mobility Showcase, being staged from 24-26 March 2010 alongside Intertraffic 2010 at the RAI in Amsterdam, the Netherlands. The on-road demonstrations and Traffic Management Centre of the Future exhibit constitute the project's single largest public event.

CVIS arose from the EU's recognition of intelligent cooperative systems (ICS) as the next major challenge for the automotive electronics and ITS industries. ICS based on vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications, it says, 'holds out the promise of great improvements both in the efficiency of transport systems and in the safety of all road users'.

The EU was also well aware of comparable efforts already under way in the US and Japan. It saw an urgent need for Europe to gain a competitive position in the field.

The overall task was to create a single unified technical solution that would allow all road vehicles, and the road infrastructure, to maintain continuous communication via a range of media and with highly-accurate localisation. This was to be in the context of an open architecture and system concept for a spectrum of applications, with common core components to support real-life applications and services.

The CVIS core technology is based on the ISO's Continuous Air interface for Long and Medium distance communications (CALM). Key products completed include the CVIS reference execution platform (REP) for in-vehicle and on-infrastructure equipment installation (the responsibility of Norwegian company Q-Free); the core software (Ramsys, Hungary) and software development kit (SDK) (Makewave, Sweden)).

One intended benefit is that these will increase the 'time horizon' – in terms of the quality and reliability of information available to drivers on their traffic environment. Another is that making more detailed traffic information available to road authorities and operators will enable better use of available networks and faster responses to incidents. Both are seen as key to decreasing congestion and aiding safety.

The project has broken its activities down into groups of related sub-projects, three of which – core technologies, reference applications and test sites (into which the first two feed) – represent the building blocks of future cooperative systems (see table 1).

All CVIS technologies and applications have undergone testing in eight of the countries represented in the consortium: Belgium, France, Germany, Italy, the Netherlands, Norway, Sweden and the UK. This issue of TEC fea-

Table 1: CVIS sub-projects

Core technologies
COMM: CVIS COMMunication and networking
FOAM: Framework for Open Application Management
POMA: POsitioning, MAps and local referencing
Applications
CURB: Cooperative URBan applications
CINT: Cooperative INTer-urban applications
CF&F: Cooperative Fleet and Freight applications
COMO: COoperative MOnitoring

Table 2: CVIS test sites

Country	Location	Activities
France	Lyon	Freight and fleet applications in urban/ motorway environments; enhanced driver awareness (EDA)
Germany	Dortmund/Hessen	Cooperative traveller assistance and EDA in interurban applications
Italy	Turin/Bologna	Cooperative network management, monitoring, area routing and traveller assistance; dynamic urban bus lanes
Netherlands/Belgium	Rotterdam/Antwerp	Cooperative monitoring, network management and acceleration/deceleration in interurban and urban environments; cooperative parking and traveller assistance application in urban areas
Sweden	Gothenburg	Cooperative monitoring, EDA and dangerous goods tracking on motorways and local roads
UK	London	Urban freight loading space booking
Norway (associated)	Trondheim	Instrumented vehicles/roads

tures two of the trial sites: Karlsruhe-based PTV's demonstration of strategic routeing in Dortmund, Germany (see page 87); and Transport for London's piloting of controlled urban freight loading.

PTV also played a role in the London trial. Both report positive outcomes and prospects.

CVIS has also signed a number of cooperation agreements with external actors, paving the way for the use of its results in future field trials or, eventually, commercial service platforms. Paul Kompfner, CVIS Project Manager at ERTICO-ITS Europe, hopes to see future large-scale CVIS-based trials in countries including France, Germany, Italy, the Netherlands, Norway, Sweden and Spain. The EU FP7 call 6 for field operational trials of cooperative systems, closing mid-April 2010, also offers a potential path towards deployment, with projects probably starting in 2011 and trials from 2012.

Meanwhile, a number of CVIS partners are known to be planning products incorporating project results. Several partners are collaborating on a more advanced version of the reference platform CVIS 1.1 that will be launched in 2010, and evaluating with the semiconductor manufacturer the suitability of Intel's Atom processor.

CVIS PARTNERS
www.cvisproject.org
www.q-free.com
www.ramsys.hu
www.makewave.com
www.intel.com

CVIS delivers freight loading solution

David Crawford reports on the London CVIS test site where groundbreaking IP technology has been trialled in order to rationalise on-street freight loading and unloading.

Future potential for rationalising on-street freight loading and unloading using Co-operative Vehicle Infrastructure Systems (CVIS) is emerging from the London test site. Managed by Transport for London (TfL), this ran between 21 September and 18 December 2009.

TfL transformed an existing bay on the busy Earls Court Road, in the west of the UK capital, into a specially-created CVIS-based facility. The road serves the nearby Earls Court exhibition complex, and also acts as a major urban corridor for personal and commercial traffic route heading south through London. The test site was on the edge of the London Congestion Charging Zone.

TfL wanted a site that was on its own road network (TLRN), and so capable of being managed directly without having recourse to third parties. Here, it successfully trialled an innovative organisational and technological solution aimed at improving freight operations in London, incorporating a groundbreaking deployment of IPv6.

This enabled participating freight companies to prebook a time slot for use of the bay. TfL then took the requisite action to ensure that other vehicles did not occupy it at this point, so allowing the booked operator free access.

TfL's role included identification of participating freight operators, delivery of the enforcement concept, integration of CVIS components with parts of London's traffic infrastructure, setting-up roadside equipment, and procuring an on-board unit (OBU) for participating vehicles to use.

A critical practical aspect of the London test site was the use of real freight operators, their drivers and vehicles, who were engaged in normal day-to-day operations. TfL also wanted to test the system in a multi-use, urban street environment.

OPERATION

TfL had to establish data communication links between participating freight operators' offices, the CVIS project back office server, freight vehicles, the loading bay and civil enforcement officers equipped with mobile phones. To deliver these, the London test site had to integrate:

- A parking bay booking system (web interface);
- A roadside unit (RSU) with an interface to London's image recognition incident detection (IRID) system;
- Vehicle tracking and communications;
- Infra red-based vehicle-to-infrastructure (V2I) data exchange;
- A purpose-designed OBU; and
- IPV6 and 3G communications media.

Figure 1 shows the elements of the CVIS London test site. The sequence of events for its operation was:

Freight operators book a loading bay slot via a web interface, an application developed by CVIS partner Volvo.

The booking data travels from the web server for storage on a CVIS database back office in Venice, Italy, developed by project partner Thetis.

The Thetis server transfers the booking data to the vehicle via a 3G connection with its OBU.

When the vehicle is ready, the driver selects the relevant reservation on a dashboard-mounted touchscreen.

The vehicle heads towards the loading bay, with constant touchscreen updates on its estimated arrival time (ETA) from a server maintained by CVIS partner PTV.

When the vehicle arrives in the loading bay, it communicates its presence to the RSU via infra red communication. The RSU, in turn, validates the reservation with the Thetis back office; while the vehicle is also detected by TfL's IRID system.

This also detects non-CVIS vehicles entering the bay. If there is no IR communication, the RSU generates an email to the parking management back office to the effect that that the vehicle is potentially illegal. The back office then converts this to a text message for sending to a mobile phone being used by a local civil enforcement officer.

A validation CCTV camera gathers traffic footage for later analysis. (The validation is being delivered by Imperial College London).

For the duration of the trial, the test site had the benefit of both a temporary traffic order and the temporary raising of the existing loading time limit from 20 minutes to one hour. The latter reflected advice from the participating freight operators that loading can often take more than 20 minutes, owing to the nature of their business. They particularly valued this feature of the trial.

Eight freight companies agreed to take part, with OBUs fitted to a total of ten vehicles. TfL chose them to represent a range of operators from multi-national companies to small, local concerns, to give it the opportunity to check that the technology being trialled could be readily used by large numbers of operators using different vehicle types.

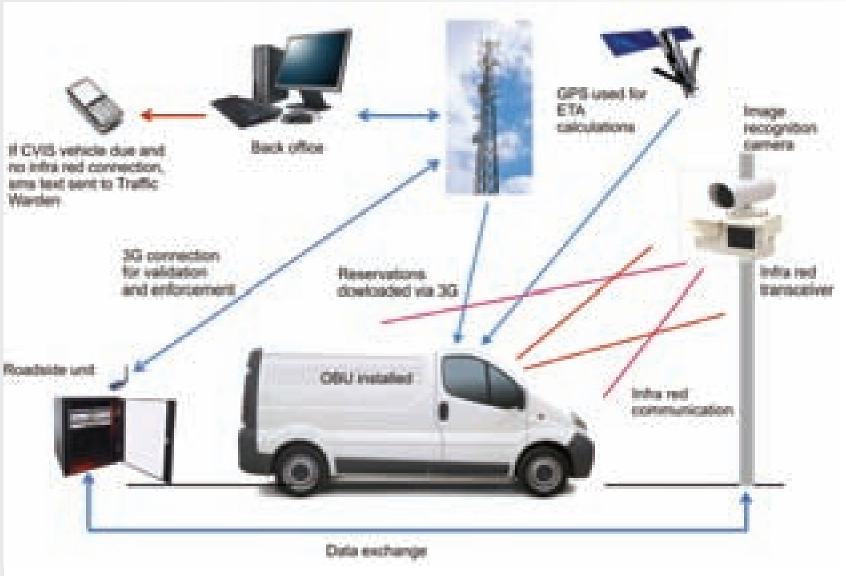

Figure 1: Elements of the London test site.

Special signage replaced the conventional 'No stopping at any time Except loading max 20 mins' sign with a message reading 'No stopping at any time Except CVIS permit holders'. Trial vehicles with OBUs installed carried green CVIS permits, enjoyed priority and could book the loading bay at any time that it was free.

As only 10 OBUs were available, the trial made red permits available for unequipped vehicles that still needed to use the bay. These had read-only access to the system to check in advance for any green-permit vehicle bookings.

TfL undertook lab setup and testing of CVIS core technologies in the months leading up to the trial. This included the testing of parking zone application software, developed by CVIS partners, which also benefited from improvements made throughout the trial phase.

A key element of the trial was the enforcement, carried out by TfL's civil enforcement officers and the London Metropolitan Police. Alerted staff generally arrived on site within five minutes of receiving a text message, and this element proved particularly successful.

HARDWARE AND SOFTWARE

The London trial hardware components were prescribed by the relevant CVIS partners and integrated by TfL. A portable metal flight case housing the OBU (Figure 2) sat either behind or underneath the vehicle driving seat; with the infra red transceiver, touchscreen, GPS and 3G antennae mounted on the dashboard.

The software, developed by CVIS partners, consisted of:

Figure 2: The OBU in its flight case housing

Dashboard installation

Platform and core software

The technical development of the CVIS project aimed to provide a comprehensive and integrated platform that would support a range of cooperative applications. This platform, specified and implemented as an open design, is intended to be configurable for both the in-vehicle environment (OBU) and the roadside infrastructure environment (RSU). The platform made use of a number of CVIS sub-project components:

- COMM for communication and networking;
- FOAM for the development, deployment, provisioning and management of end-to-end road management and transport safety applications;
- POMA for positioning, map updates, location referencing and dynamic local maps of current driving conditions; and
- COMO for hybridised probe-vehicle and infrastructure-based monitoring data collection, access and fusion.

Parking Bay Application for the RSU

Developed by Volvo, the software's main components were:

- Exchange of reservation information with vehicles;
- Communication with the back-office system;
- Tracking of parking zone status with information coming from external detection services (eg IRID) and geofence detection;
- Reception of the position of the CVIS vehicle and comparison of this with the parking area geofence; and
- Notification of illegal vehicle presence.

CVIS core technologies used for the RSU

- CALM service advertisements;
- POMA positioning and geofencing algorithms;
- CALM-IR, for communication with vehicles; and
- CALM-3G for communication with back-office systems.

Parking bay application for main OBU components

Developed by Volvo, its main components were:

- Touchscreen HMI interface, reservation information, ETA display;
- Communication with the parking bay management back-office;
- Exchange of reservation information with RSU;
- Sending vehicle position to the RSU over a FAST connection at regular intervals; and
- Using navigation components from CVIS partner PTV to obtain ETA at the bay.

CVIS core technologies used for the OBU

- FOAM, for user interface management;
- CALM-IR, for communication with road side unit;
- CALM-3G, for communication with back-office;
- POMA (and RT Maps) for receiving and processing GPS positions; and
- ETA computation components

Parking bay web server booking system

Developed by Volvo for:

- Web interface for freight operators;
- Calendar view of booking times; and
- Communication with the Thetis back-office server

Parking bay back office

Developed by Thetis for:

- Communication with the parking bay web server booking system;
- Management of the bay;
- Exchange of reservation information with the RSU; and
- Sending parking infringements to civil enforcement officers.

THE TRIAL

The project designed the parking zone application software to run on the CVIS hardware and software platform, with application testing initially carried out done in the lab. It worked there after the resolution of some sequencing issues.

Its functionality proved somewhat problematic on the street, however, as the application developers had not always appreciated the actual sequence of events. (One of the lessons to be learnt is that developers need to visit the chosen site).

One early finding is that about 30 per cent of bookings were successfully validated, proving that the technology could be successfully applied to the task. (The validation rate improved as the trial progressed, partly as the result of software updates). Given that it was so innovative, and being used for the first time in an on-street environment, the solution can be seen as a promising initial step towards wider application in future.

Reasons for non-validation, currently being analysed in detail, generally centred on human input. These could be readily addressed as road users became more accustomed to using the system, should it be rolled out on a larger scale. Reliability problems proved on-going throughout the trial. For any further deployment, the equipment needs to be smaller, lighter and more robust, and to draw a lot less power.

Stakeholder engagement was a very important aspect. Freight companies and enforcement agencies were both willing to take part and the level of cooperation between all parties was very encouraging, not least in site selection. The use of red and green CVIS permits proved a highly innovative way of managing the bay.

Other aspects currently being analysed by Imperial College London include log files, video footage of the bay in use, interviews with participants on their experiences, and – not least – traffic flows before, during and after the trial.The implications of CVIS on these for, eg reducing congestion and improving driving efficiency are very important. Overall, the set up and integration of the technology, and its interaction with stakeholders, proved challenging – but with measurable success. Ergonomic considerations, reliability and scalability now need to be addressed to meet future aspirations for deployment. The software will also need to be directly deployable.

The future roll-out of CVIS technology in the UK would benefit from a national lead on communications infrastructure. This would allow local stakeholders to develop local applications on a common platform to allow seamless services across the UK.

Rana Ilgaz, Traffic Systems Delivery Manager in TfL's Traffic Directorate, was the Senior Responsible Owner for the project. TfL project team members were: Stephen Cadogan (Project Manager), Rene Burke (Technical Lead), Steve Kearns, Debbie Parker, Derek Renaud, Nick Screech, Richard Parsons. Imperial College London: Dr Robin North.

LONDON PARTNERS
www.cvisproject.org
www.tfl.gov.uk
www.volvo.com
www.ptvag.com
www.thetis.it
www3.imperial.ac.uk

Bristol's B-Net story

Carol Debell reports from Bristol where a policy of sharing assets and interests has helped traffic managers extend visibility outwards from the city of Bristol to the surrounding area.

In 2006 the Bristol traffic control room had a total of 12 CCTV cameras at their disposal at various sites around the city. One was located next to a camera operated by the Emergency Control Centre. No-one thought that was a very sensible arrangement and there had been some talk of linking the two networks. But it was not until 2006 that the decision was taken to put in a fibre optic link between the two control centres.

This link gave Traffic Signals in Bristol access to another 30 plus cameras around the city centre. Adam Crowther says the result of this co-operation was that visibility around the city, which until then had been patchy and limited, was suddenly transformed with the new camera network covering 90% of the city centre. 'This coverage has made a big difference to our ability to validate and optimise our UTC SCOOT system. Instead of sending people onto the street to observe traffic flows, which in itself is less than fully efficient because the view may well be restricted, we can now observe junctions using the cameras and can validate SCOOT loops much more effectively.'

Not only has traffic management been improved – a duty for the city under the TMA 2004 – but network management colleagues have also been able to use the cameras to make regular check on road openings in the city and ensure that traffic management procedures are being correctly observed. Less time consuming and costly, says Adam, than sending people out to check and more effective because checks can be made much more frequently.

This is all very positive but there is another aspect to this story which has proved vitally important to the evolution of a communications network in Bristol. Whether it was with great foresight or not – no-one really seems to know – years ago Bristol City purchased the redundant duct network from Rediffusion. The network covered large parts of the city but was incomplete and damaged in part. However, it had been used to provide a fibre link, known as B-Net, to offices, schools and libraries and, crucially at this point, CCTV cameras to the Emergency Control Centre. The huge advantage of this legacy network was that it incurred minimal revenue costs to the Council. So, when traffic control linked to the Emergency Control Centre and gained access to the public space monitoring camera network – conveniently located mainly along the major roads – there were zero revenue implications.

According to Adam Crowther the sums go something like this. It would have cost between £8-10,000 to put in one CCTV camera with on-going revenue costs of between £1-3,000 a year. A fibre connection provided by one of the major telecoms providers to a new camera which is not on the fibre network recently cost £7,000 with ongoing annual maintenance costs of around £2,000. So, to create this network from scratch, including new power supplies to the cameras, would have cost around half a million. In fact, the fibre link between control centres to create access to a new city centre network of 30-40 cameras, cost Traffic Signals just £55,000 with no revenue costs.

It was, as Adam says, a win win situation and it was the beginning of a process which continues today and is extending the visibility of traffic managers outwards from the city of Bristol to the surrounding area.

The realisation of what access to the fibre network could deliver fired imaginations and gave wings to a number of UTMC projects in Bristol. A new traffic control centre was built and a new joint CCTV matrix was installed funded by Traffic Signals and Emergency Control.

A process was begun to link the B-Net network to existing traffic signal ducting so that where possible the network could be used to run traffic signal controllers.

And Showcase 2, a major project which saw the complete refurbishment of a 5km bus route within the city, from new paving and cycle lanes through to junction upgrades and the introduction of bus priority systems, demonstrated how the fibre network could be extended as part of on-going projects without incurring additional costs.