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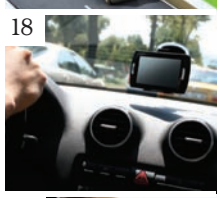

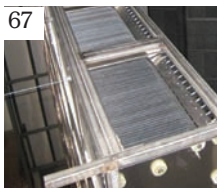

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Foreword

Champagne ideas and lemonade pockets is how my father used to refer to my inability to save for my future. Such words of wisdom seem rather apt for the 13-year tenure of the Labour government. Now a few months after the election (the UK's new Conservative-Liberal Democrat coalition having trawled through the finances) the full extent of the malaise in which we find ourselves is clear and doesn't make pretty reading.

In a world of uncertainty, what's set in concrete ahead of us are years of cutbacks, tax rises, cutbacks, and possibly some more tax rises tucked in between the sheets (The Beatles' *Taxman* springs to mind!). Labour project after Labour project is being canned or put on ice by the new occupants of Number 10 and transport and roads (and ITS by proxy) are not escaping the axe. "There's going to be much, much less money available for new roads," Transport Secretary Philip Hammond warned, with a focus on "aggressive prioritization". Projects that deliver the most value and most economic growth will be at the top of what will almost certainly be a very short list, particularly in light of the Department for Transport being tasked with slashing its spend by a reported 25-40% (of a £15 billion annual budget).

The previous government had earmarked £6 billion for improvements to major trunk roads and motorways in England up to 2015. A champagne proposal for sure… Now we'll be lucky to fill in the potholes that a harsh winter has left behind. Road Safety Partnerships will almost certainly feel the brunt of this budget cut; even the wave of 20mph zones designed to make our urban areas safer seem to have fallen by the wayside. Let's keep our fingers crossed that traffic casualties don't start to creep up again after years of moving in the right direction.

Change is quite simply something we're going to have to face up to, individually and collectively. So I predict that sooner or later we'll become more accepting of toll roads in this country (maybe even selling off existing roads), as well as managed and dynamic lanes to make more intelligent use of existing capacity. PPPs will therefore be integral. And the UK and many other countries certainly need a complete rethink on infrastructure financing. As my interview with IBM's Eric-Mark Huitema and NXP's Maurice Geraets reveals (page 20), you'll be surprised at what can be achieved when smart thinking and mobility collide. If, in a year's time, 3,000 people are dying in traffic accidents, the roads are still shot to pieces, and your daily commute is taking longer than ever, I just wonder if public opinion will have softened somewhat to PAYD road pricing.

Speaking of change, you may notice a few tweaks to this latest edition. Amazingly, we had a bit of budget to spare, so we thought we'd get the decorators in. I hope you like the new look!

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Clean-up operation

By marrying the perfect eco-driver with the perfectly eco-managed road network, the team behind this newly launched EU-funded project feel that 'green ITS' technologies can make a significant contribution to reducing the impact of transport on the environment. **Saul Wordsworth** is the first to the story

Illustration courtesy of Magictorch

Most of us think we are pretty decent drivers but that doesn't mean the way that we drive is good for the environment. If we're all honest, we probably spend far too long in low gears, allow ourselves to become snarled up in jams that we could avoid, or maybe even leave the engine running for minutes at a time while waiting for passengers. Such examples are wasteful if performed by each of us individually, or by fleets of truck drivers. We can, of course, try and remember to drive more slowly or gently, or listen into traffic information to optimize our route. We can even attend eco-driving courses that show us ways to keep fuel wastage and, as a consequence, emissions to a minimum. But all too often the best of intentions get forgotten and default behavior ensues.

Road transport is responsible for 70% of all transport greenhouse gas emissions, which themselves make up one fifth of all global emissions. This means that private and commercial vehicles account for 14% of all CO_2 emissions. Any attempt to reduce this number, however small, would add to our tentative collective efforts to address global warming. Hence the reason why eCoMove is so important.

Funded through the European Commission's 7th Framework Programme of Information Society Technologies, the eCoMove project has been established to tackle the problem of energy efficiency by combining ICT (Information and Communication Technologies) and ITS – known collectively here as 'green ITS' – to achieve cleaner and more energy-efficient mobility of goods and people.

How it works

The eCoMove concept intends to achieve this reduction through the exchange of information between vehicles (V2V) and between vehicles and traffic infrastructure (V2I). This constant communication and swapping of information should allow driver, vehicle and traffic system to optimize the driver's route and driving style, thereby improving overall energy efficiency.

"Each eCoMove application will use cooperative data exchange as either originator or recipient," explains Jean-Charles Pandazis (see *Behind the scenes*), who prior to joining ERTICO built a successful career with Bosch Corporate Research as R&D engineer, project manager and group manager within the field of ADAS. "With eCoMove, a vehicle equipped with an onboard eco-driving system and communication platform will be able to exchange data with the infrastructure and other equipped vehicles, just as an eCoMove-equipped roadside traffic management unit will be able to exchange data with equipped cars and trucks."

eCoMove's communication platform will be adapted from technology developed during

Behind the scenes

This multimillion dollar project is being coordinated by Jean-Charles Pandazis, head of EcoMobility at ERTICO. "The idea behind eCoMove is that for any given trip there is a minimum energy consumption that could be achieved by the perfect eco-driver traveling through the perfectly eco-managed road network," he explains.

"In reality, though, this never happens. Today the main contributing factors toward wasted fuel consumption are inefficient deceleration and lack of anticipation, traffic congestion, driving too fast, inefficient traffic light control and poor management of work zones – in other words, a blend of driving behavior and traffic management and control. Through a combination of technologies – including pre-trip planning, real-time eco-driving support and post-trip feedback – eCoMove will address each of these contributing factors in turn and hopefully reduce traffic fuel usage by up to 20%. That's the magic figure, but I think we can go further," Pandazis predicts.

Better IT,
higher passenger occupancy and freight loading could lead to further fuel consumption reductions of 20%

> Drivers will be assisted before, during and after driving with dedicated eco-applications that will make all drivers aware of how it is possible to drive in an optimal way to reduce fuel consumption and CO_2 emissions

previous projects, particularly CVIS and SAFESPOT. As well as the core technology already discussed, the eCoMove project is divided into three application subprojects – ecoSmartDriving, ecoFreight and Logistics, and ecoTraffic Management and Control – plus one horizontal subproject, Validation and Evaluation.

ecoSmart Driving

The ecoSmartDriving applications focus on everyday drivers and similar to all other eCoMove applications are based on existing information functions that can be provided by traffic management, other vehicles, advanced navigation systems and in-vehicle systems. Luisa Andreone of Centro Ricerche Fiat (CRF) is project leader for this particular subproject: "Drivers will be assisted before, during and after driving with dedicated eco-applications that will make all drivers aware of how it is possible to drive in an optimal way to reduce fuel consumption and CO_2 emissions. There are a number of key elements within ecoSmartDriving, including navigational maps that provide real-time data on traffic congestion, route planning and road conditions to give a view of the road ahead."

Road transport
is the third-largest source of UK greenhouse gases and accounts for over 20% of total emissions

The first application within this subproject is called ecoTripPlanning – a pre-trip application that will enable green routing complemented by relevant information that can support the reduction of fuel consumption in areas such as parking availability. During the journey itself, Dynamic Green Routing will be available, which integrates the information from traffic centers, other vehicles and ecoMaps. The ecoDriving Support module will provide information for the driver about how to drive depending on traffic, location, road and environment, as well as the driver's style, vehicle type and fuel usage. The ecoInformation application meanwhile will guide the driver as to how to tune other vehicle functions to minimize fuel consumption.

Once the journey is complete, ecoPostTrip comes into play. Based on the drivers' personal storyboard, this is an essential component as it will be the key to understanding how each person drives. The information collected will then be used to optimize particular eco-driving strategies as well as the provision of customized information to the driver.

ecoFreight & Logistics

The applications for ecoFreight & Logistics aim to improve truck energy efficiency by introducing a learning driver coaching system and a planning and routing system that give all stakeholders the possibility and motivation to strive for optimal eco-behavior. "The challenges are twofold," says Guillaume Vernet from Volvo, who heads up the subproject. "The first is to overcome the potential of traditional eco-driving training wearing off over time; the second is to achieve sustainable eco-driving via adaptive coaching and incentives."

The first application, the ecoDriver Coaching System, will support the driver at different stages of his learning. During the pre-trip phase, an ecoDriving training system implemented in a virtual simulator will train the driver with the eCoMove system for relevant situations. During the trip itself, a real-time eco-driving system will provide appropriate instructions to the driver using an interface, and once the journey has been completed, a cooperative fleet management back-office system will analyze trends, provide feedback and handle possible driver incentives and bonus schemes. The second application, Cooperative ecoFleet Planning & Routing, will enable route and driving planning for different

A day in the life of eCoMove

Susan and Alan are married. Susan drives to work while Alan drives for a living. Susan's daily commute begins with her inputting her destination into her in-car navigation device. She discovers the nearest motorway junction is closed due to roadworks, but the alternatives are computed using historical data already stored in the system so she sets off on her new route. After five minutes she reaches a sharp bend, so her eco-drive assistant advises the optimal deceleration profile for the smoothest outcome. She then approaches a slope and is given the recommended acceleration and gear selection. Next she meets a barrier at a railway crossing, which the system informs will remain closed for 90 seconds before automatically turning off the engine. Once the train has passed, she restarts the engine and eases off. Susan arrives at work and receives a summary of her eco-driving performance compared to the past three months along with the amount of time, money and fuel she has saved compared to driving without the eco-drive assistant.

Alan, meanwhile, works for a haulage company that has recently invested in a fleet of eCoMove vehicles. His transport manager uses the eco-fleet management system to calculate optimal routes based on historical data, real-time traffic data from traffic information services and data shared directly by other vehicles on the road. This route is then displayed on the driver's eco-driving support system. Alan sets off and follows the route he has been given. After being guided to his allocated parking space he picks up the package. He then drives off and heads for the city center. As he approaches a set of traffic lights, his truck sends its position to the traffic control center, which puts his vehicle into the green wave phase. Calculating distance and speed, the truck adjusts its approach and drives through the lights on green without having to stop. Once Alan arrives at his destination, all relevant speed, gear change and acceleration/deceleration data is automatically sent to his manager. The data shows that Alan has improved his fuel economy on the previous month and so he receives a cash bonus.

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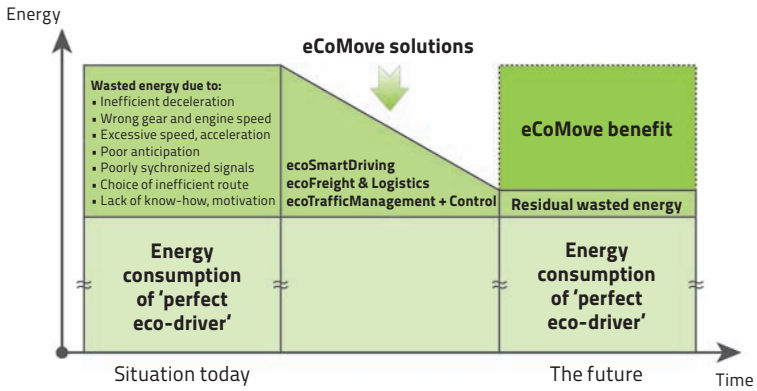
Optimism

"Other projects may work toward optimizing the engine but this is not our area. This is about efficient driving," stresses Jean-Charles Pandazis. For him and his colleagues, the key to the success of eCoMove is to produce something simple and user-friendly and for this to be achieved the interface with the driver is vital. How the information is presented is the key to getting both commercial and non-commercial vehicle drivers to use the technology, thereby changing their driving behavior.

"We believe there is great value in eCoMove," he says. "At the end of the project when we have shown the results we hope that car companies as well as the traffic companies will be motivated to deploy our solution. People will then possess a vehicle that will be more eco-friendly and that will help them to fit their needs in a cost-effective way."

And what of its wider impact? If applied worldwide, eCoMove could at a stroke reduce all greenhouse gases by 2%. Although this is not likely to happen overnight, by lighting the touch paper, he says that eCoMove may yet be shaping a greener driving future for everyone.



(Left) **eCoMove Vision targets a perfect eco-driver traveling through a perfectly eco-managed road network** (Below) **Cooperative data exchange as enabler of eCoMove solutions**

transport scenarios. The pre-trip application cooperates with other systems such as traffic management, map data and eco-cooperative horizon to take the optimal route and adapt truck parameters accordingly. The final application, In-vehicle Truck ecoNavigation, will use the routing application developed in ecoSmartDriving but include truck attributes to calculate the most fuel-efficient route.

ecoTraffic Management and Control

The final application subproject is managed by Jaap Vreeswijk of Peek Traffic: "Applications for this module aim to find a balance between the collective interest of road operators to optimize the overall performance of the transportation system (including energy efficiency) and the individual interest of road users to travel the quickest route at the lowest cost," Vreeswijk reveals. "The challenges to overcome fuel waste related to traffic management are excessive stops, poorly optimized traffic lights, unstable traffic flows and congestion."

The first application, ecoAdaptive Balancing and Control, looks at balancing traffic demand and network capacity by distributing traffic over a road network and facilitating this traffic locally with traffic light control. Vehicle-to-infrastructure interaction plays a key role in acquiring real-time vehicle fuel consumption data, and in return informs drivers about the optimal route choice and traffic light status. The second application, ecoAdaptive Traveller Support, provides personalized recommendations to vehicles for both efficient vehicle operation and an optimized driving strategy, including speed profiles. The third and final application, ecoMotorway Measures, aims to improve the stability of traffic flows on motorways by optimizing vehicle speeds, headways and lane-change maneuvers.

Over the next eight years, road passenger transport in Europe is forecast to increase by 19%, while freight transport is set to go up by 50%

Validation and evaluation

The aim of the Validation and Evaluation subproject is to validate the functionality of the systems and applications as well as evaluate if the key reduction in energy consumption of 20% overall can be achieved. Several validation tests will be carried out at sites in Germany, including Helmond, Munich, Düsseldorf and Berlin, in addition to motorways in France – a task that will be managed by Stefan Trommer of DLR. "The eCoMove consortium will have to take on some of the most difficult challenges facing both the automotive and ITS industries," Pandazis suggests. "In other words, how to create truly cooperative technical solutions to deliver substantially reduced energy consumption and greenhouse gas emissions from road transport."

In all, eCoMove constitutes a partnership of 32 companies. The main stakeholders in this impressive list features companies in automotive R&D (Ford, BMW, CRF, DAF trucks and Volvo) and Tier 1 automotive equipment (Bosch and Continental). It also features digital maps (NAVTEQ, Tele Atlas), traffic management systems (Peek Traffic, PTV and Vialis) and communication system suppliers (NEC and Q-Free), along with systems integrator Logica, which is developing the architecture and integration of the eCoMove solution. The partnership also includes university and research institutes specializing in modeling, simulation and validation (DLR, ika from RWTH Aachen University, TNO and the Technical University of Munich), along with the RACC (motoring association) and Go Green (eco-driving trainer), which brings its experience and point of view to guide eCoMove in developing a product that can be accepted by the end user.

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Politically incorrect

As the social and political barriers to nationwide road tolling will never be solved using the type of thinking common to DOTs over the past decade, **Bern Grush**'s assessment is that governments can't simply toll roads

Images courtesy of Johnny Green & Carolyn Kaster/Press Association Images

Former Labour Transport Secretary Alistair Darling fleshed out proposals to head off 'gridlock' on UK roads by replacing existing taxes with a high-tech system of road charging

The progress of long-sought nationwide tolling programs is abysmal. Austria, Switzerland, Germany and Slovakia have achieved it for heavy-goods vehicles alone, and generally only on highways. This meager outcome – about one every two years – after a decade of planning and development has been made possible due to a combination of reasons, not least the fact that commercial operators can arrange a measure of financial recovery. There has also been a modicum of trust in the reasonable argument that it's a necessity to fund roads. Finally, technocratic vision and political will have also been key.

Even for Austria, Switzerland, Germany and Slovakia, specific circumstances have made it easier than for many other countries wishing to achieve this. In terms of size, three of the above four are relatively small and culturally homogenous. With regard to foreign hauliers, all four are heavily traversed by foreign vehicles, making cost recovery more urgent. Also, some already had numerous tolled road segments, so there was already a level of familiarity. Finally, in the area of industry and trade, Germany saw that the technology selected for the task might revive its moribund high-tech export industry. No single reason would have sufficed in any of these cases, so hard is the political argument for nationwide tolling.

Success with wide-area urban tolling has been limited to half a dozen instances, including Bergen, London, Milan, Singapore, Stockholm, and Valletta. Here, too, a number of factors were at play – different in each case. Some combination of bold leadership, political fortune, geo-morphology, severity of congestion, and trust in persuasive reasoning helped put these programs in place.

A program as difficult and complex as nationwide road user charging requires many circumstances to line up to be put into play. To have sufficient buy-in, you need things such as an affordable and reliable way to measure and collect fees for use, a trusted government, a way to guarantee privacy, a way (and the will) to educate drivers about the problem, politicians who can understand the need (and who are willing to speak out for it), and a set of social policies to address things such as revenue allocation and people made worse off by the change.

Instead of these things, any particular country is more likely to have circumstances such as drivers and journalists being fixated on misinterpreted constructs of entitlement and privacy, a history of government non-transparency in relation to earmarks for fuel-tax revenues that make promises of correct revenue allocation hard to believe, politicians taking a position against to garner votes and a general lack of understanding of road funding and transport economics.

No driver is eager to pay for road use – including those of us who understand the need for it and the ways to make it respect privacy – and only a minority of people understand that paying by time and place of use rather than with fuel or property taxes sets up pricing signals that can reduce congestion. Fewer still are aware that one dollar of road tolls has the congestion abatement effect of three dollars in fuel taxes – implying that fuel taxes are three times harder on lower income earners than are road tolls, and making

Good news, bad news

The good news is that existing deployments such as these 10 have been successful in achieving their goals. It is true that the London system – in hindsight perhaps the least-well executed – has experienced a slide back to earlier congestion levels, but the reasons are understandable and the argument that London would still be worse off without it is worthy.

The bad news is that the expected domino effect of nationwide and urban tolling everywhere shows all the signs of a late arrival. The UK's lorry road user charging system and its nationwide road tolling system has been withdrawn or hobbled – even the majority of its congestion-related Transportation Innovation Fund has been withdrawn, and the new Coalition government has recently provided only a timid promise to "work toward" tolling heavy goods vehicles. Programs from the Netherlands, Sweden and several other states have been postponed, slowed down or iced. Maybe something will be pulled off in the Czech Republic, France, Poland and Slovenia in 2011 or 2012 to keep up our limp, one-every-two-years performance.

Around

58% of 1,000 UK drivers surveyed by Ipsos MORI said they would reduce their driving if a PAYD scheme was introduced

Evidence base

Programs such as those described to address these shortcomings may appear circuitous to advocates of the switch from fuel taxes to road use charging. They are. But all the evidence to date says that governments cannot go about universal road tolling directly. They need industry help. But today industry waits for government tenders for trials or for massive tolling systems such as the singularities in Germany or Stockholm. Transport ministers complain that driver populations grant no permission for an economic solution to the road funding and traffic congestion problem, but it is also the case that government behavior in the form of parking and insurance regulation grants no markets to incent solutions.

transparent road tolls a social improvement over relatively hidden fuel taxes.

In spite of the hurdles, every year hundreds of transport economists study and write about the need for road pricing and congestion pricing, often without paying tribute to the breadth of these social and political problems much less suggesting how we will overcome barriers to deployment. In the USA, since the National Surface Transportation Infrastructure Finance Commission released its report in February 2009, the note of urgency has sharpened, but the discussion in the inner circles has generally been about what kind of trials, or what kind of technology or who among the state DOTs or the Federal government should lead system setup.

Shift in thinking

The cumulative weight of social, political and system complexity is dawning on the community that must solve the combined sustainable mobility problems of road funding, traffic congestion, vehicular emissions and national security (oil independence). An increasing number of us are seeing that we have no choice but to address this from the driver's perspective, "What's in it for me?"

In 2006, the Eddington Transport Study stated a well-designed, large-scale road pricing scheme would produce £28 billion in benefits a year

In other words, a direct focus on how to technically and programmatically shift from fuel tax to road use charging is migrating toward a more nuanced focus on how to gain acceptance and increase the desirability of autonomous telemetrics for fee collection, how to compound the price signals possible from pay-by-use, and how to increase government confidence in the reliability, security, and privacy of telematics technology. It focuses more on how to enforce the use of such systems cost-effectively and while respecting privacy, as well as how to lower the capital and operational costs of such systems.

> "This new focus – should it take hold – means that we would consider user-focused market approaches rather than government tax mandate approaches

This new focus – should it take hold – means that we would consider user-focused market approaches rather than government tax mandate approaches – at least in the near to mid-term. Specifically, we would be designing programs for parking payments, pay-as-you-drive insurance, parking finders, green discounts, intelligent safety, navigation and other traveler services to which motorists would voluntarily subscribe in significant numbers because of convenience, savings and rewards – systems on which road tolling can depend later.

If this sounds more suited to the consumer design sensibilities of commercial telematics innovators than to tax programming schematics of national governments or their departments of transportation, how can we then best tap into these? After all, there are not yet massive 10 million subscriber markets for financial transactions for automotive use such as telematics-based parking and insurance payments. If this were to change, then cheap, autonomous road tolling programs could hitch a ride on the same wireless infrastructure.

Governments could encourage parking reform by eradicating underpriced or free parking in urban areas. National governments could incentivize regional or urban governments to do this. National, state or provincial governments could encourage insurance companies to switch to PAYD using a combination of incentives and regulatory change. The creation of markets attracts innovation, investment and new tax bases. Such innovation can easily be directed toward telematics-based financial systems for anonymous, autonomous metering systems for parking, insurance and road-use payment systems. Furthermore, such platforms also

Transportation Secretary Ray LaHood drew a sharp rebuke from the White House after he suggested a vehicle-miles-traveled tax would need to be considered in the USA

support safety, navigation and traveler services – things that have been shown to have an attraction for 40-60% of drivers in the EU. These same systems can accelerate safety and congestion management in the immediate timeframe, all while paving the way to earlier tolling of congestion in urban areas or of certain classes of vehicles such as all electric cars. The bonus is that this approach minimizes the political fallout compared with massive nationwide tolling programming.

If these new markets were liberated and correctly regulated (privacy, fairness, interoperability, transparency, accessibility, etc), a metering and collection system for road use charging could be built with private money in exact analogy to the way private money developed the current fuel distribution systems on which governments currently depend to collect fuel taxes.

How long will our transportation ministers and secretaries continue to beat their heads against the road tolling wall? How much longer until the lessons of markets and driver services will be used to ease the road to fuel taxation reform?

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Pushing boundaries

As well as high-profile clients such as Transport for London – which has pre-purchased TRANSYT 14 – TRL has seen a surge of interest in recent generations of this product from all over the world. "In Australia, as well as new contracts from VicRoads, our partner Aurecon is also using TRANSYT to model Hoddle Street, a congested area of Melbourne, in one of the largest studies of recent times," Jackman says. "This is a real test as the size of the modeled area pushes the boundaries of the software: it's a very large, complex area of road infrastructure."

VicRoads in Australia has signed a corporate license and taken delivery of multiple TRANSYT, ARCADY and PICADY licenses

> "Typically, 10 to 20 runs will give worthwhile improvements in network performance for most networks

Another dimension

TRANSYT 14 features specific functionality for the simple assessment of isolated signal-controlled junctions. **Louise Smyth** talks with TRL's Gavin Jackman about the new release

Images courtesy of TRL Software

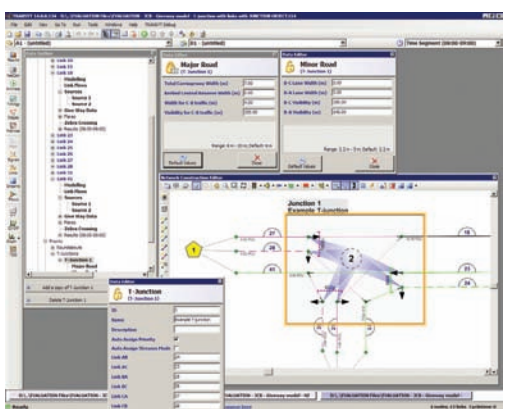
Among the various brands in the transportation modeling sector, TRANSYT from TRL is perhaps the most well known and highly regarded. With a 40-year track record, though, this is hardly surprising. The basic premise of this macroscopic software package for the study of large signalized networks hasn't changed much in those four decades, despite functionality evolving greatly. In 2008, TRANSYT 13 was launched, featuring enhanced modeling capabilities and a new GUI. In 2009, version 13.1 was announced, with additional functions and new modules linking TRANSYT to two very popular microscopic models, Aimsun and VISSIM.

More functionality

This year, though, is all about TRANSYT 14 – a version that TRL says "extends the product's capabilities further than previously possible". Gavin Jackman, TRL's head of software, explains how one of the specific new benefits relates to roundabouts and priority junctions.

"TRANSYT 13 is already well known for its modeling of signalized roundabouts, but what happens if you have a primarily unsignaled or even a fully unsignaled roundabout within your network? In conjunction with an ARCADY license, for the first time TRANSYT will allow users to model all roundabouts from fully signaled to fully unsignaled. The platooning effects of other parts of a network are also taken into account in the model."

Other priority junctions have been considered, too. "These can be modeled using a PICADY license," Jackman adds. "Geometric parameters can be specified directly within TRANSYT and stored within the TRANSYT file. Give-way coefficients are then calculated and assigned to the user's network structure."



Screenshot showing a full-page view from TRL's latest software release, TRANSYT 14

Signal control

As well as enhancing abilities at unsignaled junctions, standard signaled junction modeling has also been improved. A new controller stream object separates the signal data from the network structure and phases are now separately defined and referenced by links or traffic streams, making for a more intuitive way of working.

Complex scenarios – particularly one Jackman describes as "the dreaded 'mutual opposition'" have long been a challenge for modeling software, but TRANSYT 14 allows this situation – and others similar – to be accurately modeled.

Another key part of this new launch relates to something TRL calls 'the Optimiser'. "In TRANSYT 13.1, we introduced enhanced optimization to take advantage of the speed of modern processors, and the 'extended green splits' options to help when using the new links to microsimulation," Jackman explains. "With TRANSYT 14, we have introduced two new Optimiser options. In addition to the standard 'hill-climb', there is now the option of either 'simulated annealing' or 'shotgun hill-climb'.

Jackman suggests that the original hill-climb is very good at providing efficient timings quickly, but not necessarily the best timings. "Investigations have shown how different starting points affect the results and it is this effect that is 'cured' by the introduction of the shotgun hill-climb process, which allows the user to set how many runs from different starting points (different timings) they wish to run," he says. "Typically, 10 to 20 runs will give worthwhile improvements in network performance for most networks. The simulated annealing process also offers control over its optimization, so that the balance between speed and performance can be user-defined."

With TRANSYT's new 'Degree of Saturation' limit penalties, upper and lower limits can be specified on individual lanes or links, with penalties when they are exceeded. This means users can encourage the Optimiser to provide solutions that keep main arterials running, which improves modeled journey-time reliability on corridors – a strategy that is widely used to keep traffic moving in congested areas.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Team players

The GINA consortium consists of 12 partners covering the different links in the value chain and the many competencies needed to carry it through. Their knowledge and expertise helps define the technical and commercial requirements to comply with GNSS-based road pricing and VAS schemes including local mobility information such as traffic and weather, driving assistance and accident data recording.

Dutch car leasing company ARVAL and Portuguese highway operator ASCENDI represent the end-users sector in the consortium. "By considering real end-users' needs and expectations, we hope GINA can create a product that suits all," notes Sara Gutiérrez-Lanza. "The system, known in the Netherlands as the ABvM scheme, was to be the first nationwide road pricing scheme based only on GNSS and was proposed to act as a reference model to the road charging demonstration definition. The Netherlands is hoping to roll out this distance-based charging scheme in full by 2018."

Buy in the sky

Saul Wordsworth receives an update on the GINA road pricing project from **Sara Gutiérrez-Lanza** and **Konstandinos Diamandouros**

Images courtesy of GMV and Martin Meissner/Press Association Images

In March 2009, while many European road institutions were caught up in a debate over the Eurovignette Directive concerning road tolling for heavy vehicles, a brand-new pilot project was launched that could still shape the way Europe's roads are priced.

GINA (GNSS for INnovative Road Applications) – a scheme commissioned and co-funded by the EC and 12 consortium members – is designed to test the effectiveness of European GNSS as a means of setting up a nationwide pay-as-you-drive road pricing scheme. The project – which is taking place across the highways and byways of the Netherlands – would enable users to be charged according to their vehicle type, the roads they use, and when and how often they use them. GINA is being run by Spanish technology company GMV and Sara Gutiérrez-Lanza is its project coordinator: "The purpose is to analyze and hopefully demonstrate the technical effectiveness and economic viability of such a scheme, using first EGNOS and later Galileo as a next step in the use of GNSS, and to validate the possibility of value-added services (VAS) running on a same platform."

Effective strategy

Gutiérrez-Lanza and her colleagues hope that the success of the project will lead to a greater understanding of GNSS. "No-one has ever attempted a national all-road all-vehicle GNSS-based pricing system before, and its benefits are little understood on a national level," she suggests. "What is crucial for the project is to demonstrate that European GNSS suits the expectations of the different road pricing schemes and improves congestion and pollution. If we can show that this is technically effective and economically feasible, the politicians will be on the side of using European GNSS and the public will better understand its advantages."

At its inception in 2009, GINA was divided into two distinct phases: the first was to analyze user requirements, assess the technology and parameters of the project, define a preliminary business approach and understand the local context of the project. The second involves what Gutiérrez-Lanza refers to as "the core" of the project – the trial phase. The trials themselves are nationwide and are divided into exhaustive trials and the end-to-end trials.

"The trials took place over a four-week period in March," she adds. "Two vehicles equipped with our I-20 OBUs and accurate reference systems followed three different routes defined by the project. Each route was repeated a minimum of 20 times in order to gather enough data to create statistical significance. These trials looked at specific issues regarding the performance of EGNOS, including accuracy, integrity, performance of distance measurement, detection of geo-objects and charging performance, particularly in comparison with GPS. We were very pleased with the way the trials went and the preliminary results have revealed some interesting information."

busier times obviously you pay more. This incentivization not to travel during peak times should reduce congestion and lessen the environmental impact."

Konstandinos Diamandouros is employed by the European Road Union Federation (ERF) and is the dissemination leader of GINA. Similar to Gutiérrez-Lanza, he believes the project is a landmark in data collection: "No-one has ever implemented a European GNSS-based road pricing pilot on such a scale as this," he states. "The crucial question is whether EGNOS will perform in terms of integrity and accuracy. If you do not have these factors present it could lead to a driver being charged incorrectly. We have to protect the driver from such an outcome and instill confidence. Also, if we can produce tangible evidence that such a scheme influences road behavior and in the process lowers congestion and pollution levels, it will provide ammunition for policy-makers as it will help overcome widespread skepticism that road user charging is merely an extra tax on drivers."

Overall assessment

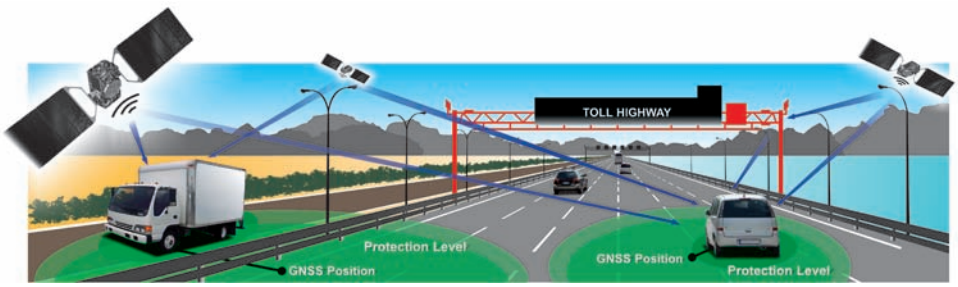
Different aspects will be assessed in the end-to-end trials, which are more drawn-out and set to begin soon – 100 vehicles are to be equipped with I-20 OBUs for a period of six months and allowed to drive freely across the Netherlands. "These drivers will be volunteers comprising car leasing company ARVAL's employees and customers. This phase is more of an overall assessment of the capabilities of the system, for instance the ability of the OBUs to generate invoices and the opportunity for us to analyze the feedback of the drivers participating in the trials. This is our opportunity to look at driving behavior. The idea of the Dutch ABvM scheme was to charge per kilometer and this price would depend upon different elements such as the use of specific road segments and the time of day. If you drive during

All in the timing

With many RUC schemes currently under discussion across Europe, GINA is extremely timely. Those involved have created an intensive and well-defined strategy to identify decision-makers within Europe's ministries who have influence on their own country's forthcoming road-pricing schemes. "We are trying to connect with them and convince them of the added value of EGNOS," Gutiérrez-Lanza confirms. "We are also in contact with manufacturers such as Siemens who are involved in this kind of technology."
In September 2010, a dedicated GINA workshop will be run where the full results of the project will be revealed for the first time. "We hope to gather as many high-level policy-makers and companies to give them first glimpse of results and persuade them of system," she concludes. "This will be the first time that people will have not only the proof of concept but actually something real. When we show them our results, we hope they understand the added value of European GNSS."

> "If we can produce tangible evidence that such a scheme influences road behavior and in the process lowers congestion and pollution levels, it will provide ammunition for policy-makers

In the UK, combined taxes raised from motoring are around £42 billion a year, yet only £10 billion is spent on new roads and maintenance



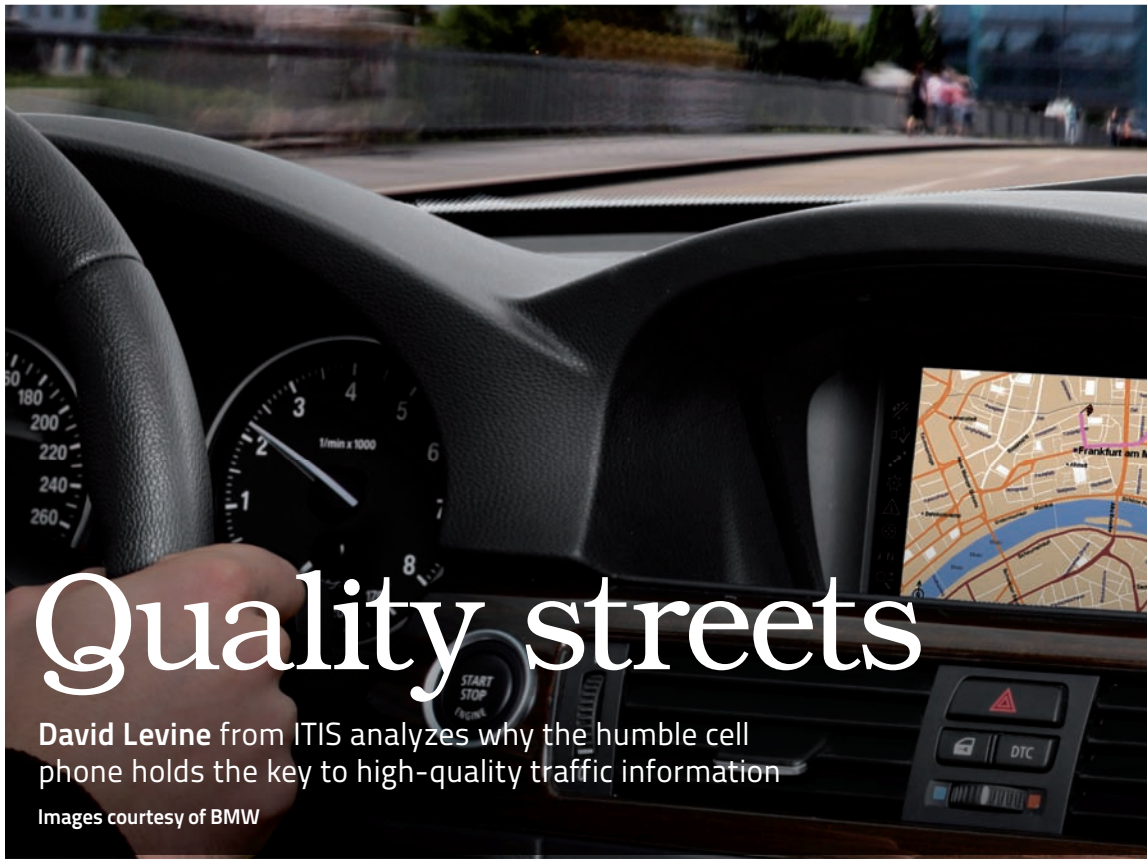
The use of GNSS – such as GPS, Galileo and EGNOS – for electronic road tolling is part of a growing trend in Europe

Pathfinder

BMW experts are unlocking new potential for navigation through the car-maker's microNavigation research project. A detailed large-scale map display allows complex enclosed destination areas to be visualized that are not covered by road maps in today's navigation systems, or only have incomplete coverage. This solution doesn't abandon drivers where conventional navigation leaves off; even on foot, a mobile unit will guide you to your destination and back to the car.

Users are able to download information about their destination in advance. If there is a microMap for the destination area, they are offered this automatically and can select their destination within the microMap. This destination is automatically transferred with the map data to the vehicle and augments the navigation available there.

Researchers have also developed lane-specific positioning for the prototype 3 Series by networking camera information, GPS coordinates and map data. The driver is guided to the desired destination on a lane-specific route – for example a free parking space near the lift in the best position. Detailed maps in combination with precise car-park positioning help drivers find their way around parking lots and during the journey. After parking, the data can be transferred to the driver's mobile device. This handheld then provides continuous navigation and helps drivers to navigate on foot in complex and unknown destination areas.



Quality streets

David Levine from ITIS analyzes why the humble cell phone holds the key to high-quality traffic information

Images courtesy of BMW

High quality traffic information is no longer merely an aspirational goal for traffic information service providers (TISPs) – it will become a key component in next-generation navigation, insurance and telematics strategies.

Automotive manufacturers want to help their customers avoid congestion at all costs. It's clear why. Drivers emit more CO_2, use up more fuel and have a far less pleasurable driving experience if they're stuck in traffic. Indeed, routing around traffic information is not just about spotting what's happening on the road and informing drivers – but fusing both real-time and near-term traffic prediction to ensure a planned route is monitored and adjusted on the fly to prevent the driver getting caught in traffic.

Imagine the possibilities

It goes further than the obvious use-cases in navigation. Imagine if the vehicle knew it was coming into an area of congestion and reduced the torque to the engine. Or if live and predicted traffic information was shared with the operators of a Smart Grid who could better anticipate load demands on the electricity network and store energy near to e-vehicle charging points in advance of that demand.

It's not just the automotive manufacturers though. Insurance companies are looking to new business models to better match policies and risk profiles to different types of driver. We've already seen pay-as-you-drive (PAYD) insurance specifically aimed at leisure and young drivers – these groups are charged different amounts per mile depending on when they drive. What about if you take that idea further and charged people different amounts based on their choice to travel more congested routes (and potentially higher risk of a crash) or at different times that avoid routine congestion.

Car-sharing clubs such as Streetcar are also starting to look at traffic information as a core part of their offering. It's not just delivering that information to their members into the vehicle, website or via their cell phone. Real journey-time information that takes real and predicted traffic into account can allow the clubs to better plan availability of their vehicles at strategic locations; avoiding a current problem of one member arriving to pick up a vehicle to find the previous member hasn't dropped it off yet due to being stuck in unexpected congestion.

Of course the automotive clubs have immense interest in traffic information – and not just providing that information for their members to consume from their website, iPhone application or cell phone, but as a means to better inform roadside assistance assets of fresh incidents that may impact on deployment of those assets.

Finally think about the emergency services – the ability to advise first responders on routes into an incident zone and to help evacuate people from that disaster zone is clearly of immense value.

Yet all of these initiatives have one important requirement in common: incredibly high-quality traffic information. Today, though, that's not such an easy thing. The delivery channel we typically use in the automotive industry (RDS-TMC) is constrained by bandwidth – we currently talk about 300 bits per second compared with the hundreds of thousands of bits a second we talk about with cellular connectivity. More importantly, the data sources commonly used and processed by TISPs haven't really delivered the amount and type of data that can deliver the levels of quality needed to support the above applications. These data sources can be placed into three categories: fixed sensors (e.g. loops, traffic cameras, etc), floating-car data (anonymous GPS data from fleets) and cellular data. These sources are processed individually and fused to give an overall picture of current traffic conditions.

Cell probes have emerged as a means to monitor traffic

Cellular data, though, is showing the most promise. Despite the complexity involved in turning the raw data into traffic flow information, the core idea is actually quite simple: a cell phone is passed from cell tower to cell tower as the driver moves along the road. This anonymous data is passed to the TISP. The rate at which those handovers occur helps to determine the traffic flow along the road. Of course, the TISP only ever receives purely anonymous data – nothing passed from the network can ever identify an individual.

It's far more complex in reality. Specialist skills and expertise that can only come from many years' investment in the technology are required to do it properly. Huge amounts of data need to be processed in almost real-time; cell phones belonging to pedestrians or passengers on buses and trains need to be filtered out. Combining the output of this cellular feed with other forms of data and matching this to the road network also have to occur – and all in less than four minutes (or much less for an urban road network) from generation of the initial raw data to delivery of the processed information to the driver.

Yet it is the sheer volume of data that can be accessed that makes cellular data so attractive. Research shows the number of cell phones traveling through an area is highly correlated with the market share of the mobile operator delivering that information. To put those numbers into perspective, in the UK, access to GPS fleets (such as logistics, taxis, home delivery services, etc) can yield over 150,000 vehicles' worth of data. Typically, well over 100,000 of those vehicles will send their GPS positions every minute or so. If you take an operator in the UK, such as O_2, with approximately 30% share (20.7 million subscribers as of end 2009) and assume even 50% of those will have their phones on at some point the day, you are already looking at several million anonymous data probes. It is precisely this amount of data that makes the use of cellular technology in traffic information systems so valuable.

No silver bullet

Of course, having access to cellular data – even fusing that data with GPS and fixed-sensor information – is no silver bullet. Producing traffic information of such high quality and in such a timely manner is the work of sophisticated algorithms, large processing power and relies on significant investment, R&D and experience in the deployment of such systems.

So, in essence, it's not what data sources you have, but what you do with them.

> "Imagine… if live and predicted traffic information was shared with the operators of a Smart Grid who could better anticipate load demands on the electricity network and store energy near to e-vehicle charging points in advance of that demand

More than
one billion speed measurements have been captured by Intelematics Australia using probe vehicles and road sensors

City of dreams

The results of a recent road pricing trial in Eindhoven have proved that smart GNSS-based technology can influence travel behavior, leading to quicker and cheaper commutes, and a cleaner environment for all. **Nick Bradley** speaks with the men behind the groundbreaking study

Portrait photography courtesy of Lex Kembery

We live in challenging times. Continuing urbanization and increasing population densities in our cities have added to congestion, commute times and CO_2. With no extra room for capacity expansion and (shall we say) uncertainty over available funding, it's a puzzle that would force some traffic managers to throw the towel in. That said, desperate times should not always call for desperate measures – at least that's the stance of IBM's Eric-Mark Huitema and NXP's Maurice Geraets, both of whom are adamant that smarter thinking and technologies can help to deliver smarter mobility and alleviate the pressures somewhat. Granted, the statement bears all the hallmarks of a cliché machine from a marketing department, but it's an ethos that is nevertheless guiding both companies' strategies in the transportation sector, and they've got some highly notable success stories to report because of it.

The Eindhoven trial showed how advanced road pricing technology can incentivize drivers to change their behavior and reduce traffic congestion

> A Smarter City is about providing traffic managers with the right tools to act based on decision support systems rather than intuition

Dutch masters

Huitema is responsible for Smarter Transportation business process outsourcing at IBM, while Geraets is in charge of business development at NXP's Mobility Solutions division, part of the Dutch company's Automotive group. Both men were at the heart of the recent GNSS-

Eric-Mark Huitema is responsible for road user charging and strategic mobility deals in Europe

The Stockholm syndrome

The trials in Eindhoven would never have taken place were it not for the successes experienced in Stockholm. Joining IBM way back in 2001, Eric-Mark Huitema still regards the Swedish capital's trailblazing congestion tax, Trängselskatt i Stockholm, as the standardbearer for the ITS industry.

The way in which the congestion charge or environmental tax in Stockholm was introduced was in Huitema's eyes "textbook", kicking off with a six-month trial to demonstrate to the city's residents the positives of such a strategy. As a result, the general public felt engaged and consulted from the start – this wasn't a tax brought in via the back door. Ultimately, its implementation went to a referendum.

"There was a 22% reduction in traffic, around 40,000 people switched to public transport, and amazingly there was a 6% increase in revenue for the shops within the cordon," Huitema reveals. The University of Stockholm analyzed these results and concluded that this anomaly was the result of more reliable travel times.

The environment, though, was the driver for implementing Stockholm's congestion tax, so how has it fared in this respect? "Overall, there was a 14% reduction in emissions in the inner city, while carbon dioxide has fallen by 40%," Huitema reports. "Not only that, as hybrid and electric cars are exempt from the charge, we have also seen a 10-15% year-on-year increase in the amount of green cars in the area."

The decision as to whether it should be implemented permanently went to a referendum, with 68% of residents in favor (approval has since increased further still).

Get smart about travel

Smarter City is IBM's mantra when it comes to making the necessary changes to help cities deliver the services, safety and infrastructure that its residents need. "The first approach is to predict traffic flows and provide this information to the traveler before traveling in order to influence their behavior, whether that's going by car an hour or two later or taking another means of transportation entirely," Huitema says.

"A Smarter City is also about providing traffic managers with the right tools to act based on decision support systems rather than intuition," he adds. "Such tools are based on powerful mathematical processes that can even predict the future – and not just the near term!" In Tokyo, for example, IBM has developed a traffic prediction system that will legislate for the city's aging population and through the use of powerful computing platforms forecast traffic 10 years ahead, based on the fact that a larger population of older drivers will behave differently and thus impact the traffic situation in a different way.

Another facet of Smarter City focuses on empowering people with the knowledge to make wise decisions about routes when out on the road. "In several European countries, details of roadworks are published, but that information is not pushed out to personal navigation devices," Huitema feels. "What we're trying to do is align the two, so that all of the free-flow data, the traffic data from the PNDs, is sent and synchronized with that of the traffic managers and local authorities. This also helps traffic managers to establish if there is a particular reason for slow-moving traffic, a faulty signal for instance."

based road pricing trial in the City of Eindhoven, in which an in-car personal navigation device displayed the financial ramifications of subjects' travel decisions. If they drove at peak times or on more expensive city center roads, they would pay more. But by driving on cheaper roads and at non-peak hours, or taking alternative means of transport, they would pay less, helping them save money as well as make more efficient, greener driving choices on a daily basis.

Competition mode

The study also created a competitive environment between the 50 participants by offering those who best reduced their average price per kilometer an incentive – in this case a small prize. According to the much publicized results, published in February 2010, 70% of the test subjects consistently changed their travel behavior over the three-month trial, leading to an average reduction in travel cost of around 16%, without even factoring in fuel costs.

Can you imagine the impact that this might have with 10,000 participants, 100,000, or even the whole population of Eindhoven, not just in terms of travel times and traffic jams but the environment and overall quality of life? Try, if you can, to imagine it on a nationwide basis. Huitema and Geraets do little else but envisage how such a scheme might play out on a much larger scale. And despite their obvious chagrin that the Netherlands' nationwide road pricing project for all vehicles on all roads, Anders Betalen voor Mobilitiet (ABvM), was shelved at almost the same time as they announced their groundbreaking achievements in Eindhoven, both of these eternal optimists have their eyes set on other Dutch cities and beyond… ○

Technically speaking

NXP's chipset is based on its Automotive Telematics Onboard unit Platform (ATOP), which Geraets feels boasts all of the ingredients to be a big hit in road pricing. A platform-based approach able to deliver services such as emergency call, breakdown assistance, parking, stolen vehicle tracking, insurance, and road pricing is the most likely model for a large-scale future deployment, so OBUs could potentially be factory-fitted into cars at OE level. "Being the worldwide number five in the automotive semiconductors market, we already have our foot in this door," Geraets states.

The chipset measures 30 x 30mm and is just 3mm thick. Inside, a GPS receiver communicates with GPRS to the back-office. Near-field communication technology allows communication with other devices, while OTA (over-the-air) provision of secure services enables the wireless and instant update of new services. Smartcard (JCOP) technology from the banking world supports the safe co-existence of payment and other services as well as cross-border interoperability, while RFID helps to store and read information remotely.

With privacy a concern for many when it comes to GNSS, Geraets is quick to silence the Big Brother debate. "You have a thin-client extreme where the chip communicates via GPRS all the positions relating to where the car has been," he says. "But in a thick-client variant – as proposed in the Netherlands – algorithms within the OBU calculate how much tax a road user has to pay. That's the only data that leaves the OBU." The chip just communicates a unique ID for a car, not its license plate, so nobody in central government can see where you have been, just how far you've driven based on the total fee.

> The reaction has been immense… We've had delegations from Japan, China and Denmark to name just a few flying in to view the demonstration

All's fair in PAYD road pricing

The ideology of the Dutch ABvM scheme was that it was deemed a fairer way of taxation – those who drive less and pollute less pay less. It was for this reason that there was widespread support, with a survey of 400,000 members from the Dutch motoring organization, ANWB, revealing 68% of respondents in favor of PAYD. "They were concerned about privacy, and worried about paying extra to drive in a certain location, which sometimes cannot be avoided," Huitema says of the findings. "But as in Stockholm there was a general support for the concept that you should pay more for roads when they are crowded – that's the market mechanism.

"This support was explicitly linked to the government's stated intentions – it's fairer, better for the environment, and will increase mobility," Geraets stresses. "Dutch politicians were steadfast about not increasing taxes. On the principle of paying as you use the roads, rather than just paying a fixed cost for owning a car, that makes a great deal of sense."

There's value in these services

As evidence of the value-added services that such a GNSS-based system can deliver, Geraets and Huitema highlight the April 2010 showcase in Leuven. "We're keen to show the variety of services," Geraets says. Huitema adds, "With bCall, if you break down you simply press a button and the recovery service – in this trial Touring (Belgium's motoring organization) – pinpoints your exact location and sends assistance straight away." A safety alert could theoretically also be sent out to other drivers. Such warnings might also be relevant for ghost vehicles (wrong-way drivers), emergency vehicle priority at intersections, or even schoolzones.

"eCall obviously helps in the event of an accident and automatically notifies the emergency services as to your exact location," Huitema continues. "But as the OBU is also connected to the vehicle CANbus, the severity of the accident and thus the type of injuries sustained could be assessed as a result of in-vehicle diagnostics. At the same time, the cars driving toward the accident are alerted: their OBUs might advise them to adjust speed or take an alternative route, which would also reduce any jams that might otherwise occur."

Maurice Geraets said results from the Eindhoven trial vastly exceeded his expections

Gone but not forgotten

"There was a lot of disappointment that nationwide road pricing in the Netherlands was put on hold once again," Geraets admits. "But the message to the ITS world should be that it was nothing to do with the scheme; it was simply that the government ceased to exist." Moreover, the NXP man is convinced the project is not dead in the water, just on ice. So once the new coalition government in the Netherlands is formed and the politicians settled in, the policy will most likely resurface. "The topic has been on the agenda for more than 20 years," Geraets says. "It's very clear that something needs to be done and the politicians to whom we talk know this. All of the universities that have researched such a strategy are certain that it will have a huge impact on the traffic jams as well as providing huge economic benefits."

A recent TNO study substantiates the economic benefits perfectly, as Huitema goes on to explain. "The study stated that every euro you put into building a new road generates 60-70 euro cents in GDP for the country," he says. "But the same amount invested into road pricing, and making sure that traffic is more efficiently managed, will return €1.8-2.0. When budgets are tight, you need to make the most out of every euro invested and politicians have slowly but surely come around to this."

Trials and celebrations

"Regional mobility trials are continuing in the Netherlands," Geraets says, when asked what happens post-Eindhoven, which could add more weight to the argument that such an approach to road pricing could prove perfect for congestion mitigation and emissions reduction. "In the Arnhem-Nijmegen project, there are 6,000 cars involved," he continues, which might increase to 15,000 cars in the future. "With such a large-scale sample, the results from this trial will really highlight the potential, as well as showcase the economic, environmental and mobility benefits."

"IBM is a big employer in Amsterdam, with about 5,000 employees," Huitema says of another potential project. "We have around 1,000 staff interested in a similar trial in the city, but we'll be taking a slightly different approach. We will still provide feedback via the PND, but rather than an incentive in the form of a prize, as in Eindhoven, we will be reimbursing participants their €100-€150 fixed vehicle tax based on their travel choices. So, if you change your behavior, drive on cheaper roads, at different times of the day, take public transport, you can potentially earn, say, €80 back." Although on hold for the moment, Huitema hints the trial could begin in earnest after the summer and increase to 10,000 cars.

Setting off a chain reaction

"We were blown away by the reaction to the results seen in Eindhoven," Huitema remarks. "We knew it was an innovative approach to a road pricing strategy, certainly the visual feedback on the device as well as summaries via the back-office, but with over 1,000 clippings worldwide the press coverage was immense." In fact, such was the global attention, governments the world over have been clamoring to visit Eindhoven to see the results up close. "They want to see it and know how we were doing it. We've had delegations from Japan, China and Denmark to name just a few flying in to view the demonstration.

"We were also able to take the core elements of the Eindhoven trial and put together shorter demonstrations in other countries as well," Geraets says. "We've been to countries all over Europe and Asia, in addition to North America and Brazil. Of course, these countries might not start with a nationwide deployment, as was planned in the Netherlands. But bit by bit, we will get there. Just a few weeks ago in Germany, it was announced that Toll Collect will be extended to more roads and lighter trucks. France is in the process of switching to a GNSS-based solution, Denmark is interested, and then there's Poland, Hungary and Belgium. You have to make sure that the cost of the system is viable and that the reliability is high, and that's what I think our technology brings to the table."


ROAD TRAFFIC TUN
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ROAD TRAFFIC TUNNEL
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EMERGENCY TELEPHONE
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What lies beneath

Although as we show, there is much ingenuity in the development of specific tunnel subsystems, **Lloyd Fuller** learns that the way in which these many parts are integrated will ultimately dictate efficient management for operators as well as safe passage for tunnel users

Illustration courtesy of Magictorch

As well as the usual concerns associated with managing road traffic – such as detecting incidents, maintaining steady flows and providing accurate guidance to motorists – arguably those tasked with managing tunnels have an even more acute, ever-present awareness of safety. Accidents on an open stretch of highway are one thing, but that same accident, fire or even chemical spill in a confined tube can quickly escalate into a disaster.

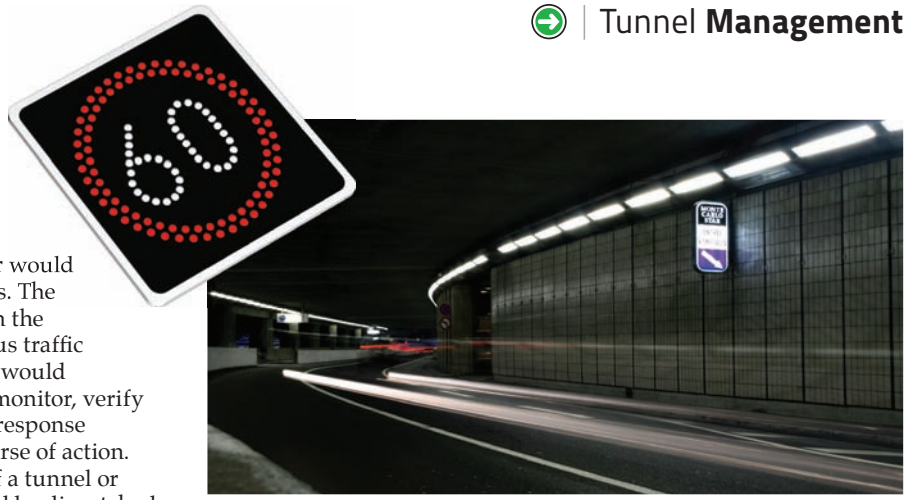
Road tunnels undoubtedly solve many traffic problems, but ensuring they do so safely has taken many years of trial and error. And even today – with all of the high-tech systems available – research suggests that one in three European tunnels still isn't up to the minimum standards required by Directive 2004/54/EC. This simply isn't good enough. More needs to be done to ensure that all tunnels – whether the world's longest road tunnel (at present the Lærdal Tunnel in Norway) or a regular motorway tunnel – complete both parts of their designed mission: to keep traffic moving through them, and to keep that traffic safe from harm.

Managed for success

Road tunnels demand sophisticated management to minimize the chance of incidents, as well as appropriate response systems to prevent casualties and/or reduce the severity of any incidents if they occur. This holds just as true for a tunnel managed as a standalone unit, or as part of a wider complex highway network. A modern approach to tunnel operations should therefore consider fewer standalone subsystems and far greater integration, leading to a safer and smoother passage experience for drivers as well as more efficient management for operators.

Modern tunnels today are packed with so much technology that they're a veritable work of engineering art, but what happens all too often is that not all of the equipment is fully utilized. There is a tendency to regard subsystems as a world on their own with separate highly specialized features. This fails to consider what can be achieved when all of the separate entities are combined to work

harmoniously as a complete, unified whole. It is during tunnel incidents that this integrated approach really pays dividends.



As a result of the confined environment, accidents in tunnels – and particularly fires – can have dramatic consequences

Integrated tunnel management

In the event of an incident, a truly integrated center would in an ideal world enact a specific sequence of events. The incident would be detected by one of the systems in the tunnel, possibly based on video or data from various traffic counters and other detection devices. The operator would instantaneously receive a video feed on the alarm monitor, verify the situation and from a menu of carefully crafted response plans subsequently select the most appropriate course of action. Everything else would be initiated automatically. If a tunnel or road section needs to be closed, that message would be dispatched automatically to drivers via a public announcement system, broadcast throughout the tunnel via a radio broadcasting system and warnings displayed on LED signage within and at the entrance to the tunnel. Simultaneously, road crews and the emergency services would then be notified as a matter of course by an in-built messaging system, while the information that the tunnel is closed would be sent out to the local media.

A modern, fully integrated tunnel management system should be modular, so allowing for the integration of newly added subsystems as well as factoring for expansion of the system from the addition of new sections of road or elements to it. Independent modules allow for this expansion without or with very limited impact on the rest of the system. Furthermore, the possibility of communicating with other control centers at the same or different level is a must.

Such integration is advised at all levels, starting from the field level to ensure the fastest-possible response that is completely independent of the control center. The integration should then continue all the way up to highest control center level, in doing so allowing for a comprehensive reaction to influence each and every deployed subsystem. System integration on different levels also enables specific automatic or semi-automatic response on each of those levels, which is enabled by an intelligent alarm generator incorporating the possibility of alerting on a combination

Optical allusion

The VMS Limited solution is installed at the northbound section of the Blackwall Tunnel in London, UK

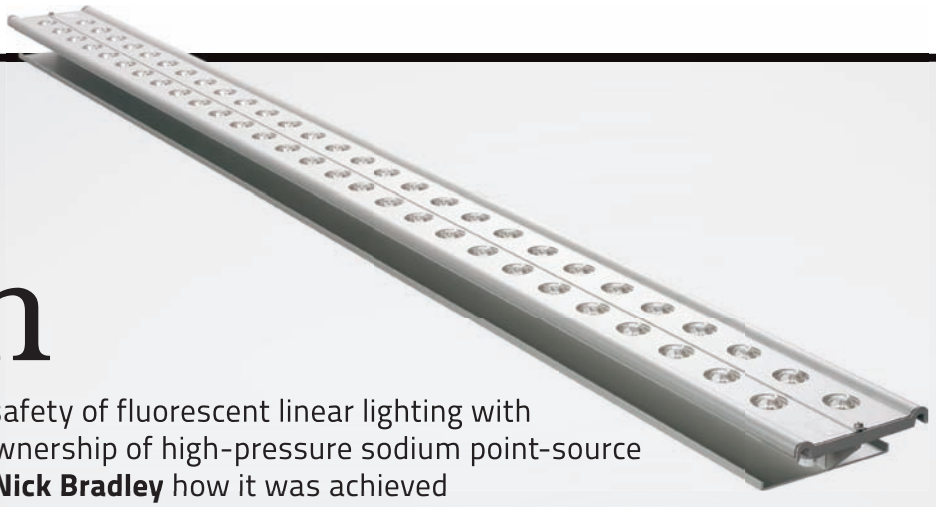
As there aren't any specific legislative requirements for electronic signs in tunnels, this means companies such as VMS Limited are able to offer the same solutions for tunnels and highways. "All signs obviously have to comply with the relevant performance requirements for whichever country they are to be used in," stresses Roger Stainforth, chairman of VMS Limited. "In the UK, for instance, this means the optical and environmental performance requirements in BS EN12966 and the Highways Agency's TR 2516B." The performance requirements for signs in tunnels were added to EN 12966 as a result of the Mont Blanc and St Gotthard tragedies. "What subsequently changed for signs was that all sign enclosures must be stainless steel to withstand the heat, as opposed to aluminum," Stainforth recalls.

"There's also more control and monitoring now," he adds. "Rather than just switching on a green arrow or a red cross, today's operator must know when messages were set, why they were set, what messages are on at any point, and they must be able to monitor the sign. They're now very much like motorway signs."

With its vast experience in motorway deployments, this fact alone presented VMS Limited with an opportunity, which Stainforth fully grasped. The company has since won contracts to supply all types of tunnel signs to the Hatfield, Hindhead, Blackwall Tunnel Northbound refurbishment, as well as the Tyne Tunnel. This latter contract is an especially significant one, with 244 lane-control signals and around 30 signs being supplied for the tunnel approaches.

Stainforth found his company's work on the Hatfield Tunnel most rewarding though. "There is a very restricted height allowance of 355mm," he details. "By designing the optical system with a sloping front face and doing some clever things with the LEDs and the elliptical shape of the apertures, we've been able to get quite close to the normal type of UK signal, the matrix indicator, which is around 550mm high. It's a little like an optical illusion and has been really interesting work.

"We have also been awarded a contract by Transport for London for an overheight vehicle and lane detection scheme to protect the Blackwall Tunnel northbound portal from vehicle strikes. Once an overheight vehicle and its lane has been identified, the system will read and display the license registration number and warning message on the VMS."



Tunnel mission

T-line combines the quality and safety of fluorescent linear lighting with the efficiency and total cost of ownership of high-pressure sodium point-source lighting. Indal's **Neil Morris** tells **Nick Bradley** how it was achieved

When driving through a tunnel, you've probably never even paused to consider the lighting – and why should you? As Indal WRTL's Neil Morris suggests, if the lighting is designed correctly you actually shouldn't notice it at all, which is a shame as the company's new T-line LED tunnel lighting actually warrants closer inspection. "Our goal when developing T-line was to attain the quality and safety of linear lighting, a total cost of ownership comparable or less than point-source, with maintenance and energy consumption less than either," Morris says.

The main benefits of a linear scheme are high uniformities, excellent visual guidance, and good color recognition. The Indal man also believes redundancy is key, as with point-source systems if two lamps in a row fail you could potentially have up to 40m of road without any illumination at all. In some cases this would be deemed a Category 1 fault, so an emergency closure might have to be enacted, which could involve a police rolling roadblock.

"The quality of the actual LEDs is also important, which is why we select them very carefully," Morris adds. "White LEDs range from a color temperature of around 5,000 kelvin, a warm yellowish color to 10,000 kelvin, a cool blueish color. We insist on narrow binning, which means the luminaire looks consistent so in an installation they all appear the same."

Light distribution is also vital, hence Indal's direct-lens approach known as DIRECTA. "You shape a clear lens such that when the light passes through, it is directed onto the desired surfaces in a predetermined pattern – the footprint," he continues. "You get much more flexibility as you can distribute the light precisely where you need it." The unique part of this design in particular is that the lens is also the cover to the LED and luminaire. "Most other luminaires have a glass cover in addition to the lens, which introduces further unnecessary losses," Morris says. As a result, the T-line luminaire has a very impressive light-output ratio when compared with traditional technologies and other LED products."

Linear LED lighting provides a much improved and safer driving experience for tunnel users

With temperature linked directly to efficacy and lifetime, it's a must to ensure the luminaire doesn't overheat, which is where COO-LED comes in – Indal's combination of low-current, low-density LEDs with a large cooling surface.

> "The main things that favor linear schemes are uniformity, visual guidance and color recognition being above 75 CRI
>
> **Neil Morris, technical and operations manager of i-TunneL, Indal WRTL, UK**

"Because of this, we don't need cooling fins on the back of the luminaire, which you'll find on nearly all other LED tunnel luminaires. Also, with T-line, we have a bigger luminaire and have spread the LEDs out to keep the temperature down."

Similar to temperature, if you reduce the drive current, lifetime and efficacy also increase. "We drive our interior luminaires at 350mA, so we're effectively under-driving them," Morris says. "Many LED luminaires adopt the maximum drive current to get the highest-possible lumen output, so the energy required to light the same tunnel will be much higher, albeit you could achieve this with fewer luminaires."

T-line has a theoretical L_{70} lifetime of more than 200,000 hours, although in reality expected lifetimes are only considered up to 140,000 hours, as this is where the LED manufacturers' projections end. "Given the industry standard seems to be for a lifetime in the region of 60,000-70,000 hours, some may challenge our claims, but we're more than happy to back these up," Morris adds.

A question frequently posed is whether customers should go for fixed or replaceable LEDs, partly due to the necessity to replace traditional lamps. "We've chosen fixed with T-line because the lifetime is such that the LED will almost certainly outlast the luminaire anyhow," he says. "The only beneficiaries of replaceable LEDs are the component and lamp manufacturers!"

At just 64mm deep, the T-line luminaire also has a very low profile, so in tunnels with a low ceiling – which may have previously been lit from the cornice as a result of traffic envelope restrictions – there may be scope to use T-line luminaires directly over the lane. Also, weighing a mere 9kg – around 15kg less than a traditional fluorescent luminaire – costs associated with storage, handling and transport are subsequently reduced.

Longevity is also a consideration. "At the moment, we're doing refurbishments in tunnels in which the luminaires are being

T-line offers some of the best lifetime expectancy figures available from a high-output LED luminaire, made possible by the variety of bespoke design features

replaced well before their expected lifetime due to either low-quality aluminum or inferior surface preparation techniques," Morris reveals. "Often, corrosion starts in areas where dissimilar metals come into contact, something that is common on luminaires with 'T-slot' mounting systems on the rear. With galvanic corrosion, the aluminum is weakened until the point where the luminaire support fails, with potentially disastrous results. Our design uses a very high grade of aluminum to which a quality surface treatment is applied. T-line is also designed with completely smooth outer surfaces; we've eliminated cooling fins, hinges, and brackets – all weaknesses where corrosion could start."

Last, but by no means least, there is the issue of maintenance, which unsurprisingly Indal has also factored into the design. "As we don't require lamp changes and our drivers are mounted remotely from the luminaire, we have effectively eliminated all maintenance other than cleaning," he says.

Designed on the back of the huge success of Indal's Stela LED streetlighting series, T-line appears to tick many boxes. "We've given the industry what everyone wants – except now they can afford it," Morris enthuses. "Our first big deployment was in the Vlake Tunnel in the Netherlands (see *A guiding light*, page 30), this being the first tunnel in Europe to have been fully lit with interior and boost lighting using an LED linear lighting solution. We're also working on a high-profile UK project which will be completed in October," he says. "The only negative of the T-line system is the capital outlay, which is equal to a fluorescent linear scheme but greater than point-source systems. In the long run, though, the energy and maintenance savings result in a total cost of ownership comparable to point-source lighting while delivering a much better and safer driving experience and significant environmental gains."

of events from different subsystems. Automatic system responses are organized through scenarios that cover any type of incident in the tunnel. Concurrent events in the tunnel should be prioritized and handled with great care. Also, the potential to handle concurrent events in multiple tunnels should be incorporated. Automatic reactions bring uniformity to crisis handling as the system always reacts in the same way, quickly and unambiguously. At the same time, it is built and designed for people by using simple rule system alarms and suggests – operator confirms, system responds. Through check lists and procedures, the operator is guided through emergency situation handling, which eliminates the risk of different reactions or inadequate response. Information about any of the events can be easily and automatically dispatched to management, media or any road user by SMS, email or even fax.

Such an integrated center will fully utilize each tunnel subsystem, in doing so allowing one point of control and ensuring a fast and reliable reaction to any event in and around the tunnel.

The job of a tunnel operator is far from easy. They are burdened

A great deal of investment was put into safety measures and equipment in the Lærdal Tunnel in Norway, currently the world's longest road tunnel

with responsibility for the lives of drivers, the protection of valuable property, work long shifts around the clock and are, after all, only human. It's just common sense to do everything possible to make the task easier and do whatever it takes to reduce the margin of error and increase the safety of all participants to the greatest extent.

Telegra's future-focused approach

Control rooms of the future and indeed those of the present day should be simple, smart, and reflect the reliability of the system and the improved level of traffic safety created by implementing the sophisticated and complex systems. The Croatian traffic management expert, Telegra,

A guiding light

Linear LED tunnel lighting combines a flicker-free driving experience (exceptional uniformities) with outstanding visual guidance and excellent color rendering (white light)

LEDs are popular for a number of uses in the traffic sector, yet applying them in tunnels is still relatively fledgling. In 2008, when Willem Zandvliet at the Dutch Ministry of Transport, Public Works and Water management decided to look into their potential for tunnel lighting, he teamed up with the appropriately named 'LEDexpert' to conduct a feasibility study. "In tunnels, lighting is the main energy consumer," says one of the company's founders, Marinus Jan Veltman. "LEDs consume far less energy than conventional lighting so we set out to establish whether they could be utilized as a light source for tunnels."

The aim of the feasibility study was to establish some creative solutions with the lowest energy consumption, yet which conformed with the European regulations. Several routes were investigated with regard to colored light and colored road surface, but the strategy that presented itself was to work with white light and a counterbeam luminaire.

"The main advantages were a high efficacy of the source, plus instant light and dimmability," Veltman says. "Besides that, the control of light with injection-molded optics could give the luminaire the ideal beam control and thus best light-aiming efficiency."

Based on this research, LEDexpert generated a product specification sheet, describing all parameters for the ideal solution. The most important defined a tunnel of 10m wide and height of 5m, with a luminance of 10cd/m^2 in the central zone. (The uniformity along the road was defined as better than 0.7.) A scale model was then constructed along with extensive computer simulations to show that LED luminaires bring an extreme uniform illumination compared with high-pressure sodium.

The report was issued in October 2008 and the Dutch Ministry then decided on the Vlake Tunnel as the best place to test such a system. Located near Rotterdam, this 327m tunnel guides the A58 motorway under the Zuid-Beveland canal and has two lanes and one service lane open for traffic in each direction.

"Our next move was to find a manufacturer able to produce a luminaire that could fulfill the requested specification," Veltman says. "We decided Europe's Indal was the best candidate."

LEDexpert tested the first prototypes in relation to light radiation pattern, quality of light, power consumption and expected lifetime. At the end of 2009, Indal began installing the system in the tunnel. LEDexpert monitored the work and measured the performance of the installation, with results presented in April. "We found a 50% energy-saving on lighting, no flickering due to the linear lighting, 90% savings on maintenance costs and 90% less nuisance to traffic," Veltman reveals. "We also observed better light in the tunnel with a higher comfort level, as well as 10cm more free space above trucks due to the luminaires having low-profile dimensions."

Veltman is certain that such results prove the real potential of LED lighting in tunnels, so predicts a surge of new projects in the years to come.

has a great deal of experience in tunnel management and already offers a complete ITS platform to promote a truly integrated system, which is beneficial to its users, distinctly ergonomic and easy to use.

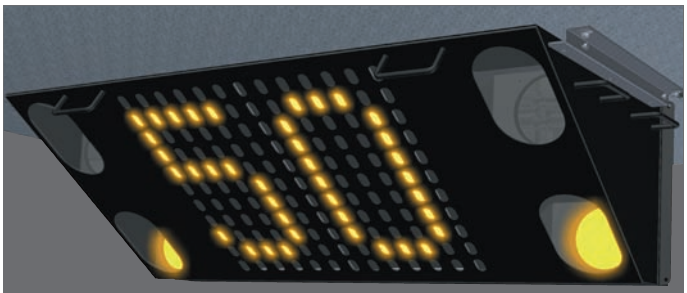
Telegra amassed its knowledge in tunnel management by participating in a number of high-profile projects in Croatia where, over the past 10 years, it has equipped more than 60km of tunnel tubes with such integrated systems. In recent years, the company has expanded and has provided these completely integrated solutions worldwide. What the company is not offering is an 'out-of-the-box' solution; each system is tailored to meet the individual needs of the client and particular project.

Who is using this new approach?

One of the best examples of this strategy can be found in Telegra's home country. The Rijeka-Zagreb motorway is a busy 145km road connecting the Croatian capital with the country's busiest port, Rijeka. One 45km stretch boasts 12 tunnels alone totaling almost 10km, featuring all of the requisite advanced traffic management systems. All of these subsystems comply fully with the European Commission's Directive 2004/54, covering everything from tunnel signage to video surveillance and SOS systems – a host of subsystems that were simply crying out to be grouped into an integrated and efficient whole.

An ITS management tool designed for tunnel applications – such as Telegra's popular topXview system – is an indispensable tool

In 2009, Telegra equipped the main control center for this particular section – which oversees the road and all tunnels – with its topXview complete ITS platform software. The topXview product achieves integration at a number of levels, not least at a field level with the integration of traffic subsystem elements such as variable message signs and displays, barriers, meteorological stations, traffic counters, fire system, etc. topXview also allows for integration on a subsystem level – emergency road telephone system, video automatic incident detection system, and so on. Finally, it allows for the integration and inclusion into overall system control and



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Best practice in tunnel safety

Guillaume Ponsar and **Steve Morello** from Egis Road Operation provide some real-world experience about operational procedures to maximize safety and security in a tunnel infrastructure

Over the past decade, improvements in tunnel security and safety have become paramount for operators and concessionaires, with minimum safety requirements, service levels and equipment to be maintained and operated frequently becoming increasingly stringent. For Egis Road Operation's subsidiaries, this has necessitated a new approach to cross-fertilization of best practices within (and among) them.

In January 2010, operations commenced for the Bonaventura project in Austria, which is one of the company's most recent operating subsidiaries with tunnels. Before the official opening of the Bonaventura road network and tunnels in November 2009, several drills were organized in the three main tunnels along the motorway. The drills were undertaken during the course of three consecutive days and allowed the operator and its partners to apply and assess several procedures related to emergency evacuation and intervention plans. In addition, various emergency service stakeholders (fire services, first aid, rescue teams, and police) experienced different scenarios and situations, such as fire-fighting, treatment and evacuation of injured users inside the tunnels, dangerous goods identification, management of an accident involving a coach with multiple victims, etc – all of which were previously identified as potential and realistic.

In tandem with the drills, the operator developed appropriate response strategies for the various incidents and incorporated them into the final versions of the emergency plans, procedures and manuals. As a result of these drills, all types of operational and emergency services had the opportunity to confront exceptional situations in which severe incidents might arise and address mitigation measures as part of the program for continuous monitoring and development. The drills also enabled the requisite emergency response units to assess and subsequently improve their behavior in the event of severe and critical incidents in the tunnels.

Following the drills, debriefings and conclusions showed that the predefined procedures and rescue operations were efficiently applied, managed and conducted. Notwithstanding coordination and communication between the emergency response units, control room operators and onsite staff always have room for improvement. But the drills enabled the new operator and different emergency response units to familiarize themselves with the tunnels and main management and operational aspects. It also allowed the different operations personnel and emergency response units' staff to become acquainted with each other.

> "All types of operational and emergency services had the opportunity to confront exceptional situations in which severe incidents might arise

Egis Road Operation and its subsidiaries are also adept in the development and application of Safety Files and Emergency Plans. In 2004, the European Parliament issued a Directive on minimum safety requirements for tunnels that are part of the Trans-European Road Network (TERN). This Directive has been transposed into local law in each country concerned, so tunnel operators are now required to comply with the Directive as soon as possible – but no later than 10 years after the Directive's entry into force (i.e. 2014).

A consequence of the Directive is that Egis Road Operation has undertaken an in-depth review of the application of the Directive within its operating subsidiaries in EU Member States and elsewhere. In this regard, it provides support in the implementation of a Tunnel Management System tool (an aid-to-decision support tool) that helps to organize the complete range of tunnel operation requirements. It also allows the operator to ensure maximum security and safety levels for traffic and users.

As required by the EC Directive, everything is spelled out in complete documentation known in the UK and Ireland as the Contractor's Plan, or the Safety File in continental Europe. This Safety File also contains potential incident and emergencies identified before the opening. The identified, defined and ranked emergency scenarios provide the basis for appropriate response strategies and are included in the tunnel operator's manual and operational procedures of the police and emergency services.

These plans are tested, assessed and updated (if necessary) during regular emergency exercises/drills that are carried out to ensure continuous effectiveness of the response strategies. Advisory services are also supplied by Egis Road Operation for its subsidiaries and other private and public road/tunnel operators during the organization and debriefing of such drills.

In Australia, on the M2 and M5 East Sydney, and Melbourne CityLink, Egis Road Operation's tunnel operations are

(Above) **Deluge systems on the M5 East Sydney in Australia, which are a requirement in all Australian tunnel infrastructure** (Left) **Fire-fighting training in the Bonaventura Tunnel in Austria**

provided with deluge systems that are requirements in all Australian tunnels. Fixed fire suppression systems control fires, cool the air temperature and prevent the fire from spreading in a tunnel. Monthly testing and training occurs with the fixed fire suppression system, but deluge systems require permanent maintenance, elaborate and detailed high-level operating procedures and specialized training.

Operating road tunnels requires a high degree of competencies in areas such as equipment needs and maintenance, setting up of drills to mitigate potential incidents, special training and organization, appropriate documentation realization, and implementation depending on local safety and monitoring requirements, etc. With 1,550km of road network under contract, Egis Road Operation has this experience, running 47km of tunnels in total. Among these are bi-directional tunnels, twin-bore tunnels (2x2 or 2x3 lanes per tube), some continuously monitored tunnels, operation of single-tube tunnels, and (as with the Bonaventura) tunnels in a motorway stretch.

Efficient and safe travel through tunnels requires systems that integrate a host of applications, such as traffic management, SCADA, facilities management, and safety, surveillance, and security systems

management of specialized tunnel electromechanical systems, such as ventilation, air quality measurement and management, fire alarms, lighting, power back-up and distribution, handling of emergency exits and tunnel security, etc.

The software has allowed the Rijeka-Zagreb motorway authorities to create a more automated system that is less susceptible to human error. A number of scenarios are covered, encompassing all safety procedures designed and required to be implemented by the authorities. This includes facets from traffic accident scenarios (inside the tunnel or at its

> Coordination and communication between the emergency response units, control room operators and onsite staff always have room for improvement

entrance/exit) and special situation scenarios (such as export of vehicles with dangerous goods, regular and scheduled maintenance, or an alarm due to the UPS batteries being too low) through to general operation and regular maintenance procedures. This last point is worth emphasizing. Applied systems are not only solving incident and emergency situations, but providing valuable tools for everyday control, management and maintenance of tunnels and complete road sections.

The complexity of this road section in particular and the fact that it controls and monitors 12 different tunnels (or 24 tunnel tubes) increases the likelihood of concurrent events in the same tunnel, as well as in the different tunnels. Such challenges are

Sense and sensibility

One of the up-and-coming technologies in the field of tunnel fire detection revolves around fiber-optic linear heat sensing. So what sets this technology apart from other methods? "First, the fiber itself is totally passive – there are no active components in the tunnel area, just a single cable upon which there are thousands of detection points," explains Clemens Pohl, managing director of AP Sensing. "It's an entire fire monitoring solution, so we are not only able to detect a fire, but monitor its size, spreading (width) and its direction, as well as control the activation of fire suppression systems."

Admitting that video is great for visualization, Pohl says that in the majority of cases, within a very short time all an operator will see is smoke. Likewise, a smoke detector can only sense that there is smoke and sound the alarm. Electrical linear detectors also give an alarm, but in seconds their cable is broken so no further information can be sourced. "With fiber-optic, you're in a position to go way beyond the traditional approach. You can control the escape lights, the ventilation, and give crucial information to fire services relating to how hot it is and in which direction it's heading."

An added-value of AP Sensing's kit is that it's capable of preventing potential fires. "Being able to detect a power cable running hot in a cable tray is extremely valuable," Pohl says. "Our system allows operators to investigate a hot cable immediately and we even provide a pre-alarm ahead of the next maintenance cycle so that the system can be upgraded."

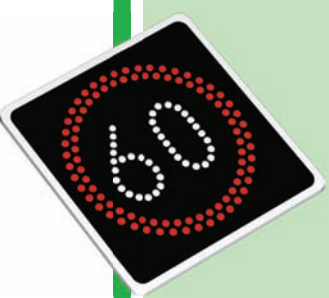
Another system benefit that should appeal to operators is that it is plug-and-play and can easily be integrated to the overall management system – usually a SCADA or similar.

> "It's an entire fire monitoring solution, so we can monitor its size, spreading and its direction, and control the activation of fire suppression systems

solved using two principles: a configurable set of priorities about events in the single tunnel; and the ability for the operator to choose between active events in different tunnels. Ultimately, the system guides the operator to solve the most crucial events first, while giving them the opportunity to rearrange the list if necessary. An accident in one of the tunnels can easily create a jam and congestion in upstream tunnels, which only reinforces the need for harmonization on a larger scale; in the case of a severe accident you don't close the tunnel in front, just at the most appropriate exit upstream.

Another operating group that would endorse the value of topXview for day-to-day activities are those at the Mala Kapela, the longest tunnel in Croatia – a modern two-tube structure that's part of the A1 Zagreb-Split-Dubrovnik motorway. All safety and signalization equipment in this 5,780m tunnel is controlled by topXview, while the main control center benefits from

New management strategy



More than 220 cameras inside the Clem 7 tunnel automatically detect and alert tunnel operators to any variations in normal traffic flow via the Traficon Flux product

The challenge associated with video-based automatic incident detection (AID) systems has long been how best to manage all of the data supplied by the AID components – particularly as over the years tunnel projects have increased in size and complexity.

A company offering a solution to this challenge is Belgian AID expert, Traficon. When the company was awarded the AID contract for the Paris DIRIF project (*for more on this, see page 36*), it decided to revamp its existing video detection management software, which led to the creation of a new product called 'Flux'.

"We've always delivered a management tool that can handle all inputs and alarms from our detectors," explains Johan Gachon, Flux's product manager. "But as projects have got bigger – from 10-20 cameras a few years

ago to some schemes, such as DIRIF, featuring 1,500 cameras today – two issues have really come to the forefront: scalability and redundancy."

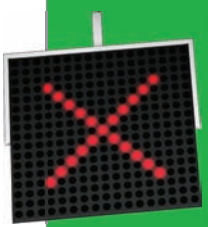
Along with positive feedback from the Paris project, Gachon reports that the team behind Australia's Clem 7 tunnel are also pleased with their investment in Flux. "Safety is paramount here; the operators have told me that if the AID system went down for half an hour, it would be in the papers the next day!" Redundancy was therefore essential. On all levels, the equipment has effectively been doubled. For instance, if one Flux screen goes down due to a PC crash, another will step in."

Scalability was also tackled within the new software. Instead of potentially dozens of similar alarms, intelligent filtering means Flux simply and quickly sends one alert to the operator's screen. "The Clem 7 has up to 20 incident detection alerts a day. They have 224 cameras, so you can imagine the chaos if multiple alarms were popping up from all of those!

"Often AID is just one part of a wider system (usually a SCADA) so we use an open-source approach and Flux seamlessly integrates with the overall management system. The whole goal is to make life easier for the operators, and to ensure they can swiftly respond to incidents."

Enhanced safety for Parisian tunnels

Every tunnel in France longer than 200m is now required to be equipped with an AID system, the management of which is now easier with Traficon's Flux



Over a period of five years, Optelecom-NKF and Traficon will work together with leading systems integrators, installers, and industry suppliers to implement a video surveillance system for acquiring, analyzing, transmitting, and recording video in 22 tunnels in and around the city of Paris. Directed and financed by Direction Regionale de l'Equipement d'Ile-de-France (DIRIF), the French Ministry of Equipment, the system covers 45km of tunnel roads and is the largest traffic monitoring project of its type ever implemented in Europe.

"The strength of camera-based intelligent technology is its unique fast detection rate in combination with the direct visual feedback," explains Steve Collins, director of Traficon France. "As a result of this intelligent surveillance system, the operator is warned instantly about any abnormal traffic behavior inside the tunnel and can quickly launch all steps to prevent an accident from escalating into a major tragedy."

Around 200,000 cars drive through these 22 Parisian tunnels daily, with camera images merged with AID information generated by nearly 1,500 of Traficon's VIP-T boards. Optelecom-NKF will integrate 1,600 of its Siqura codecs to compress the video into MPEG-4 and H.264 and transmit it to dedicated tunnel control rooms for viewing and storage.

Data, events, and alarms generated by the VIP-T detector are handled by the Traficon Management System (TMS), known as Flux (see page 35). This software platform includes both a configuration client and server and allows tunnel personnel to draw up the incidents that the Traficon detector boards need to monitor. Incidents might include anything from pedestrians, stopped vehicles, wrong-way drivers and lost cargo to queuing, speed drops, and even the presence of smoke. Furthermore, tunnel personnel can also specify scenarios that might occur, such as maintenance projects, or day and night lighting parameters. Armed with these scenarios, Flux can discern between actual events and anodyne occurrences.

Moreover, it uses configured AID events to trigger a Siqura network video recorder (Siqura i-NVR) to save any relevant video clips to the system for future use. These recordings can be reviewed later to help improve the traffic monitoring system and hence the safety of the motorways in and around Paris.

The world of video networking is a booming industry containing a collage of devices and technologies from an array of manufacturers and vendors, all competing for the best solutions to the problem of how to keep people and places secure.

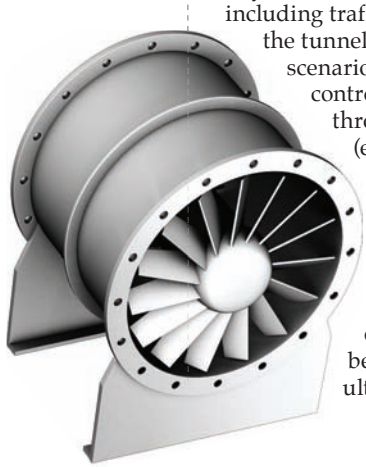
With such an abundance of options, the real achievement comes when system designers and manufacturers, such as Traficon and Optelecom-NKF, as well as others involved in the project, come together and connect their solutions with other network components to produce life-saving and valuable video surveillance systems. Ultimately, what DIRIF's Parisian AID tunnel project shows is that – along with all the other groundbreaking technological advancements that have been made – we are well on our way to effectively combating bottlenecks, as well as creating safer and smoother roads for motorists.

a videowall that enables a quick overview of the traffic situation and state of any other important subsystem in both tubes.

Additionally, topXview allows operators to run a variety of automatic responses covering regular events, such as escorting dangerous goods vehicles, malfunctions (such as power supply), incidents (such as fires detected in the tunnel), as well as maintenance operations.

Tunnel management in practice

Further afield from Croatia, Telegra has recently been involved in projects in Germany, Austria, Qatar and Turkey. In Qatar, the Ras Abu Abboud road interchange tunnel has undergone a deployment of ITS technologies such as VMS, lane-usage signalization, CCTV coverage and video-based incident detection and traffic counting and classifying equipment. In 2009, all of these separate components were integrated into an automatic management system using topXview. A number of scenarios – triggered by alerts about fire, air quality and visibility, overheight vehicle detection and other subsystems – are now automatically dealt with. Meanwhile in Istanbul, two tunnels are also using Telegra's ITS platform – the 1,745m-long Kagithane-Piyalepasa and 2,195m-long Bomonti-Dolmabahçe tunnels, both of which pass under the center of Istanbul in a bid to reduce the crippling traffic congestion from which the city chronically suffers. This particular project includes two tunnel control subcenters and one main control center, all of which are equipped with topXview. Plans are also in place to build more tunnels in the coming years, which will also be controlled from the supplied main control center. As you would expect, the system covers a range of scenarios, including traffic accidents, special situations (such as pedestrians in the tunnel and even horse-drawn carts!), as well as maintenance scenarios. There is also a lengthy list for scenarios such as controlled applications (e.g. a military convoy passing through the tunnel), while a general situation scenario (e.g. traffic jams at portals) has been implemented.



These examples in Croatia, Turkey and Qatar show what can be achieved through integration. But in many operation and maintenance control centers around the world, truly integrated solutions are not being implemented – in fact, it's commonplace to see very disparate subsystems controlled by several operators on multiple workstations, which can only be potentially detrimental to smooth operations and ultimately, the safety of those passing through.

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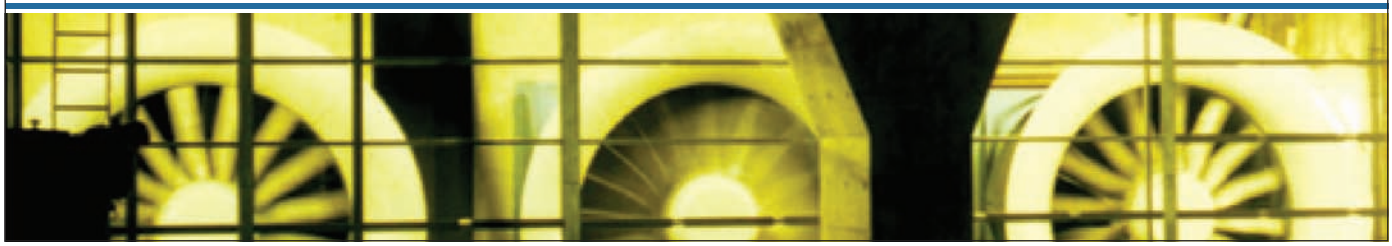

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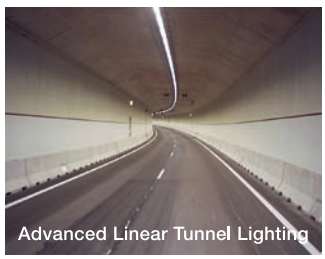
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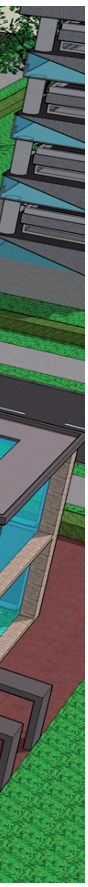
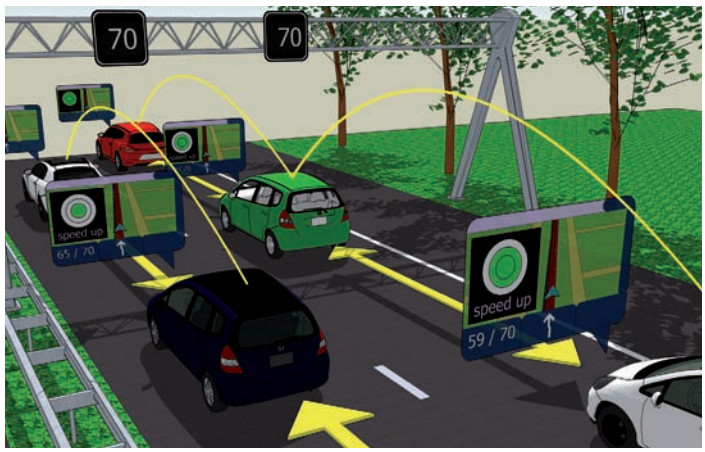
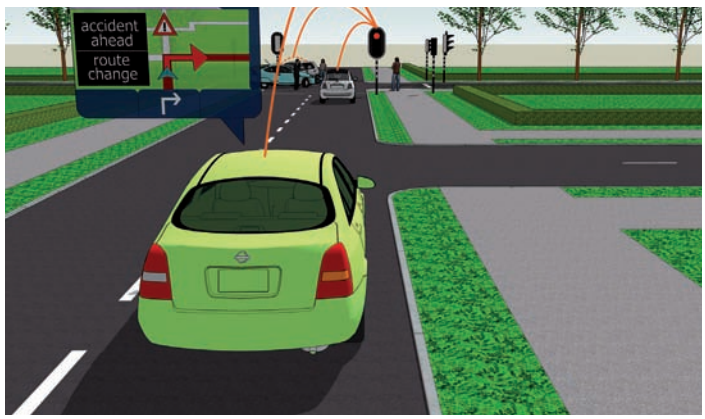
Open champions

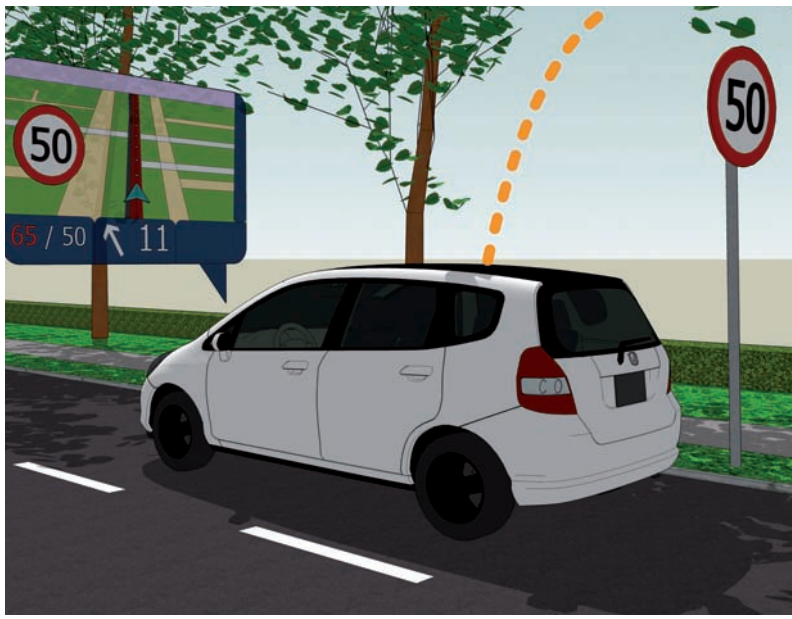
Peter McSean and **Leonard van den Berg** reveal how a bold Dutch-led project known as SPITS is looking at revolutionizing intelligent traffic systems with an open, scalable platform that's easy to upgrade. Could this be the future?

Images courtesy of Chris Bannink









There is a roadmap for cooperative driving being sketched out in a bold initiative in the Netherlands. Known as SPITS, this Dutch government-backed program is not just the biggest thing since the Cooperative Vehicle Infrastructure System (CVIS)… it's bigger! SPITS, or the Strategic Platform for Intelligent Traffic Systems, is a unique two-year project that aims to advance the technology, services and infrastructure of cooperative driving.

At the heart of its mission lies the development of a potentially revolutionary approach – an open, scalable platform for the systems of the future. SPITS is defining what that may be and how best it will work. This vision is being pursued at a remarkable pace by a consortium of 13 organizations, including Logica, NXP, TomTom and TNO.

Companies and institutions are joining forces in the SPITS project, with the goal of bridging the stalemate between government and industry in creating an infrastructure for cooperative applications

Why an open platform?

TNO's champion of cooperative driving, Nico Zornig, is on the SPITS steering committee and sees real advantages in an open platform. "The problem for cooperative driving is not a lack of platforms," he says. "The problem is the lack of a universal, open and integrated platform that can in real-time turn all roadside, vehicle and traffic center data into useful information. That's what we're working on now."

The SPITS project officially began in July 2009 and aims to cover a lot of ground as quickly as possible during its two years. Its remit incorporates the whole chain of cooperative systems and services, including architecture, software development, onboard units, roadside units, back-office, applications and services, HMIs (human-machine interfaces) and business models. The aim is that this joined-up approach will hasten the advance of cooperative driving systems and services. The best way to make that happen, the SPITS consortium reasons, is to ensure that everyone sings from the same technological hymn sheet – hence the open platform.

"CVIS was a large project," Zornig says. "We want to go a step further than that, using CVIS-type knowledge, and also advance the sharing of resources within the consortium while addressing privacy and security issues. We are not designing ready-to-use onboard systems that you'll be able to buy in August 2011. Instead, this project focuses on producing a prototype that is scalable and upgradable. So we've started by integrating the existing platforms of consortium members, together with others that have already been thought of, including in CVIS-type projects."

Addressing sensor fusion

As part of the work in developing an open, scalable platform, SPITS plans to develop greater cohesion between different methods of data collection and analysis. "Within this development, we want to address the roadside infrastructure sensor fusion problem. That is getting the different sensor-type information – video, data, laser and so on – and incorporating it into cooperative driving."

In doing so, SPITS aims to demonstrate to potential technology partners, consumers, fleets and governments the benefits that cooperative driving can bring to safety, environmental and societal concerns – including traffic management and parking issues. TNO and TomTom have, for instance, already conducted a public experiment to show one way in which cooperative driving can help optimize traffic capacity on the existing road infrastructure.

However, the project is acutely aware of the fast pace of technological advancement, so the need to make SPITS' solutions upgradable for existing users is an essential element of the program. SPITS expects that as the in-car telematics market develops, traffic management devices will become a logical extension of the vehicle's onboard infotainment system. But because such devices will develop quickly, it's important that users can upgrade existing systems within their car easily – such as a plug-in upgrade via the head unit, for instance. SPITS foresees that such upgrades are likely to happen several times during the lifetime of the vehicle, so the aim is an open system that is scalable and upgradable.

"We are investigating how a driver can have one integrated display system to use all sorts of services that are available via wireless LAN chips and plug-in modules (USB)," Zornig explains. "Examples include parking services, speed limit information or instructions to prevent 'ghost' traffic jams."

The project is also exploring service download and management solutions for in-vehicle services that cover consumer, fleet and traffic applications. As well as being able to upgrade the hardware during its life-cycle, SPITS is putting an emphasis on being able to evolve the systems and the data they use. The aim is that an open, simplified approach will speed up the pace of development and encourage greater innovation, to the benefit of future traffic management and driver safety.

The A270 Experiment

An early indication of SPITS' progress was revealed on the lead up to the Intertraffic 2010 event in Amsterdam. Known as the A270 Experiment, this public demonstration gave the outside world a glimpse of the kind of advantage that cooperative driving can offer in everyday traffic conditions.

The aim was to study the effect of SPITS' technology on traffic flow and to assess how it might be used to increase traffic capacity safely and effectively. TNO pioneered this experiment, using a TomTom navigation system as a convenient hardware solution, to focus on what's often called the shockwave, or ghost, traffic jam.

> We are discussing opening up our platform to others and challenging them to see what they can do with it… We have the chance to become the Silicon Valley for cooperative driving in Europe
>
> **Nico Zornig, program manager, Cooperative Driving, TNO**

In dense traffic, cars tend to be driven more closely together – it's an almost instinctive way for drivers to increase a road's capacity. But when one car brakes, the car behind it brakes a little harder, and the one behind that harder still, and so on. This creates a concertina effect that ripples its way down the line of traffic and causes vehicles to slow significantly, bunch up and sometimes stop altogether for a brief while. Could cooperative driving technology mitigate the effects of such a shockwave? To find out, TNO gathered 100 cars together on three Sundays during February 2010 to conduct trials in real-life conditions on the A270 in the Netherlands.

Real, accurate information

"We equipped 50 cars with technology that measured the distance to their predecessor using a camera," Zornig reveals. "They measured the speed and acceleration of each car and transmitted that information, using wireless technology, to the car five vehicles behind them. Using that information and an algorithm, the drivers received advance knowledge of how to adjust their speed to optimize the distance to their predecessor. So they were receiving real, accurate information rather than just looking at brake lights."

According to Zornig, installing the technology took two to three hours before the 50 equipped vehicles were ready to begin the experiment. The other 50 cars, meanwhile, were left completely standard. Each group of 50 cars then drove one behind the other, in their own individual lane, behind a pace car. The two groups were in adjacent lanes and the pace car's role was to replicate normal driving conditions, including the type of braking that creates a shockwave jam, as Zornig recalls. "We demonstrated that in the lane equipped with cooperative driving, the shockwave was damped more critically. Specifically, the cars in this cooperative driving lane drove faster out of the shockwave jam. That was because the effect of this anomaly – this fast braking – was less acute in the equipped lane."

This was all the more indicative of the technology's potential because the trials were conducted using normal cars and normal drivers on normal roads. In these real-world conditions, the test showed how the use of SPITS-style technology can increase capacity on the existing road network during busy times, but it also offers

A big part of SPITS involves exploring what can be done with onboard equipment such as integrated display systems

safety and environmental benefits that are likely to be welcomed by European governments in their bid to cut emissions and road casualties. In reducing the severity of braking and accelerating, vehicles use less fuel and therefore produce fewer emissions. And by basing decisions on real, accurate information rather than an instinctive and fallible reaction to brake lights and diminishing braking distances, the scope for reducing vehicle collisions is greatly reduced – and could even potentially be eliminated altogether if this information is hooked up to a collision-avoidance system that can override throttle and braking inputs when the situation demands it.

Next step... 'GCDC' in 2011

The A270 Experiment is but one element of a much wider ambition and SPITS is pursuing an holistic program of car-to-car and car-to-infrastructure communication, as well as backroom applications and commercially robust services. Many of these will come together for an event that SPITS will take part in next year – the 2011 Grand Cooperative Driving Challenge (GCDC). The GCDC has attracted interest from automotive suppliers and OEMs, as well as European academic organizations. Scheduled for March 2011, the GCDC will be a showcase of what cooperative driving technology can achieve.

SPITS understandably wants to be a part of that but it is also looking at throwing its own doors open to the international cooperative driving community. "We are discussing the possibility of opening up our platform to others and challenging them to see what they can do with it – maybe challenges appropriate for fleet owners and for the consumer market," Zornig explains. "It would show how open our platform really is. It would give us useful feedback – for instance on areas that may need to be more open."

There is also talk of looking into setting up a permanent cooperative driving test site, potentially on the A270 in the Netherlands, based on the SPITS platform. The hope is to launch a test site by the end of 2010 and for it to operate for the next five to 10 years. Such a site is also likely to be made available to other like-minded European projects – after all, integration and openness are an integral part of the SPITS mission.

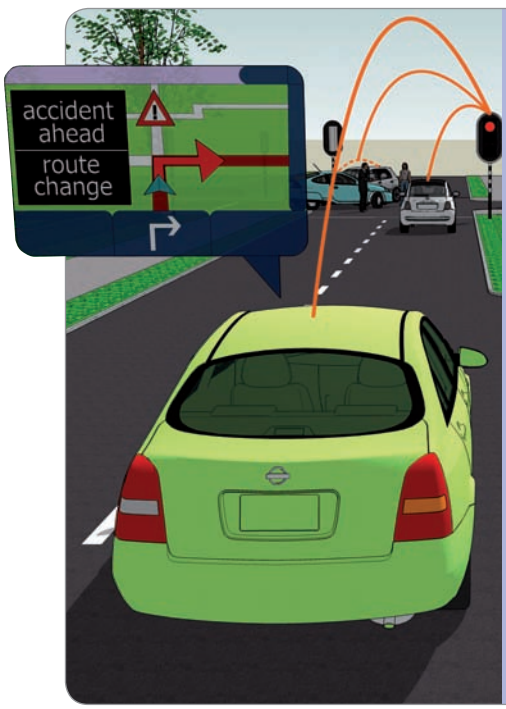
The A270 Experiment saw 50 vehicles equipped with cooperative driving kit to see if they could mitigate the effects of 'ghost' traffic jams

What about internal rivalry?

But with 13 different partners within the SPITS program, hasn't the need for an open, scalable platform caused friction and competition within consortium members? Zornig says not. "You have to address intellectual property issues in a project such as this, but we have an agreement and we trust each other. We have assembled a whole chain to make this project happen, but there is only one company in each link. If we'd had several parties competing in the same link, it may have been different, but we don't."

Zornig is a self-confessed "accelerator of cooperative driving," so it's natural that he's excited by the potential advances within SPITS' grasp. But he's also keen to ensure he and his colleagues work hard to make the most of the opportunities open to them. "We really have the chance to become the Silicon Valley for cooperative driving systems and services in Europe," he concludes.

For more information, please call Leonard van den Berg on +31 644 266 226, email lfvandenberg@gmail.com, or visit the project's website at https://spits-project.com



It's good to open up

Privacy is important to every company – especially in such highly competitive and fast-moving arenas as the automotive and ITS industries. So why should firms cooperate on developing an open platform and how can it work in practice?

According to Nico Zornig, a senior SPITS player and project manager of cooperative driving at TNO, intellectual property (IP) is the key to it.

An open platform makes it easier to integrate more applications from a wider range of suppliers into a single device. It also makes it easier to upgrade those applications in situ, encouraging improvements and innovation. This is good news for the consumer, but it's also good for suppliers.

It simplifies the design and engineering parameters, while the wider integration of applications allows suppliers to offer greater functionality. Smaller firms, too, may find it easier to make a business case for developing a product or service if there is already a pre-existing, widely used platform for it.

In practice, on a project such as SPITS, you must tackle IP issues straight away. "You don't need a full signed agreement immediately," he says. "But you need an understanding and to develop trust between each member. The main members of the SPITS consortium came to an agreement on IP pretty quickly and that helped us to convince the smaller members to do the same."

So why should SPITS members spend their time and money developing an open program that will, if successful, be made available to their rivals? Because the indications from other similar industries are that open platforms are the way to go – it's what consumers and industry want. So there's no point being left behind. And when the industry does adopt the open platform you've helped develop, you'll be in the ideal position to capitalize on it with your hard-won experience.

Planned for perfection

The proactive management and control of traffic in support of planned special events is, writes **Laurel Radow**, one area that can have a positive impact on relieving congestion

Illustration courtesy of Magictorch

The streets of Rio de Janeiro exploded with cheers when on October 2, 2009 the International Olympic Committee (IOC) announced in Copenhagen that Brazil would be the host of the 2016 Summer Olympics. Planned Special Events (PSE) on the scale of the FIFA World Cup, the Rugby World Cup, the Cricket World Cup and the Olympic Games (both summer and winter) occur somewhere around the world every two years. As the site for one of these events is selected, a second is in the middle of planning for its own event, a third is testing its systems (including transportation) and a fourth is just about ready to open the stadium's doors.

These PSEs, especially ones of this size, bring prestige and attention as well as the many visitors and fans to an ever-expanding list of cities and countries that may be unfamiliar with being at the center of the world's attention and with all that a PSE entails. This year has already seen Vancouver host a very successful Winter Olympics and, for the first time, Africa has hosted the World Cup for soccer, with nine cities hosting the month-long tournament. South Africa is familiar with hosting world-level events as it hosted the third Rugby World Cup matches in 1995. With two events to be held in just a few years, South America is preparing to host both 2014 FIFA World Cup and the 2016 Summer Olympic Games – both in Brazil. When the world's attention is on these events, so too is the attention of the world's media.

Such sporting showcases are large – large with regard to the planning that goes into them, large with regard to managing the transportation needs of both the official family – dignitaries from the many countries represented in the games, players, officials, sponsors and the media, as well as the transportation needs for the fans – and large in the implementation of the plans. Each of these events also involves the close participation of the sponsoring organization. Whether it's the IOC (the Olympic Games), FIFA (soccer), the WCC (cricket), WCR (rugby), or any other sponsoring agency, the host governments, national and local,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Finally, even though security has been a concern of these events long before 9/11, the security overlay and the security considerations that both the plans and the implementation of the transportation plans need to incorporate has increased in the past nine years (see *Considering the security factor*).

Events of this size place great demands on the hosting cities. As is noted on the World Cup Rugby (WCR) 2007 website, the 2007 event was six weeks in length – from September 7 to October 20. France hosted the 20 nations that competed in the 48 matches during the 44-day event. The cup's 48 games were played at 13 venues with 42 of the matches played at 10 venues throughout France. Outside of France, Cardiff in Wales hosted four and Edinburgh in Scotland hosted two of the matches.

This year, from June 11 to July 11, 32 teams and tens of thousands of ticket holders traveled to South Africa for the 2010 FIFA World Cup. In anticipation of nearly one million visitors for the month-long event, the South African government set up the website, 'Find your Way' to provide transport information.

Whether it's an event that is international in scope or a small town's annual parade, the transportation network takes on much of the demand for these major events. For events such as rugby or soccer, as the cup matches progress from the quarter-finals to the semi-finals and eventually the finals, fans move from one city to the next host city. In addition, within the city the official family, the ticket holders and those who come to participate as onlookers put a strain on the city's transportation network.

The sheer magnitude of the number of people that must be moved for these events whether within a city (the Olympic Games) or between cities (soccer or rugby) also places a great demand on the transportation agencies that prepare and implement the transportation plans. Transportation management plans are needed for PSEs whether it is one that captures the attention of the world, a country or even a region within a country. With the understanding that these events put a great stress on the transportation networks of states, since 2004 the Federal Highway Administration (FHWA) in the USA has produced a number of publications and held three PSE conferences to assist those local and state DOTs in the planning and implementation of transportation plans for PSEs. PSEs do not only take place in large metropolitan areas though. The Dutchess County Fair, as described in the *Intelligent Transportation Systems for Planned Special Events: A Cross-Cutting Study*,[1] is one such example of how a rural county handles an event with an attendance that can be far greater than the population of the county.

Security played a role in the decision to close Washington's highways and bridges for President Obama's inauguration, but the primary motivation was traffic management

Role of ITS at PSEs

To gain a better understanding of the role that ITS plays in PSEs, the USDOT Joint Program Office (JPO) and the FHWA Office of Operations co-produced the November 2008 publication *Intelligent Transportation Systems for Planned Special Events: A Cross-Cutting Study*.[2] The report examined how six agencies in five US states used and continue to use ITS to reduce congestion generated by PSEs. The study found the use of ITS helped to reduce crashes, increase travel time reliability, and reduce driver frustration. The six PSEs included in the report were held in Montgomery County

Defining a planned special event

In 1988, the FHWA's National Highway Institute defined a special event as an occurrence that "abnormally increases traffic demand", unlike an accident or workzone activities that restrict roadway capacity. According to the FHWA, PSEs include sporting events, concerts, festivals, and conventions at permanent multi-use venues. These events also include less frequent public events, such as parades, fireworks displays, bicycle races, sporting games, motorcycle rallies, seasonal festivals, and milestone celebrations at temporary venues.

The term planned special event is used to describe these activities because their locations and times of occurrence are known and their associated operational needs can be anticipated and managed in advance. Severe weather events or other major catastrophes represent special events that can induce extreme traffic demand under evacuation conditions. Occurring at random and with little or no warning, they are in contrast to the characteristics of PSEs.

A PSE creates an increase in travel demand and may require road closures to stage the event. They generate trips, in doing so affecting overall transportation operations. This includes freeway operations, arterial and other street operations, transit operations, and pedestrian flow. Unlike roadway construction activities or traffic incidents that constrain travel within a single corridor, PSEs affect travel in all corridors serving the event venue(s).

To improve air quality in Beijing ahead of the Olympic Games, transport leaders limited cars on the city's streets based on license plate number

(Maryland), Boston (Massachusetts), Anaheim and Pasadena (California), Daytona Beach (Florida), and the Dutchess County (New York).

The major finding of the report was that those people at transportation agencies found ITS helps to ease the congestion and frustration that accompany many PSEs. ITS benefits all types of agencies that host such events in all types of locations, from large urban areas that host many events throughout the year to small rural areas that host only one or two events annually. The report also found that transportation officials in localities around the country have recognized the important role that ITS plays in the success of their PSEs. Many of these individuals also recognize that without those technologies, efficiently managing the transportation needs of both event attendees and local citizens would be a much more challenging proposition.

The report also found that the use of ITS technologies themselves can, however, offer challenges. Many systems use sophisticated communications or networking applications that require operator training. Systems that are newly acquired may also experience glitches or difficulties associated with initial deployment that require maintenance or remediation from the manufacturer. Other technologies or systems – while potentially effective – are cost-prohibitive for smaller communities and rural areas with more limited budgets. Local factors can also have an effect on the usefulness of a solution. For example, an event with significant use of radio frequency bandwidths at the venue may make wireless communication via cellular phone difficult or impossible.

All agency staff interviewed, however, agreed that the benefits of a technology that is effective and robust clearly outweigh the initial challenges of finding and deploying the right solution.

The economy and congestion

To understand the magnitude of events held in the USA on an annual basis, in 2008 the FHWA produced the study, *Planned Special Events – Economic Role and Congestion Effects*.[3] The purpose of the study was to estimate the influence that large PSEs have on both the economy and congestion on a national level. The types of PSEs that were included in the study were those with more than 10,000 participants and spectators. Increased awareness of the frequency and economic magnitude of these large events is essential to have a better understanding of the important role transportation planning should play in managing the transportation aspects of these events.

Currently, information on PSEs is largely fragmented and dispersed. The FHWA report was the first known systematic attempt to collect and estimate the size, frequency, and economic magnitude of large PSEs nationally. In order to overcome challenges in data dispersion and availability, an effort was made to collect information from secondary sources, event organizers, event venue managers, and government officials. The study was essentially a first glance of PSEs from this perspective and as such provided an order of magnitude estimate of the extent of these events.

> Increased awareness of the frequency and economic magnitude of these large events is essential to have a better understanding of the important role transportation planning should play

Considering the security factor

Long before 9/11, large numbers of people at a single event or venue raised concerns. As sobering as events such as the bombing during the 1996 summer Olympic Games in Atlanta or the massacre at the 1972 Munich Olympics were, since 9/11 PSEs have added and continue to add layers of security and safety.

Sporting events and security offer an interesting twist. All involved in the planning want to make sure attendees enjoy themselves but at the same time understand that security will have a presence. The vast range of non-sporting events also involves great levels of security. The almost 1.8 million people who attended the 2009 inauguration of President Barack Obama in Washington DC was a key reason why security played a major role in the development of the event's transportation management plan. Security was ever-present but every effort was made to ensure that their presence did not interfere with the event. All of those traveling to see the inauguration were provided with advance information about which roads were closed to cars, what roads were open to pedestrians and when the Metro would open.

In the USA, National Security Special Events (NSSEs) are those deemed to require national-level security planning. NSSEs are not infrequent. According to a March 2009 Congressional Research Service report, 28 NSSEs were held between September 1998 and February 2008 in 14 US cities. With the frequency with which they occur, FHWA has underway a task that will help state and local DOTs to be better prepared to carry out their roles and responsibilities.

When an event is designated an NSSE, the US Secret Service assumes its mandated role as the lead federal agency for the design and implementation of the operational security plan and federal resources are deployed to maintain the level of security needed for the event and the area. The goal of such an operation is to prevent terrorist attacks and criminal acts. Since 1998, the Secret Service has led federal security operations for a range of major events, including the past two presidential inaugurations,

Several approaches were employed to collect event size and frequency data – a venue and permitting authority-based approach and an association-based approach. The venue and permitting authority-based approach was designed to collect data from a sample of special events venues and permitting authorities, such as stadiums and police departments at a micro or city level. The association-based approach was designed to collect data from trade associations representing the relevant entities within various special events categories at the national or macro level.

For the micro- or city-level approach, case study cities were selected: venues, permitting authorities, and other officials were identified and contacted to develop estimates of the number of PSEs and respective attendances. For the macro or national approach, the first step was to collect the available data at the national level from the US Census Bureau, associations and other organizations. This process was effective for many types of events, particularly sporting events, which have national groups that collect such data, such as the National Football League, National Basketball League and the National Collegiate Athletic Association.

To address the congestion concerns, as part of the report appropriate mitigation strategies were discussed. For freeway sections, for instance, ramp closures and/or elimination of weaving areas were recommended, as were ramp metering and/or rolling road blocks. Late diverges should be prohibited, additional exit ramp lanes were advised, alongside different plans for ingress and egress. For street-level congestion, though, alternative lane operations were suggested for predominant high-volume, directional traffic flow during ingress and egress. This would be achieved through vehicle travel on shoulders, reversible lanes, and contraflow operation. Additionally, temporary trailblazers for venue parking areas and freeways were advised.

For congestion at intersections, the report suggested that the number of intersection conflict points and signal phases at major pedestrian crossings should be reduced. There should also be longer cycles to increase the normal favored phase, while a custom timing plan should favor a minor street phase – serving venue and parking access roads. A contingency flush plan would also facilitate corridor flow.

Winter Olympic routes were designated throughout the city of Vancouver to provide reliable travel between venues, accommodation, and locations such as the Olympic Village and main media center

As every PSE should have an incident management plan as part of its operational plan, incident management strategies are critical to the successful management of the transportation component of PSEs. These strategies include the use or increase of service patrols, while safe, quick clearance initiatives should be enacted. The incident management plan should also be integrated into the larger PSE transportation management plan.

The inclusion of public transit service into the transportation management plans for PSEs helps relieve demand on the road network. Some of these strategies include adding vehicle hours to existing service, modifying existing service, implementing

the 2004 and 2008 Republican and Democratic National Conventions, the State Funerals for Presidents Reagan and Ford and the past four States of the Union Addresses. In the past 12 months, Pittsburgh hosted the G-20 in September 2009 while Washington DC hosted the Nuclear Security Summit to 47 world leaders in April 2010. As these events will continue to be held in more and more cities, more transportation agencies will be called upon to provide their expertise.

Once designated an NSSE, the Secret Service relies on existing partnerships with federal, state and local law enforcement and public safety officials with the goal of coordinating participating agencies to provide a safe and secure environment for the event and those in attendance.

A number of factors are taken into consideration when designating an event as an NSSE, including the anticipated attendance by dignitaries, and the size and significance of the event.

The safe movement of those in attendance, especially dignitaries and officials, as well as the ability to limit the difficulties that the residents may face as they move around restricted streets requires the involvement of transportation into the planning and implementation. Up to now, the transportation-based information related to these events has not been shared; information acquired during previous NSSE events has not been transcribed and so cannot be made available for those who need it in subsequent years. To address these concerns, the FHWA is completing work on a best practices guide to aid state and local jurisdictions about how to plan for and address traffic associated with these events.

The Secret Service has developed a core strategy to carry out its security operations, which relies heavily on its established partnerships with law enforcement and public safety officials

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ITS management during PSEs

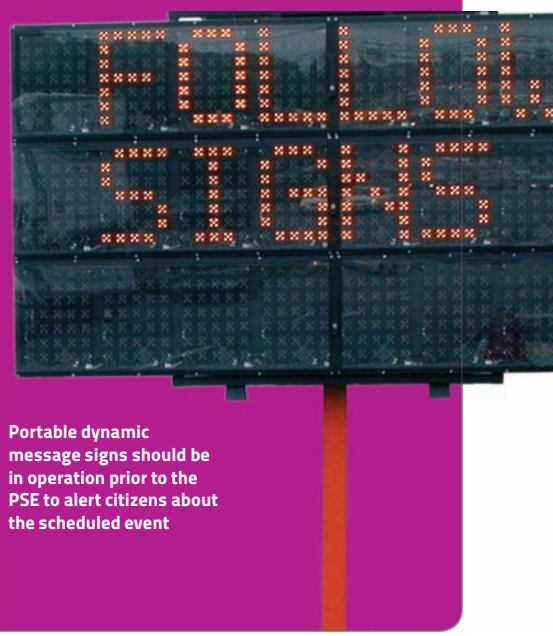
The following are lessons learned derived from six study sites about the use of ITS for PSEs, with categories that correspond to phases in planned special event management.

Event planning and coordination: Regular coordination meetings should be held among stakeholders in advance. Each agency operates in a manner that is consistent with its own goals and operational concepts. When planning for a regularly held event, a fluid plan should be adopted that is open to change. There should be coordination with construction programs at the state, county, and local levels to ensure that there are no projects scheduled to occur on the day of the event. The needs of local citizens as well as event attendees should

be remembered. Also, when developing a traffic plan, you should consider detours for commercial vehicles and other non event-related vehicles around the event venue. Portable DMS should be in place several days prior to inform motorists and give them sufficient time to find and become familiar with other routes. Equipment should also be thoroughly tested beforehand.

Day of event: While the event is actually underway and plans are being executed, the same core members of the planning group should be available to modify the plan as necessary. Also, the local media should be used to publicize special events and advise about alternate routes and diversions. Agency staff or field technicians should also conduct on-site observations during large special events. It is also recommended that state or regional motorist assistance vehicles should patrol the roadways around events, borrowing from other agencies if necessary.

After-action/post-event: An after-action review should be developed both to identify shortcomings as well as to determine what works well so successful practices can be expanded or repeated for other events.



Portable dynamic message signs should be in operation prior to the PSE to alert citizens about the scheduled event

express bus services, and encouraging combined transit/ticket pricing that's lower.

Travel demand management for PSEs is often overlooked as a way to mitigate demand on the prime routes at peak times – strategies that can be discussed with the venue managers during the planning phase of the event. However, should these or other strategies be incorporated into the plan, the public outreach that is developed and implemented during the event need to make these strategies known to the attendees. A variety of traveler incentives exist, including the use of alternate travel modes, the shifting of arrival and departure times, increasing vehicle occupancy, and diverting background traffic around affected areas.

Public information can be provided in any number of ways. The world of social media options will continue to expand the number of ways to provide traveler information. In addition to these newer methods, the traditional media and the internet, other ways of providing traveler information include changeable message signs, HAR, and the 511 travel information phone service. Public information campaigns, event/venue guides, and kiosks can also help convey vital travel messages.

Pre-trip and en-route information is also vital, providing attendees the best driving/transit routes from specific origins, venue parking area locations and fees, recommended event ingress and egress routes, and up-to-the-minute travel information. Estimated travel times via the different travel modes and advisories and restrictions can also be transmitted.

At the time that the report was written, though, very little quantitative data on effectiveness could be found, but the authors of the report did learn that mitigation strategies offered some relief. A University of California study using a simulation model found that ITS reduced delays by 14-34% for attendees and 10-13% for non-attendees, while a Maricopa County DOT (Arizona) study estimated outbound travel time for the Phoenix International Raceway decreased from 5.5 to 2.5 hours as a result of ITS introduction.

> The wiser investments are those that consider not only the event itself but how those investments can be used once the event has ended

Use of technology post event

In preparation for an upcoming PSE, localities make tremendous investments in their transportation infrastructure. The wiser investments are those that consider not only the event itself but how those investments can be used once the event has ended and the world's attention has moved on.

One city that has made managing PSEs a major part of its day-to-day operations is Anaheim in California, at which the Anaheim TMC was established because the city draws so many visitors to its many special venues, including Disneyland. DOTs have also made use of other technologies that were employed for PSEs. As Salt Lake City prepared for the 2002 Winter Olympic Games, for example, Utah DOT hired a meteorologist to provide weather information.

Since the Games, Utah has added more meteorologists and the state DOT is an active user of RWIS.

The continuum

FHWA's Office of Operations views emergency transportation operations as a continuum that is defined by the probability an event will occur and the severity of the impact and complexity of response. As such, the Office established the Emergency Transportation Operations team, which is concerned with three primary ETO activities. The first is the high probability-low severity traffic incident through its Traffic Incident Management or TIM program. Then there's Planned Special Events, which is the platform for community preparedness and response readiness for events that range from parades through town and subsequent street closings and a focus on traffic management to events that might attract malevolent acts that cause a potential emergency response – the Super Bowl, for example. Finally, it includes the low probability but high impact of a catastrophic event, covered through the ETO's Evacuation Planning program. In this program (detailed in the *In Times of Crisis* article in the June/July 2009 edition of *Traffic Technology International*), the FHWA works with local, state and federal officials to address special movement coordination operations, particularly in the area of evacuations.

ITS is an excellent example of how the same technology is used for these three different types of non-recurring congestion. Although the same ITS tools will help in each of these areas, the different nature and response requirements of each event will result in different players, expectations and/or demands.

The number of partnerships required for planning and operations is inversely related to event probability. In the case of PSEs – especially those described here – a diverse group of partners are involved, including venue managers, law enforcement, fire and rescue, emergency medical services, safety/service patrols, towing and recovery, emergency managers, elected and appointed officials, traffic media, highway users, public works, metropolitan planning organizations (MPOs) and, of course, other transportation agencies, such as transit, traffic engineers, and private bus operators.

> Transportation has much to offer – especially when ITS is employed – to make the time of those traveling to view their team, that special player, or merely to be present to enjoy the atmosphere as enjoyable and safe as possible

Conclusion

PSEs bring out the best a city, region or country has to offer. It is for that reason that so many countries vie to host the Olympic Games, the various World Cup sporting events, the upcoming World Equestrian Games that will be held in Lexington, Kentucky in September, or other high-visibility events. Transportation has much to offer – especially when ITS is employed – to make the time of those traveling to view their team, that special player, or merely to be present to enjoy the atmosphere as enjoyable and safe as possible.

Laurel J. Radow is the evacuations and planned special events program manager within the ETO Team at the FHWA's Office of Operations, Washington DC

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Traffic control for the Superbowl

In 2008, the City of Glendale in Arizona's 70,000-capacity University of Phoenix Stadium played host to the Superbowl. Avery Rhodes, the city's ITS manager was delighted with the team effort that helped keep traffic moving. "We started planning for the Superbowl about two years in advance," he says. "As the event got closer, we were very busy with a number of traffic management projects. One key task was getting all of our traffic signals hooked up to a fiber-optic communication system. We were also responsible for all the traffic signal timing and traffic control plans."

Events such as the Superbowl generate huge amounts of extra traffic

The stadium is the home of the Arizona Cardinals. "The good thing about the Superbowl is that it starts at 16.30hrs, so people are arriving all day long, rather than for Cardinals games where the parking lots are opened just a few hours before," Rhodes says. Despite this, there were still up to 25,000 extra vehicles to contend with for the Superbowl.

Rhodes highlights the importance of inter-agency cooperation. "We're very proud of our close relationship with the local police department, which is important as there's an overlap in traffic responsibilities. They're an integral part of the planning process. They take care of all the VIPs and teams, with escorts to the stadium – we don't have to close roads, but we're all on the same radio system so we're constantly updated as to their location and prepared for them when they arrive."

Soccer cities

Paul Vorster, ITS South Africa's CEO, cites three challenges the country faced when it was awarded the 2010 FIFA World Cup: accommodation, security, and transport – the latter being the most significant. "South Africa is a very big country and we had 10 venues a number of kilometers apart from each other. Many are linked by air but a lot required road transport."

Thankfully work had already been underway on a large road infrastructure project – the Gauteng Freeway Improvement Project (GFIP) for the previous three years. Vorster says: "Roads were upgraded and new lanes added, which gave us huge improvements in terms of traffic flow. For the duration of the World Cup, we put a moratorium on construction work so that spectator traffic was not competing for road space with construction vehicles and so that the work zone lanes could be used by regular traffic."

Another recent traffic-busting project established pre-World Cup is the bus rapid transit (BRT) system deployed in Johannesburg. Vorster describes this as one of the transport backbones for the spectator traffic – he even used it himself when attending the opening match at Soccer City.

Various park and ride schemes using temporary ITS (traffic counting, VMS for guidance) were deployed at hubs leading to the BRT system and the regular Metro Rail trains.

"The real legacy of the whole experience is that it's shifted the mindset of people to start embracing public transport."

Olympic effort

For British people, discovering that London had won the bid for the 2012 Olympics on July 6, 2005 is now embedded in our collective memory. The jubilation of hearing that news was starkly contrasted with the brutal scenes the following day when London experienced a terrorist attack on various parts of its transport network.

Obviously, preventing a similar attack from occurring during the Olympics is a priority. ITS UK's Neal Skelton – who has a background in counterterrorism – believes that ITS has a strong role to play, both in ensuring planned events run smoothly and in stopping unexpected incidents from occurring. "The main thing is making sure the city runs alongside the special event. There is a danger that an event such as the Olympics will end up taking precedence over the whole city. ITS has to carry on serving the needs of the regular citizens regardless," he says.

"It's also about ensuring that what you're doing is coordinated so that if something does go wrong – as in the case of the London bombings – you are in a position to try and maintain some sense of normality on the rest of the network."

Skelton believes that Transport for London is in a strong position to both cope with the extra traffic on all modes of transport (estimates suggest up to eight million spectators could visit) and – due to its excellent relationship with the Metropolitan Police – be able to keep things running if the worst were to happen. He cites concrete examples of this relationship working effectively in the past, the G8 summit being one. ALPR created a 'virtual ring' of protection, and he expects the Olympic venues to be similarly protected.

"ITS helps with everything from logistics and freight to route closures for VIPs, and of course ensuring that competitors don't get stuck in traffic en route to the games!"

Bright sparks

ITS America's Best of ITS Awards commend the most innovative, effective and influential achievements in the transportation field. Once again, **Louise Smyth** talks with those ingenious champions in the 2010 spotlight

Main image courtesy of Yurovskikh Aleksander

The ITS America Annual Meeting & Exposition is a key fixture in *Traffic Technology International*'s events calendar. The North American market is where more than half of our readers reside, as well as some of our most respected and engaging contributors. It's also where we source many of the stories and features that we share with you.

The sheer scope of the US ITS industry is in part what makes it so compelling. In such an expansive country, it's unsurprising that mobility is so integral to US society. And getting people and goods from A to B safely and swiftly is a crucial and ongoing challenge. Hence we see deployments of every kind of ITS technology you can think of – from tolling schemes and smart transit projects to vehicle-to-vehicle and vehicle-to-infrastructure communication efforts, not to mention the political will required to get new laws passed and maintain the momentum behind these deployments.

But there's also another aspect to the US traffic sector culture that sets it apart from others, and it's something that simply comes down to attitude. At US events, there is always an overwhelming sense of sharing. Whether that's sharing experiences (including mistakes), new technologies or strategies, there's a strong feeling of all participants pulling together for the same ultimate goals.

This 'feeling' is illustrated in a more tangible way by looking at the annual Best of ITS Awards. Product vendors, DOTs, consultants and others all embrace the opportunity to share their success stories and submit them to be judged by their peers. The eventual winners receive their awards from ITS America in front of an audience of those peers. This year's ceremony in Houston, Texas highlighted what the ITSA president Scott Belcher refers to as "the best and brightest in the ITS community". For the fourth year running, we were on hand to get their stories....

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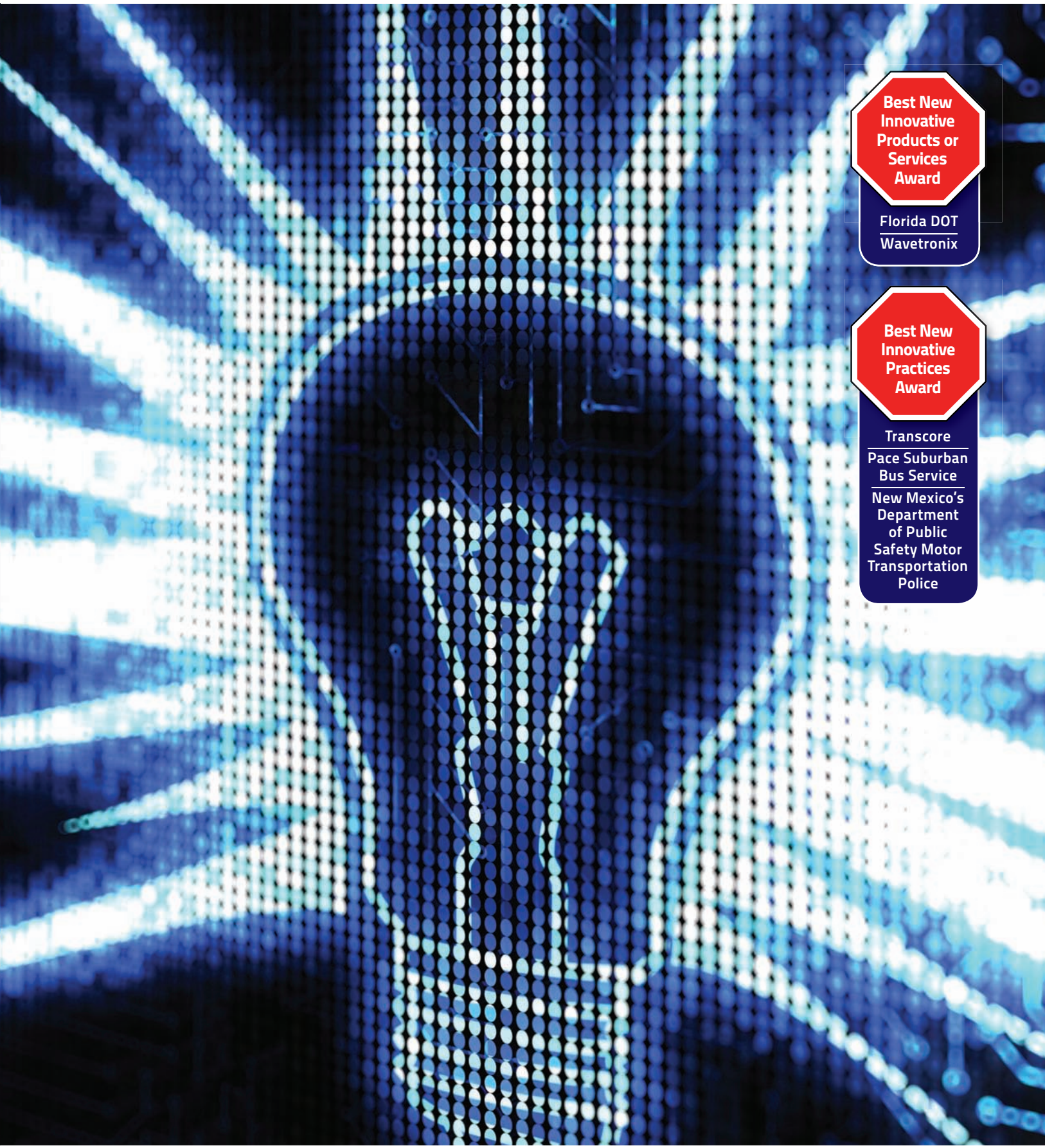


Best New Innovative Products or Services Award

Florida DOT

Wavetronix

Best New Innovative Practices Award

Transcore

Pace Suburban Bus Service

New Mexico's Department of Public Safety Motor Transportation Police

Winner

Pace Suburban Bus Service

Transit Operations Decision Support Systems

John Braband, department manager, Bus Operations, Pace Suburban Bus, USA

The Pace Suburban Bus Transit Operations Decision Support Systems (TODSS) project is proof that smart thinking can solve many of the issues that the operator once considered out of its control.

Pace provides regular bus routes and special services (dial-a-ride, subscription bus and vanpool) throughout a six-county region in Northeastern Illinois. "There are more than 800 fixed-route vehicles with total ridership in 2008 approaching 37 million," explains Richard Kwasinski, Pace's chairman. "Pace dispatchers have been using an advanced CAD/AVL system since 2004. The existing system meets many demands but we, too, had a number of requirements. For instance, we wanted the ability to include external sources of information with the CAD/AVL messages to provide a complete 'operational picture'. We also wanted to design and incorporate a rules base that defines and sets the threshold and priority level for early service disruption notifications, as well as design and incorporate a rules base for service restoration options and strategies to be associated with each service disruption type.

"The TODSS was designed simply as a prototype, but evolved into a complete intelligent decision support system that Pace continues to use daily at all 10 dispatching centers," Kwasinski says. "All levels of management and the dispatchers have confirmed that it has improved dispatcher service performance, the quality of the dispatcher responses has improved, there is greater uniformity of action among dispatchers, and that there is increased real-time operations communications from the dispatch center agency-wide."

Best New Innovative Practices Award

Winner

Transcore

RFID technology

Tim Schock, vice president, Revenue Management Systems, TransCore, USA

TransCore claimed a Best New Practices Award for its partnership with the Southern Connector – a 16-mile toll road in Greenville, South Carolina. "Initially, the purpose of the project was to provide Southern Connector with a replacement for an ETC reader system that was damaged in a car accident at one of the toll plazas," explains TransCore's John Mike. "They wanted a system that would provide identical functionality as the previous system, yet provide a technology path toward national toll interoperability. They also wanted to capture 100% of the vehicles with RFID tags on their roads – to turn violators into customers." RFID was subsequently deemed the most cost-effective solution.

TransCore installed its IAG plug-and-play reader system, in doing so proving that national tolling interoperability – a longstanding political hot potato – is technically possible. "Performance was measured by the ability to accurately read Southern Connector's Palmetto Pass toll tag base (19,000 so far) and the enhanced capability to read multiple toll tag protocols," Mike adds. "Southern Connector now has the ability to read any toll-related tag in North America, including IAG (19.2 million tags), Florida (4.6 million), Oklahoma (800,000), Texas (4.5 million), Kansas (190,000), and Georgia (218,000). Our system also provides an accuracy of 99.95%."

Best New Innovative Practices

Winner

Wavetronix

SmartSensor Matrix

Brian Hagen, executive vice president and COO, Wavetronix, USA

Best New Innovative Products or Services

The competition for Best New Innovative Product was intense, but radar detection expert Wavetronix was ultimately crowned the winner for its SmartSensor Matrix, billed as the first multi-lane radar traffic sensor designed specifically for intersection stop-bar detection (you'll find more detailed analysis on page 78).

SmartSensor Matrix is already widely deployed in the USA and among the positive feedback received so far is a strong commendation from Utah DOT: "[We] are finding operational benefits using the SmartSensor Matrix... We have been able to reduce our passage time... the main benefit of short passage times is reduced overall vehicle delay... Other benefits include reduced air pollution from idling vehicles; less gasoline consumed; less wear and tear on vehicles and pavement; and reduced driver frustration."

"SmartSensor Matrix represents the first significant technology release in the intersection detection segment in more than 12 years," reveals Brian Hagen, executive vice president and COO of Wavetronix. "It was created in response to requests from the industry for more effective, non-intrusive intersection monitoring. As a non-intrusive device, SmartSensor Matrix installs above the ground without compromising the road surface, and most installations can occur without disrupting the normal flow of traffic. Additionally, the sensor is easy to install, and easy to maintain after installation."

Best New Innovative Products or Services

Winner

Florida DOT

95 Express Lanes Project

Alicia Torrez
public information officer,
Florida DOT, USA

Florida is well known for being progressive in its approach toward ITS, exemplified perfectly with Florida DOT's 95 Express Lanes project. Moving away from a combination of general-purpose and HOV lanes, a new scheme (Phase 1A saw the northbound express lanes opened for tolling between I-95/SR-112 and NW 151st Street in December 2008) has had an immediate beneficial effect on travel times and speeds for both regular lane users and drivers in the express lanes.

"To fully address the recurring congestion and offer motorists a reliable, multimodal travel option on I-95, FDOT combined four concepts to enhance the overall mobility of the highway," says Rory Santana, FDOT's District 6 ITS manager. "These are known as the 'Four Ts' – tolling, technology, transit and transportation demand management. The approach successfully integrated the HOT lanes concept with carpool and transit incentives, ramp signaling and rapid incident management strategies to manage traffic flow in real-time and increase person throughput. By combining the Four Ts and applying for a federal grant to meet their budget, FDOT delivered Phase 1A of the 95 Express Project in less than 10 months after the notice to proceed."

Of particular note, no new lanes had to be constructed – the existing roadway was simply reconfigured. The former HOV lane was converted into two express lanes, which transformed the facility from a five-lane highway with HOV capabilities into a six-lane facility with two HOT lanes. The express lanes themselves feature a further noteworthy detail. They were designed with the regular, local commuter traffic in mind – not just as a handy treat for those who happen to have enough occupants (three, in this case) on a given day: "The HOV3s have to be registered, meaning they have to meet certain requirements and provide us with specific details."

Describing the reaction to Phase 1A as "unbelievable", Santana expects to be busy over the coming months. "I've got three presentations next week and last week we had a group of representatives from seven state DOTs pay us a visit, as well interest on a global scale. We've even had other facilities operating managed lanes come and see how we're doing things."

Best New Innovative Practices Award

Winner

New Mexico's Department of Public Safety Motor Transportation Police

Smart Roadside Inspection Program

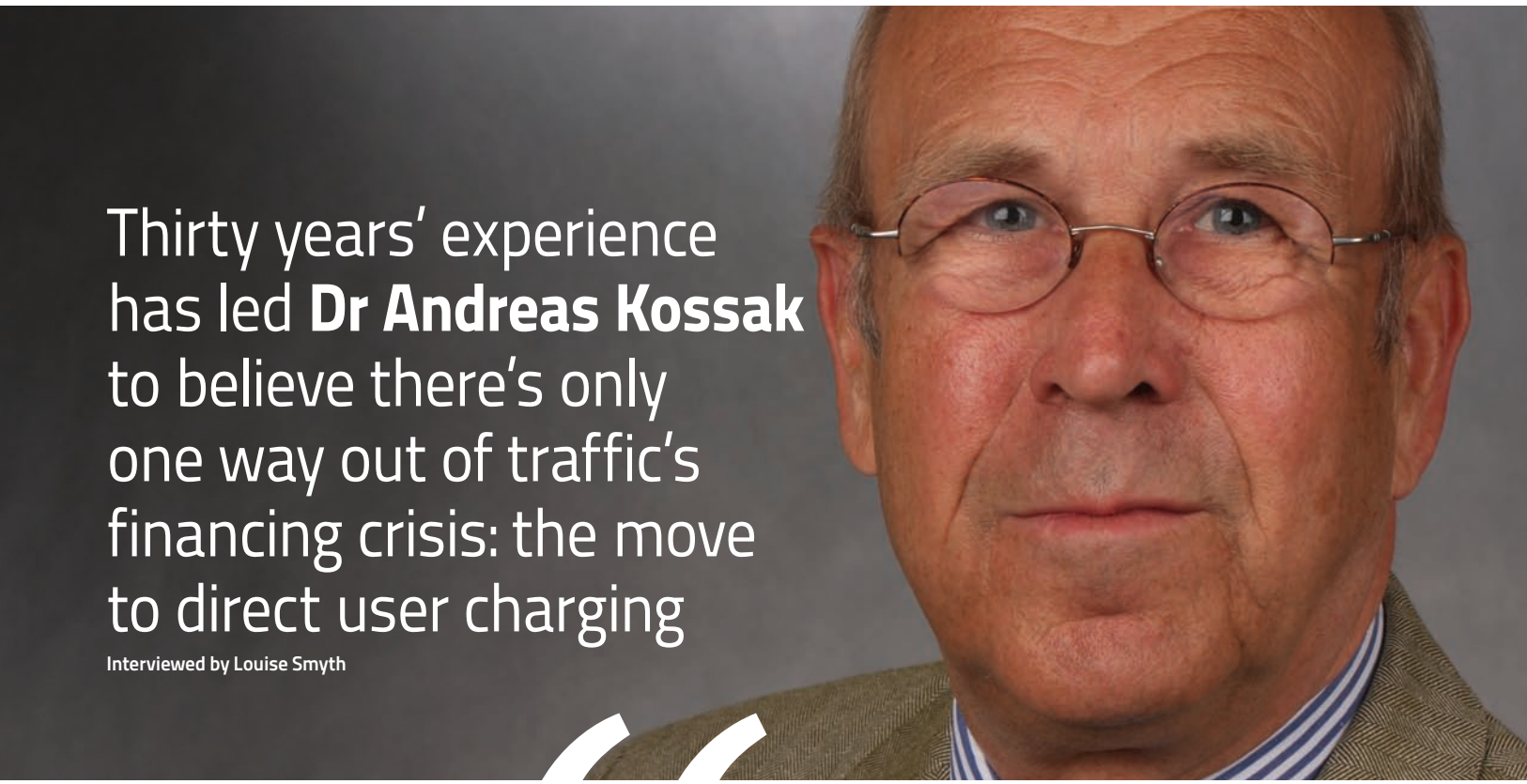
Major Ron Cordova
New Mexico Department of Public Safety,
Motor Transportation Police, USA

New Mexico's Department of Public Safety (DPS) Motor Transportation Police (MTP) was recognized for its Smart Roadside Inspection Program. "This screening tool provides our officers and inspectors with real-time information about commercial vehicle safety, as well as the administrative side of registration," explains Major Ron Cordova from New Mexico MTP.

Each passing vehicle is identified by its license plate and USDOT number. Other on-site sensor data from traditional roadside electronic devices, such as WIM systems and over-dimension devices, are integrated and pooled together with the vehicle and carrier identification.

"We had many discussions about how to get this valuable real-time information to the roadside officers at our ports of entry as vehicles enter our state," Cordova continues. "We looked at various technologies, but in the end Intelligent Imaging Systems from Canada designed a system combining the LPR cameras with the DOT's optical readers together in one hardware package. They also integrated the software to give us both safety information from the national database and the administrative side from the state database, and put it together in one system to help us more efficiently screen vehicles."

The system went live in three stages – the first in November 2009, the second in December and the third in March 2010 – and Cordova is delighted with the results. He cites in particular improvements in time-savings (no more physical checking of five databases) and also in safety, as any potentially dangerous vehicles can be stopped far more quickly. He also highlights the benefit to the operators themselves: "Carriers without safety issues, are expedited quickly; it's not interrupting commerce and helps us focus our enforcement efforts on high-risk vehicles and carriers."



Thirty years' experience has led **Dr Andreas Kossak** to believe there's only one way out of traffic's financing crisis: the move to direct user charging

Interviewed by Louise Smyth

> The transport infrastructure was characterized by a maintenance crisis and numerous bottlenecks; 10 years later, the situation is no better

When asked from where his more than 30-year passion for traffic engineering emanated, Dr Andreas Kossak suggests it could have started as a youngster. "I attended a very old Latin and Greek school," he recalls. "By studying such languages, you learn to think in complex terms and in alternate interpretations."

The other thing that gave him a well-aimed nudge down this path was that, following his national service, Kossak attended what was back then Germany's only technical university, the Technische Universtät Berlin. "The difference to other colleges was that in addition to the main fields – I chose law, history, history of art, and Swedish – you had to study what were known as 'humanistic' subjects. As a result of the link between civil/traffic engineering and town planning, I studied both.

"Long before I finished university, I was employed as a traffic engineer for a new firm focusing on interdisciplinary town planning," he says. "Until then, town planning was solely the job of architects. I first published work on pedestrian zones in the early 1970s, including mixed zones for pedestrians and public transport. That was regarded as incredible in those days."

Soon after graduating, Kossak became a lecturer on technical infrastructure (roads and service), as well as spending 10 years conducting traffic engineering and town planning for more than 50 communities. Subsequently, he was handed responsibility for the scientific side of a type of semi-governmental company dealing with new technologies for public transport. "I also worked on my doctoral thesis about the assessment of transport projects regarding aspects of urban design," he says. "In this I tried to teach my civil engineering colleagues that what they were doing was of the highest influence on the urban environment." This was pioneering in its own right as it was the first doctoral degree blending civil engineering and town planning to be awarded in Germany.

Working in a variety of transport-related roles in countries such as Egypt, Nigeria and Venezuela – and running his own transport consultancy – since 1979 Kossak has worked closely with Dr Pällmann, whose name is intrinsically linked with the German High Commission on Financing the Federal Transport Infrastructure, established in 1999, now widely known as the Pällmann Commission. "According to the commission's main findings, the federal transport infrastructure was at that time characterized by a latent severe maintenance crisis and numerous bottlenecks," Kossak states. "Ten years later the situation is no better – in fact, it is even worse. With regard to the costly construction of bridges and tunnels, independent experts have referred to 'ticking time bombs' for years. Transport politicians from all parties characterize the perspective of infrastructure financing as a 'black hole'. This is valid not only for the federal level but (even more dramatically) for the regional and municipal networks. I believe the situation in many or even most of the other EU member states is similar."

The ultimate conclusion of the Pällmann Commission was that traditional tax financing was simply not a sustainable method to maintain and develop transport

infrastructure. It offered the following recommendation: "The financing of the federal transport infrastructure should gradually be converted to financing by the user, the profiteer and/or the causer – to the extent possible with regard to the boundary conditions of the single sectors." In Kossak's words, "the commission was convinced that a full conversion to user financing was both possible and urgently necessary."

Pay as you drive

A number of advantages were cited, such as the obvious being that road user charging is a direct link between using the roads, paying the charge and employment of the revenue. A perhaps more astute benefit noted is that RUC means dependency from changing budgets and political governance and that it's also an effective form of traffic management due to the merits of congestion/environmental pricing.

"The commission's recommendations have been broadly accepted by politicians and lobbyist organizations throughout Germany," Kossak says. "Even the automobile clubs and the boulevard press are on side. Since then, numerous high-ranking commissions and expert groups have been appointed worldwide with the same (or a similar) task, and their findings have been pretty much the same."

Yet despite these efforts, the lack of concrete action has been staggering – if not entirely unexpected. In the 10 years since these widely supported findings, the only real change in Germany has been the introduction of the LKW-MAUT truck-tolling scheme – and even this has backfired somewhat. "The reality in Europe today is that the paradigm shift in transport financing – as recommended by all experts – has been limited over the past decade," Kossak says, his frustration entirely evident. "The LKW-MAUT scheme was introduced in 2005 – explicitly as the first step of this paradigm shift. But contrary to the main principles of user financing, the political handling of the revenue resulted in an immediate total change of position on the part of the lobbyist groups and the general public – they went from supporting the need for change to refusing every subsequent step. Instead of ironing out the mishandling of the revenue, the politicians reacted by declaring any further expansion of tolling not on the agenda, clearly a bid not to jeopardize their chances in the next election. Most politicians and lobbyists today admit to holding two views about road user charging – one official (against) and one unofficial (in favor). I think this is mirrored in many other EU member states."

Unlike many debates in the road pricing sector, this one is not about technology, it's the thorny issue of political will. Kossak has spent 30 years feeling like he's banging his head against a brick wall when it comes to politics: "Politicians, administrations and organizations do not like it much when you do not share their opinion, to the extent that if you don't present the result they're looking after, it might affect what work you secure in the future. This is not really funny (or economically ideal) for someone who tries to advise as independently and as qualified as possible," he sighs.

And even when politicians are on side, things don't go according to plan. "Shifting traffic from road to rail for environmental reasons has been on the political agenda of German governments for at least the past three decades," Kossak says. "But what happened in reality was the opposite. Expensive luxury rail projects have materialized, while urgently needed money for strengthening main corridors has not.

"Stabilizing and improving the transport infrastructure as well as the environmental compatibility of the whole system should be the highest priority in the 2020 EU strategy. The systematic and comprehensive shift to a distance- and strain-related user financing of the road network is the most sustainable, most efficient and fairest option for reaching the goals stated in the *EU Green Paper* of 1995 and the *Transport White Paper* of 2001."

> One of the main obstacles is the public's lack of confidence in the politics – it should be in the interest of politicians to become credible again

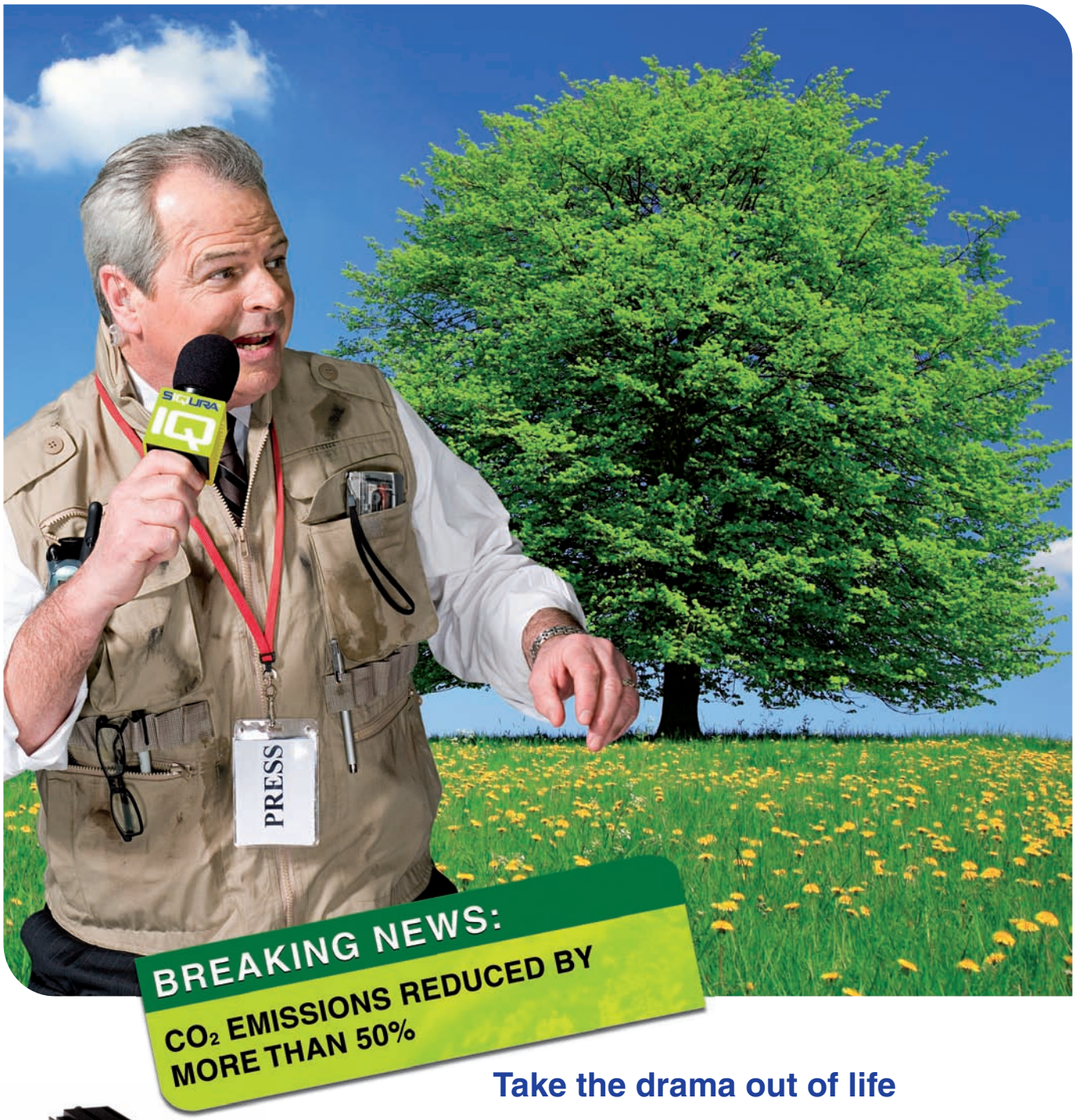
Variable pricing - just not yet

For now, Kossak believes the focus should be on dealing with the internal costs necessary to get such a scheme off the ground and then taking full advantage of the management potential regarding an optimal use of available assets, as well as improving the environmental compatibility by varying the toll level by time of day, part of the network, environmental standards and fuel consumption classes. "In particular, this means that the spread of the toll level per vehicle class should be much more than the allowed relation of 1:2 according to the Eurovignette (i.e. the highest toll per vehicle class should not be more than twice the lowest toll)," he adds. "Such a low spread is inefficient. In the USA, for instance, spreads are successfully operated up to a relation of 1:16 (the highest toll is 16 times more than the lowest)."

"Another point is the aim to outphase time-related tolling as soon as possible. Vignettes are best suited as interim solutions on the way to distance-related tolling. They offer politicians proof that the revenue is actually used for improving the transport infrastructure or is compensated for on the tax side, and the user gets the chance to experience the benefits on a relatively low level of charges."

Ten years on from the initial session of the Pällmann Commission – which suggested that the federal transport infrastructure in Germany needs at least €12 billion investment per year to survive (though Kossak believes the true figure to be far higher) – Pällmann and Kossak renewed their appeal for a paradigm shift, and now Kossak is also keen to take the momentum beyond German borders: "The strategy paper *Europe 2020* should contain a similar call to action on a European level."

Even after so many disappointments over the past decade, ultimately Kossak believes the German government has no other choice than to move toward direct user charging. "It's a politically sensitive topic, so it is very important to design and execute an appropriate migration process; it needs stamina and credibility. One of the main obstacles is the public's lack of confidence in the politics – it should be in the interest of politicians to become credible again. This means creating a system based on qualified independent expert knowledge rather than on lobby opinions and the result of lobby-sponsored activities by the same handful of 'scientists'." ○



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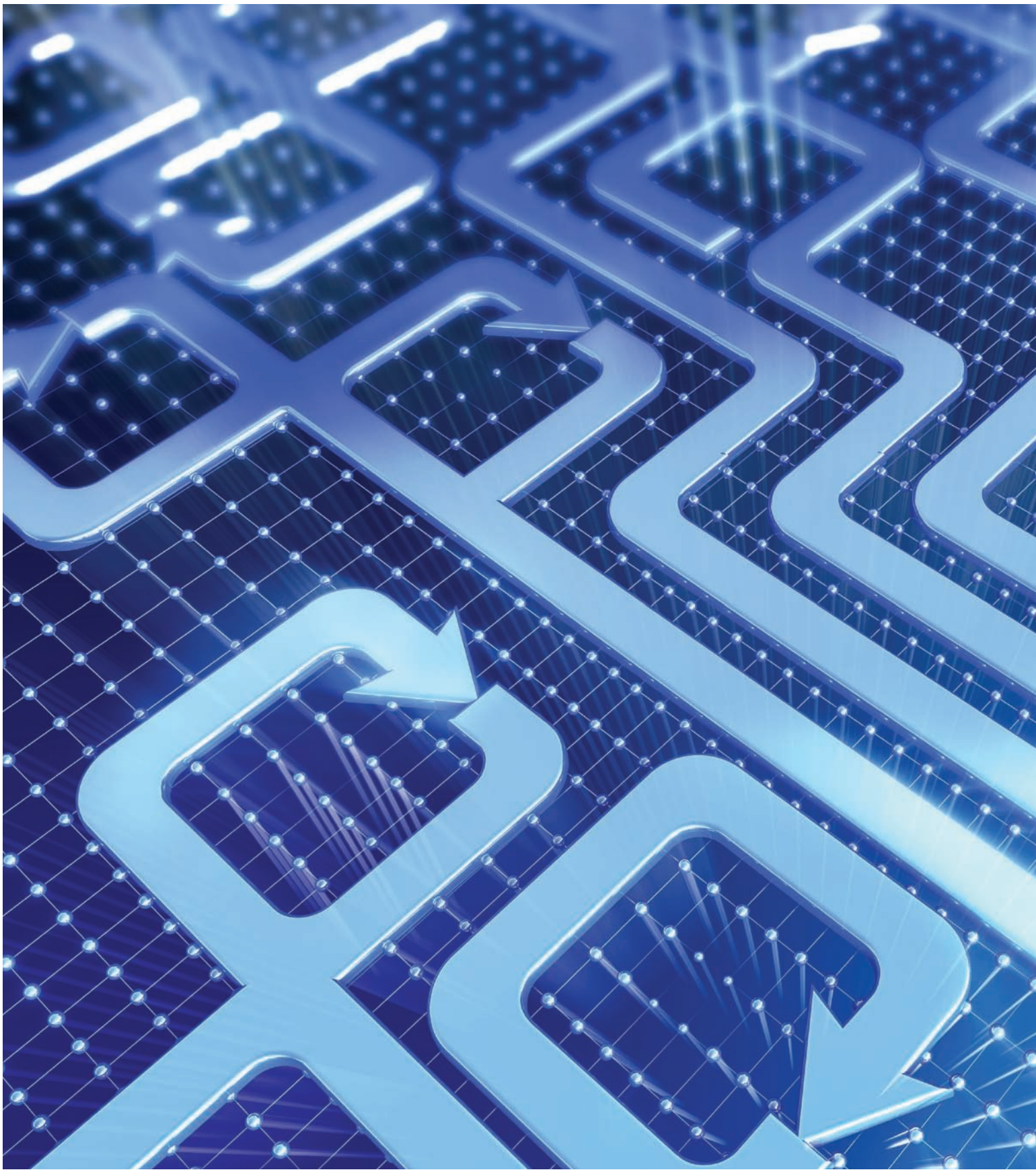
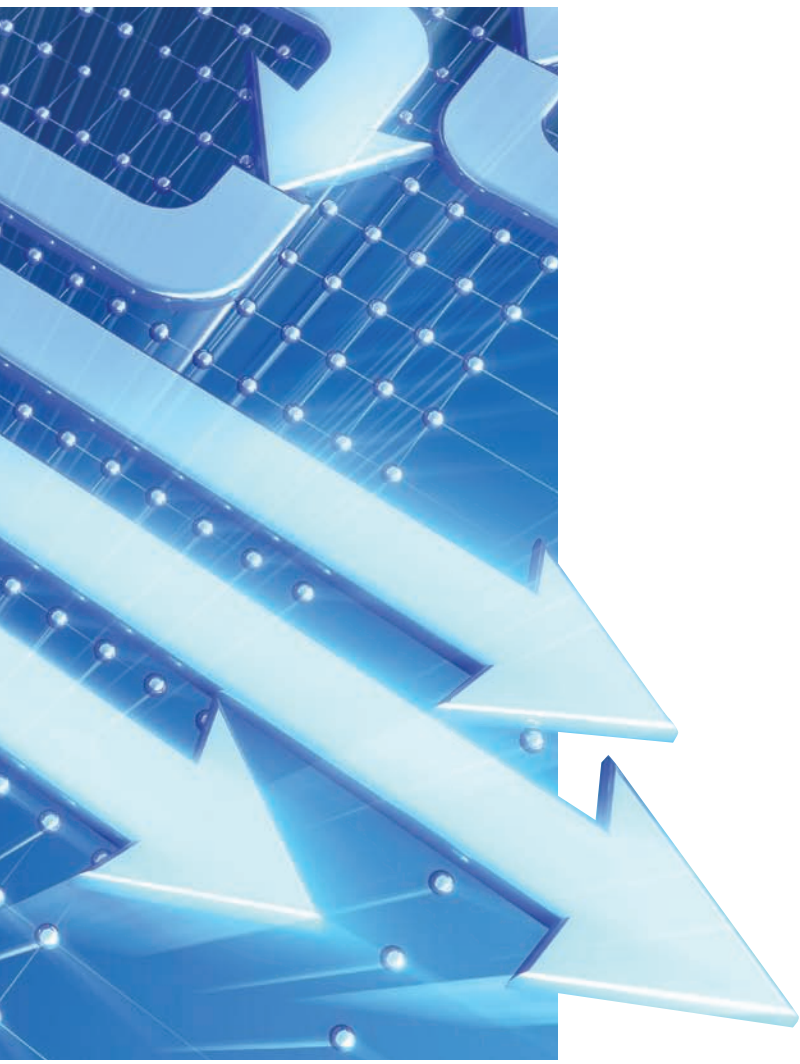


Wales' roads have never been easier to manage, thanks to a shared services highways management approach provided by the Welsh Assembly Government

Images courtesy of Inok and Rui Vieira/Press Association Images

Connected development



Since deploying a centralized highways asset management system in 2004, the Welsh Assembly Government has transformed the nation's road management activities, as a result of what is now a clean, rapid flow of information across local authority and organizational borders.

Similar to all governments, the Assembly Government is on a mission to move its services and information management activities online, in accordance with a series of strict targets. Goals include reducing process repetition and redundancy, and driving up performance and service quality. Consolidated electronic information availability, greater project visibility, and enhanced collaboration are all prominent features of that plan.

Some £60 million (US$91 million) each year is spent on maintaining Wales' 133km of motorways and 1,600km of trunk roads. Five years ago, this job was the responsibility of eight disparate local authority agents.

All roads lead to one service

Keen to adopt a 'shared services' approach to these operations – whereby support functions are consolidated to serve a broader target user base – the Welsh Assembly Government decided to reduce the number of agents to three. This would enable it to reduce costs and inefficiencies, while simultaneously delivering a much more efficient highways management service to Wales as a whole.

Yet this would not have been possible without the ability to reliably and easily share information electronically across and beyond the organization. Previously, fragmented, localized systems, manual processes and reams of paperwork were the norm. Now, all of that information is centralized electronically, making it widely accessible to authorised users across and beyond Wales' highways agencies, via the internet. "Devolved system management was impeding progress towards our goal of holistic highways management," says project manager Louis Mahendra. "We needed a single, centrally managed repository holding all trunk road data that could be accessed both by us and the agents via the web."

After an extensive market evaluation the Welsh Assembly Government appointed Exor Corporation, a leading company in infrastructure asset management solutions, to provide a centralized, modular highways management solution that would serve all of the agents and provide critical real-time information to other Assembly Government departments, too.

Specialist chosen subject

Exor specializes in highways management solutions and had already provided systems to several of the existing agents. "Exor provided a hosted and managed solution, which would free both the Assembly Government and our agents from the burden of complex software management for the highway network," Mahendra adds. The centralized, hosted solution is Exor's Highways system, based on Oracle technology and associated business intelligence tools. Initially, a pilot solution was rolled out to the agents, coinciding with the consolidation of the trunk road agents.

Exor's Highways system delivers an breadth of functionality for effective management and planning of the road infrastructure

Following the successful trial, Exor's suite of integrated modules went live in just six weeks, including the merger of the eight disparate data sets from the agents' local systems. Agents now log on to a central Network Manager to gain role-based access to their own information using a secure sign-on from any internet-enabled PC. Dates and details of all road inspections are captured and logged on to the system, together with the faults found, recommended remedial action, and estimated cost.

Inspired by the potential of the centralized solution – and the value-added information-based activities this could now support – Mahendra worked with Exor to add additional interfaces, extending the electronic collection and flow of information into other areas.

> "It's all about saving time and staffing costs, by reducing manual processes and duplication. What's more, staff can be anywhere to gain access, as everything is available over the internet
>
> **Louis Mahendra, project manager, Welsh Assembly Government, Wales**

Photos of damaged road sections or letters of complaint from members of the public can be attached to agents' reports using the Document Manager application to provide a fuller picture of the defect, for example. Following online approval for repairs, the Exor solution allows the agent to create a works order which is dispatched to a contractor. When work is completed, an invoice is generated and automatically presented to the Assembly for payment, together with the supporting documentation. All

Technology tools for asset management

There is no question that council highways departments have got it tough this year. Budgets are being slashed at a time when routine maintenance demands have risen off the scale, as a result of a brutal winter, recent flooding, and the increasingly high price of raw materials (oil is the main component of bitumen).

There are now thought to be more than 1.6 million potholes across the UK

The Budget's £100 million cash injection will help bolster the pothole repair fund, but once this has been divvied up across the various authorities it won't alleviate all of their problems.

Things have got so bad that at least one local authority has now deferred all new road improvements on the basis that if there isn't the budget to repair what's there, how can new developments be added to an under-maintained asset base. One major highways department has calculated that, even with radical efficiency plans, it will be 25-30% worse off this year – removing some £40 million from its £140 million budget for maintenance.

Plans to cut back on vital road expansion or improvement programs can only be temporary. Real progress means deriving more from existing budgets, however limited. Repairing potholes and making vital drainage provisions alongside other routine maintenance work, with less money, requires a different approach. If highways agencies struggled before to keep on top of their workloads, one can only imagine how much more acute that situation is now.

Wisely, one UK council has a lot more up its sleeves than cuts. Its highways agency is keen to drive up efficiency through the strategic use of technology tools, for example, to monitor highways infrastructure assets and thereby

With congestion management becoming a political imperative for many of the world's road operators, reliable real-time sharing of data between local government, contractors, utilities and other stakeholders is becoming essential

agents use the same report templates and set of procedures. Managing all of this electronically has led to all sorts of productivity gains, as Mahendra notes. "Before, much of this would have been documented on paper, making it much harder to trace back case histories or spot duplication. Also, managing all of this electronically means that we can ensure protocol is adhered to – for example, the system warns you two or three days in advance that you need to take action on something."

Exor's flexibility in being able to develop the additional interfaces has proved immensely valuable to the Welsh Assembly Government. "We had an original planning meeting where we came up with all of the ideas, and then Exor developed them to meet our specific requirements," he says.

Ease and speed of access to information is crucial to the way the Assembly Government now operates and its ability to share information between multiple parties. This includes internal departments at the Welsh Assembly Government or any of Wales' 22 local authorities and various public utilities.

For example, now, when new applications are submitted to the local authorities, the highways agents are notified electronically if the plans affect any roads. "We can then download the details. This is done on a map basis too, so we can see the area being affected and track the history," Mahendra explains.

"The next stage will be to let the software talk to other internal systems, for example, to extract information from the electronic document management system, so that drawings can be looked up for maintenance purposes," he adds. "It's all about saving time and staffing costs, by reducing manual processes and duplication," Mahendra says, summarizing the considerable benefits that have come from consolidating and streamlining Wales' highways management activities across organizational and geographical borders. "What's more, staff can be anywhere to gain access, as everything is available over the internet." This means engineers no longer need to return to the office to submit reports, for example.

Tangible savings

Meanwhile, agents no longer require database administrators to support and update the road maintenance software, as this is hosted by Exor, which saves them an estimated 10% on their IT overheads. Further substantial cost-savings have been derived from eliminating physical storage of paper, and the removal of redundant administration functions. A full audit is currently under way to put hard numbers to all of these savings and performance benefits. ○

hone decisions on where to focus spending. This is prudent, given that strategic asset management and maintenance prioritization can yield at least a 25-30% increase in productivity. Better information, captured, analyzed and processed with the aid of specialist technology applications, enables prioritization and risk-mitigation.

Thinking laterally about procurement is another effective strategy councils can adopt, offering them a means of limiting the need for long and costly EU purchasing processes.

Any project worth approximately £150,000 must be published in the *Official Journal of the EU*, incurring a potential time delay of up to two years. During that time, the whole process ties up staff as they work up the necessary documents, adding to the financial impact.

By pooling resources with neighboring councils, highways agencies can work toward a situation where a single procurement decision covers the needs of multiple regions. A so-called 'common shared service' approach, led by a single party, could reduce the cost of an individual road scheme by 10% – reducing spending on a £40-45 million project by £400,000.

Suppliers would welcome circumventing repetitive EU procurement cycles, too, as a means of reducing their own associated costs. When Exor recently bid for a contract worth £1 million, 25% of the cost could be attributed to pursuing the opportunity. If the cost and time burden can be diluted by combining the purchasing strategies and needs of multiple LAs, everyone stands to gain.

Double-dip or not, where resources are in shorter supply public sector organizations have a duty to use what they have efficiently and to best effect. While it could well be the case that highways agencies are still 25% down on their routine maintenance budgets, even after instigating some painful cutbacks, their pro-activity in trying to eke more from their budgets than ever before will give them a critical head start over other local authorities which still have tough decisions ahead.

Rod Beardshall, director of engineering at Exor Corporation, says there is no avoiding the pain the UK will have to go through to reduce the national debt. The challenge is how best to control that pain, and work through it, so that essential work can go on

The 'ace' range of cameras utilizes Basler's expertise in machine vision and also has a great deal of potential for the ITS market

Need to know?

Bringing the many benefits of machine vision to the traffic management market

- > Universal applicability of artificial vision
- > Specific solutions for different industry sectors
- > Digital cameras for use in traffic systems
- > The right sensor technology for the individual task
- > Developments in image data transmission
- > Higher frame rates at higher resolutions
- > Miniaturization combined with lower power consumption

Miniaturizing machine vision

Nobody can imagine state-of-the-art traffic systems without modern camera technology. But what are the differences between the camera and sensor technologies, which cameras are right for which task, and which trends are on the horizon?

Since the introduction of intelligent traffic systems in the late 1970s, cameras have been an important element in ITS design. But over time, their role has changed from a simple monitoring or capturing device to a highly integrated, feature-rich component of the whole system. A camera in a modern ITS is the precisely optimized 'eye' of the system, contributing high-quality images even in highly demanding situations. Applications range from classic traffic flow management, speed enforcement and character recognition of license plates to the identification of accidents or fire detection in tunnels.

Benefits of machine vision

Key technology developments in the camera industry, and especially in machine vision, have had great benefits for ITS applications. For more than 15 years, machine vision camera manufacturers have integrated progressive-scan CCD sensors into their products. These provide low noise and a high dynamic range combined with excellent sensitivity, even at night-time. They also moved on from the traditionally low resolutions associated with broadcasting standards and offered higher pixel counts to achieve greater resolution.

In combination with the high frame rates offered by cameras based on these sensors, their ability to perform well even under demanding lighting conditions made them the ideal fit for tunnel safety applications. CCD cameras are also well suited for speed and red-light enforcement. The standard for many traffic systems today is a camera with a low-noise, high-dynamic range progressive scan sensor with a 1.4, two, or five megapixel resolution.

CMOS entering the field

The latest sensor trend in machine vision could also drive the increased use of cameras in ITS applications. CMOS sensors have been enhanced over the past few years, to the extent that they can be employed in some types of traffic applications. This is in part the result of the latest sensors being equipped with a 'global shutter', which provides a sharp, clear image, even when the objects being captured are moving, as is the case with a car on a highway.

In addition, CMOS sensor production and implementation are typically more efficient, allowing manufacturers to offer cameras at a lower price point that fits even extremely price-sensitive ITS applications. As a result of lower pricing, we are already seeing more CMOS cameras in ITS installations and applications – for example, for overview cameras, as additional cameras for lane observation in tolling systems, for tunnel installations, or to observe certain sections of roads and highways.

These kinds of cameras also usually include compression technologies such as MJPEG and/or H.264, which are necessary for transmitting live video over an Ethernet network. Basler IP cameras include these compression technologies.

Image data transmission

In addition to sensor developments, there have been significant improvements in the transmission of image data, addressing what used to be a major bottleneck. The ITS industry has benefited from the trend in the machine vision and security markets toward long-distance transmission of data at high rates. The main drivers have been Ethernet and Gigabit Ethernet (GigE) technology because these interfaces enabled long-distance transmission of up to 100m (or beyond, using additional devices). Surveillance cameras employ compression algorithms (encoders) to transmit high-quality images as a live stream using standard Ethernet technology. This leads not only to an optimized bandwidth utilization but also decreases the cost of storage on the client's side.

These technologies began to be established almost 15 years ago and now allow easier, cost-effective connections, especially for fixed ITS such as tolling gates and bridges or fixed enforcement systems. Installation of remote cameras on roads or highways has become much easier as a result of the Ethernet and IP technologies allowing for transmission and access via the internet or wide-area networks. This has contributed to a more widespread installation of cameras and systems, even in remote locations. Enforcement systems, for example, can now be placed in rural locations that are safety-critical.

What are the trends?

Two major trends in the machine vision market are poised to influence the ITS market. The first is purely performance-driven, meaning that the machine vision market required higher frame rates at higher resolutions (such as two and four megapixel cameras). In ITS applications, this trend is seen mainly in the use of two megapixel cameras featuring HDTV resolution at 60 images a second. Such cameras are used to capture high-resolution images of fast-moving vehicles on highways. The images are used for tolling, enforcement, and to speed up toll gate procedures.

Demanding ITS applications, including tunnel management (below)**, require smart and sophisticated camera systems that enable traffic managers to keep an eye on what's happening on their roads at all times**

In addition to speed, customers require maximum horizontal resolution to capture wide fields-of-view. This is mainly driven by cost-containment measures, as the number of cameras used in an application is highly dependent on the number of lanes each camera can capture. Basler recently introduced a four megapixel device in its 'aviator' series that can capture 30 images a second while covering up to four lanes. Using such a camera could vastly reduce the number required and result in additional savings for lenses, cables, integration, and maintenance.

The second major trend is characterized by a combination of miniaturization and lower power consumption. This is being driven in the machine vision industry by the replacement of analog cameras with digital cameras in various applications. To meet this trend, Basler created the 'ace' camera, which is no bigger than 29 x 29 x 42mm (about the size of a matchbox) and consumes only 2W. In the machine vision industry, the ace is already a popular product. For ITS, such a diminutive size is a convincing argument for use in applications such as mobile enforcement systems, which can now be smaller and less visible.

However, the main driver in the ITS market will be mobile systems in government authority vehicles such as police cars. In this case, cameras monitor and document the activities of police officers or other officials, for which less-obtrusive cameras are often considered to be more desirable.

Contact

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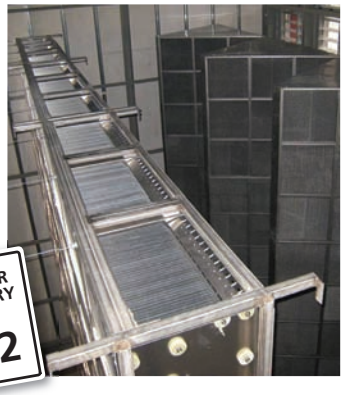
The Laerdal tunnel in Norway is taking advantage of CTA's electrostatic precipitator



READER ENQUIRY NO. 502

Electrostatic precipitation

Over the past decade, there has been an increase in medical knowledge relating to the diverse effects of particulate matter (PM) on human health. This research has confirmed the highly deleterious nature of fine and ultra-fine particles, and particularly the danger of exposure to the particles from diesel exhaust, now known to be a cause of cancer.

As a result, road authorities are looking to limit this harmful potential by installing electrostatic precipitators inside road tunnels to reduce the impact on motorists, as well as in exhaust stacks to protect the general public.

The smoke within tunnels can no longer be simply regarded as a nuisance that results in reduced visibility, but must be viewed as a potentially serious health risk. Most of this risk results not from the larger particles – such as those from road dust – but from the ultra fine and nano-particles emanating from diesel engines, which despite the advances in cleaner-burning engines still make up a very significant part of the exhaust gases.

To meet this important challenge, over the past three years, Norway's CTA has been engaged in a comprehensive process of redesign and improvement in all aspects of its road tunnel ventilation product range. This has covered all factors involved in installing and operating an electrostatic precipitator system in a road tunnel system, the essential equipment and new installation and operational techniques, reduced capital and operational costs, as well as focusing on ease of installation.

Need to know?

Filtration technology for the removal of dust particles from polluted air in road tunnels

- Mitigating the harmful effects of exhaust emissions
- Removal of all classes and size of particles
- Redesigned and improved ventilation range
- Effective flow rate through the precipitator cells doubled
- Responsible for the filtration in the world's largest road tunnel, the Laerdal

The high-voltage power supply is the heart of the electrostatic precipitator and must provide a stable voltage, be resistant to voltage dropouts caused by short circuiting, require little or no maintenance and operate with high efficiency.

CTA's new power supply has been completely redesigned and is much reduced in size and energy consumption. Each supply can operate up to 13 electrostatic precipitator modules and supply ionizing voltages up to 20,000V. Recovery to full voltage occurs in 5ms after arc-over. The compact size of the power supply (600 x 500 x 200mm) means it can be located adjacent to the precipitator and can be supplied in a protective casing resistant to all in-tunnel conditions.

Operation and monitoring of control parameters are fully remote and the ability to site the unit close to the precipitator inside the tunnel results in significant savings in the cost of installation. Current and voltage output can be controlled remotely, enabling the precipitator characteristics to be optimized for varying particle loads and ambient conditions.

The efficiency of a precipitator operation and its collection characteristics are dependent on the efficiency of corona production and the geometry and accuracy of construction of the collector plates. The characteristics of any high-voltage discharge unit will depend ultimately on the quality of its mechanical finish; the smallest burr or surface damage will reduce the efficiency and stability of the corona discharge. The new CTA corona unit is constructed using non-distorting fabrication techniques so as to obtain the finest possible finish as a result.

Operational factors

The combination of the new developments in power supplies and improvements in collector design has enabled the effective flow rate through the precipitator cells to be doubled.

CTA has extensive experience in all types of electrostatic precipitator installations in road tunnels, and has installed 16 units in nine tunnels since its first installation in the Oslo tunnel in Norway in 1990.

One of CTA's flagship filtration installations is the world's longest road tunnel, Norway's Laerdal, although it was also responsible for the installation of the world's largest tunnel EP filter and active carbon nitrogen dioxide removal system in Madrid, Spain, capable of treating 694m^3/sec.

Contact

CTA
cta@cta.no
+47 990 46 353
www.cta.no

READER ENQUIRY NO. 503

Need to know?

Architectures to meet needs for new tunnel installations and upgrades/refurbishments

- Integrating data using advanced processing
- Storage and presentation techniques
- Implementing high-integrity, cost-effectve cohesive solutions for road projects
- Built-in scenario analysis for event response features
- Supporting the mission critical tunnel and infrastructure control systems

Tunnel control and system integration

The safe and efficient management of infrastructure by its very nature necessitates the ability to manage a range of specialist systems. Within a tunnel environment, this can include lighting, radar/CCTV for surveillance and incident detection, loops for traffic analysis and management, VMS, public address systems, radio rebroadcast, and help points for driver information and guidance. In the wider context, such ITS must integrate and share data with regional control centers and urban TMCs.

Traditionally, the specialist systems are provided by separate suppliers each using their own data presentation and management systems. But an individual systems approach often leads to complex, expensive and protracted project cycles, with disparate user interfaces and operational facilities. More importantly, where 'systems information' is not presented or accessible to the operator in a cohesive or common format, it can have a critical effect on emergency response, introducing confusion and delay when fast, effective decisions may be the difference between life and death.

System architecture

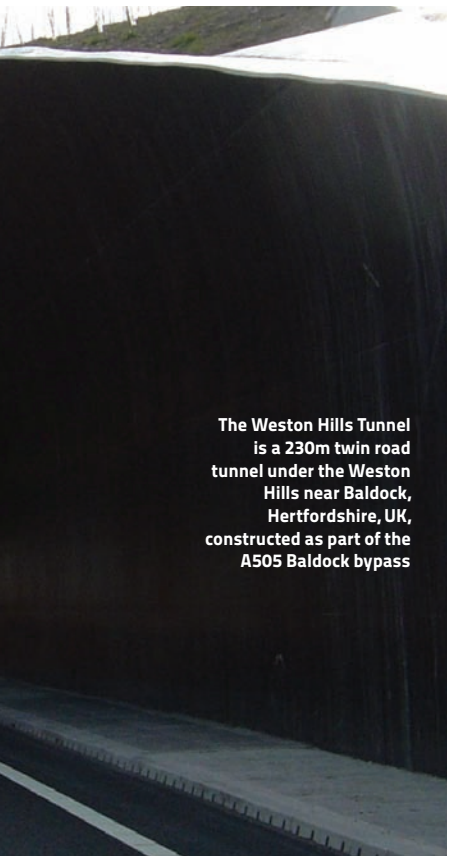
The introduction of fully managed high-reliability industrially rated Ethernet switches – and the development of IP Ethernet networks and associated data processing, storage and presentation techniques – has made possible highly effective, fully integrated systems solutions that address the traditional project implementation difficulties. Such technologies also bring a range of benefits, from reduced capital and through-life costs to enhanced operator response in emergency situations and improved system support processes and procedures.

Robust system architectures can now deliver the high-integrity solutions necessary in safety-critical applications. Networks can be configured in self-healing ring formats with data automatically routed in the alternative direction in the event of failure. Plant devices can additionally be limited to one of each type per node, while adjacent outstations can be on alternate communication loops. Not only that, multiple Ethernet switches can be configured at each location, each on a separate network, and with servers in a redundant hot/standby format, thereby providing the resilience needed to manage such ITS.

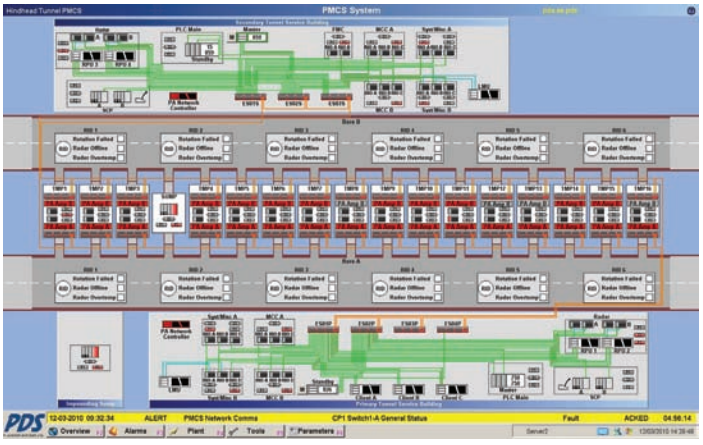
The conventional separate subsystems approach often results in separate displays and workstations presenting the various different interfaces provided by each supplier. Although some modern SCADA systems provide a degree of integration of data at the server or central computer level, an integrated ITS system can provide a one-stop workstation optimized for efficient management of routine and emergency situations.

Operational facility

Operating a facility where all subsystem information is



The Weston Hills Tunnel is a 230m twin road tunnel under the Weston Hills near Baldock, Hertfordshire, UK, constructed as part of the A505 Baldock bypass



(Clockwise from left) **Architectures to meet the installation needs for new tunnels and refurbishment projects; the Hindhead and Hatfield tunnel systems; PDS support on site**

presented in a cohesive and common format can yield obvious benefits. During emergencies in particular, the opportunity for providing a more effective and managed response is significant.

Incidents detected by loops, radar or CCTV (VAID) systems can be identified and flagged on the operator screen, and CCTV images of the incident can be automatically displayed. An in-built emergency response function working with predetermined 'best response' rules can propose the most likely event scenario based on the coordinated and combined data received. Such a function could also provide the ideal recommended response – the implementation of a traffic plan, associated PA announcements and emergency services notification, for example – all of which can be implemented in a coordinated way at the click of a mouse button.

A fully integrated systems approach also offers benefits for asset management, including the coordination and standardization of maintenance activities, and reporting and diagnostic facilities including predictive failure, all of which are empowered through an integrated system approach.

Such functionality obviously lends itself to the wider control room environment and provides an economic alternative to standard solutions, clearly offering the opportunity to manage other ITS systems, including ATM and its hard shoulder monitoring and ramp monitoring installations.

Summary

Technology is now available that can deliver project cost-savings with reduced development cycles and onsite timescales, benefiting from improved data analysis and handling, with the potential for safer operation in an extensible and expandable solution. Substantial benefits in cost and timescale are achieved from the marked reductions in cabling and termination available through taking an holistic view of the project systems, and it may also mean a reduction in cable ducts significant to civil engineering partners. System assembly, integration, testing, evaluation and optimization can all be carried out before installation at site, so reducing and de-risking the site program, and the use of a single systems integrator can reduce the contractual interfaces and coordination issues for the customer.

Established in 1988, P. Ducker Systems (PDS) provides turnkey ITS systems, specializing in robust highly integrated solutions for mission-critical facilities. The company is currently implementing a variety of projects utilizing MATRICS IP, a fully integrated system solution in which video, audio, and plant devices are interfaced using IP technology to provide a unified control, monitoring and operating facility. This has been specifically developed for transportation infrastructure projects including road tunnels.

PDS control and monitoring systems are used in many of the UK's road tunnels, including the recently refurbished Holmesdale Tunnel on the M25 London Orbital Motorway.

Additionally, the company has developed a new product called SCANLIGHT – a dimmable addressable road tunnel lighting control system, which offers improved luminaire reliability and life, highest system availability with lowest through-life operating cost, while providing the opportunity for reduced maintenance and tunnel closures – the optimum low carbon footprint. The system is currently being installed at the M25 Bell Common, A1M Hatfield, and A3 Hindhead road tunnels.

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Real-time traffic for Athens

READER ENQUIRY NO. 504

Following the introduction of Greece's new RDS-TMC (Traffic Message Channel) real-time traffic information service in March 2010, the country is now a fully paid-up member of the TMC family. The result of a private initiative involving a number of companies – including DIS, a distributor of GPS navigation devices, Infotrip and Traffic Nav – the service is for the moment only available for TMC-equipped personal navigation devices (PNDs) in the capital city of Athens. But once data and broadcasting coverage issues are overcome – as well as organizational problems – further locations covering Greece's entire urban and interurban network are expected to be added soon.

At the same time as this development, the availability of real-time information via PND through GPRS has been announced by another provider, so the country will benefit from not one but at least two real-time traffic information services available on PNDs, not to mention the various mobile/smartphone traffic applications.

Much anticipated

The integration of real-time traffic information with navigation has been eagerly anticipated, ever since the launch of real-time traffic content services back in 2007-2008 when the Greek traffic information market effectively materialized. The catalyst back then was a ministerial decision allowing the exploitation of the Athens Traffic Management Center's traffic data by any entity interested in setting up a transport-related service. Most importantly, the Ministry decided to support a few private investments for real-time traffic information services through a funding program known as 'Intelligent Trip'. Within the framework of the program, Infotrip was awarded the implementation of a content aggregation platform as well as the MyRoute suite of services,[1] which includes traffic information applications through various data and voice channels, including SMS, web, mobile internet, and interactive voice response (IVR).

(Above) **PND screenshot with traffic events** (Left) **The PND provides a route that avoids the congested roads**

Need to know?

Traffic information lands in Athens and could be just the start of a real-time revolution in Greece

- Dynamic information about the traffic conditions as well as incidents in real-time
- Floating car data set to be introduced
- Further Greek cities expected to benefit from RDS-TMC
- Users can choose the optimum and fastest route to reach their destination
- Providing content, online services and innovative solutions

Up until March 2010, the lack of a TMC has actually hindered the large-scale development of the 'virgin' traffic content market through the rapid, parallel expansion of the navigation market. However, the prospects envisaged by the Greek ITS community are now far more positive, particularly as a result of the introduction of the ITS Action Plan, which has real-time traffic information as a priority. In this context, at least, the legal framework issues should be tackled.

Nevertheless, there is a lot of work ahead in order to achieve the target of a reliable traffic content 'product', as barriers in quality and quantity of data do still exist. Although new ATMS are being deployed in Greece content is not yet as widely available as anticipated. Where it is available, most of the time it requires a lot of 'normalization' work. Previous experience has shown that the available content needs further refining before it can be deemed a 'marketable' product, especially if it is intended for more sophisticated applications such as routing and dynamic dispatching.

Floating car data

Infotrip is planning further private investments to cover this gap by introducing techniques such as floating car data (FCD) and transport model-based propagation of traffic data. The company is engaging a fleet of GPS-equipped vehicles in order to carry out large FCD pilots throughout 2010. This data will be combined with information gleaned from fixed sensors, which will subsequently be blended for a homogenous result. The combined content will also be used for building up an historical speed profiles database. FCD is envisaged to become one of the main content sources by the end of the year.

FCD pilots will also continue in the framework of the VIAJEO project[1], which is coordinated by ERTICO – ITS Europe. Besides Infotrip, the two other companies involved in the Athens VIAJEO pilots are Mizar Automazione and Magneti Marelli.

References

[1] www.myroute.gr
[2] www.viajeo.eu

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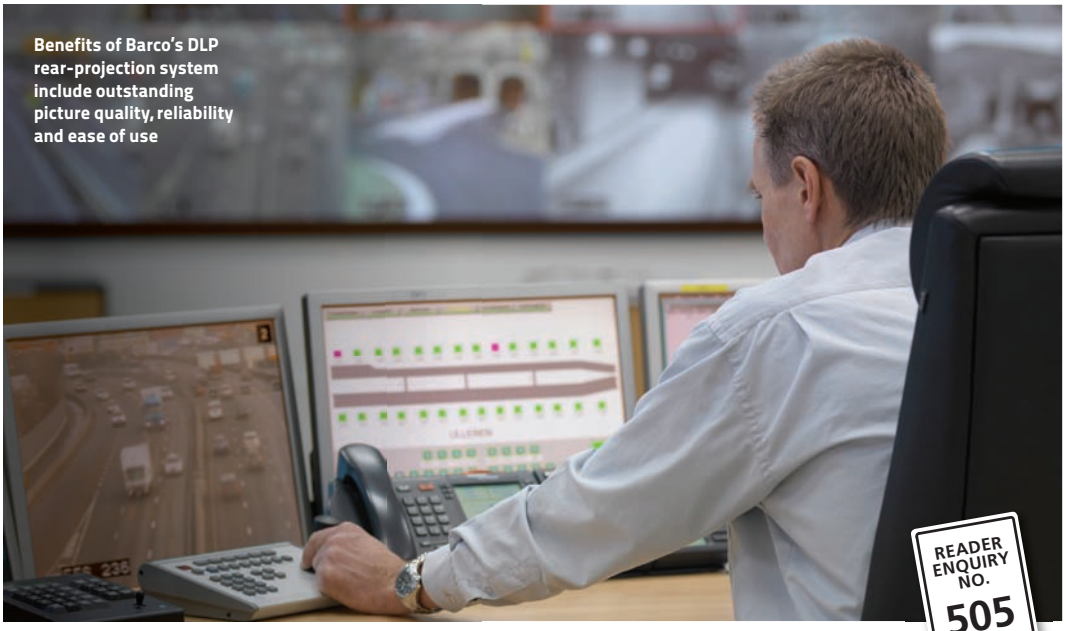

Benefits of Barco's DLP rear-projection system include outstanding picture quality, reliability and ease of use

READER ENQUIRY NO. 505

Visual decision-making

Traffic congestion and cities it seems go hand in hand. Similar to most capitals, the city of Oslo in Norway is a bustling center in which several national highways meet or pass through. As traffic has grown over the years, an elaborate system of ring roads, tunnels and bridges has been installed to alleviate traffic and improve road safety. Within the city's TMC, operators carefully monitor the traffic in their city and the broader area of eastern Norway with help from a videowall from Barco that helps them gain a perfect insight into the traffic situation.

Operators at the TMC monitor traffic on the main roads and in the 36 tunnels 24 hours a day, sounding alarms and coordinating emergency services in case of incidents, feeding the electronic signs on motorways with traffic information and sharing that information with local radio stations. With the number of roads, tunnels and bridges growing constantly, their role is increasingly gaining in importance. To better support them in their efforts, a decision was taken to replace the outdated mimic ports and monitors with a newer visualization solution.

Need to know?

Replacing outdated TMC equipment with a more modern visualization solution

- Exceptional brightness and contrast
- Turnkey supply, with 24-7 availability
- Value for money
- Full redundancy features for software and controller
- On-site training

"The quality requirements were very high," explains Morten Hansen from Barco's Norwegian distributor, VideoSystem. "They included demands for crystal-clear displays, a seamless physical gap between the cubes and 100% reliability. In addition to that, the Oslo TMC wanted a turnkey supplier that could pledge around-the-clock availability, 365 days a year, with a four-hour repair time in case of any problems."

Following a European call-for-tender process, the Barco/VideoTech partnership was deemed most likely to meet these challenges. "Barco is a tech-benchmark company in control rooms and it scored the best on all criteria," suggests Kai Gundersen, head of Oslo's traffic management center.

VideoSystem convinced the TMC with its value for money, vast experience (+50 successful Barco installations) and its promise to fulfill the center's tough requirements for system support.

Wall-to-wall technology

In August 2008, the TMC received its videowall, which consists of 70in rear projector display cubes in a setup of 8x4, spanning 11.5m wide and 4m high. VideoSystem installed Barco software and a controller with redundancy features designed to prevent downtime. In addition, two Barco 70in displays were set up in the center's training room.

To ensure optimal use of all the features, VideoSystem laid on an extensive onsite operator training course, while system administrators were introduced to the solution after taking a three-day course at Barco's headquarters in Belgium.

The feedback on the Oslo installation has been extremely positive, with operators praising the user-friendliness and exceptional brightness, as well as contrast of the displays – all of which is a must in a room with large windows and lighting at night. For the TMC's management team, the tool is proving to be a great help in fulfilling their mission.

As operators now have a general overview of traffic flows and other relevant information on the screen, collaboration has greatly improved. In an emergency, for example, they can quickly share details and see the bigger picture, leading to better decisions and faster response times.

"With this videowall, the Oslo TMC can provide for better, safer and more environmentally friendly traffic coordination. This is true not only today but also tomorrow, as the system can be easily expanded when we need extra capacity," Gundersen concludes.

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Low running costs, long life, excellent light quality and reduced light pollution are just some of the benefits available from using LED streetlight technology

READER ENQUIRY NO. 506

Satisfying safety and energy needs

Need to know?

How the use of LEDs in roadside furniture can enhance safety and provide energy savings

- > Complies with relevant national and international safety standards
- > Lifespan in excess of 50,000 hours use
- > High standard of road safety day or night and in all types of visibility conditions
- > Reduction in equipment on the pole provides significant safety improvement in the event of a collision

For some of the most stringent road safety requirements in the world, look no further than the UK, which is often the focus of international observation and replication as far as saving lives and reducing injury is concerned. A particular area in which the UK really excels is roadsign illumination, which is in stark contrast to some other European countries that shy away from the extra expense of illuminating warning signs in designated areas that are deemed to be safety hot-spots.

Two different types of illumination are currently offered – front lit and internally lit. With front-lit illumination – the earliest version – the lamp is suspended in front of the sign, shining on it to create a reflection. Internally lit variants are in effect a large roadsign with a sizeable lightbulb located behind the sign. Each has various benefits, mainly in terms of cost, installation and maintenance. With regard to effectiveness, though, there is little difference between them; both are 'satisfactory', so traditionally the selection of what type to install has been based largely on either the decision maker's personal preference or more likely, budgetary constraints.

Over the course of the past 20 years or so, another factor affecting decision makers has come into play. At the same time as accepting the need for illumination, there is the proportionally negative effect of carbon emissions increase. Signs, after all, require power and with the average daily sunshine that the UK is blessed with, it's not going to become a solar energy supernation any time soon! So, the all-too familiar environmental debate looms on the horizon. Do we compromise road safety for carbon footprint? Green options are more often than not a compromise in some way. The standard energy-efficient lightbulbs in your home, for instance, might save energy but the light can be poor – even after the three to five minutes that they require to warm up to full illumination.

Such a compromise is fine with domestic use as we will naturally adjust (or put up with it) but in the road safety arena you don't have that kind of luxury. It only takes one child to be killed on a winter walk home from school because the illumination was removed from the warning sign and it will have political implications that will run right the way through to the heart of government. And so we're faced with the ultimate conundrum – providing an illuminated roadsign that is just as effective as current systems, yet reduces your carbon footprint by saving energy.

Solid-state lighting

An area that's attracted attention and could pose a solution is solid-state lighting, specifically LED. Traditionally, LED has found its niche in fairy lights, some expensive greetings cards, and various consumer novelties. But over the years, technical advances in LEDs have quietly ticked over in the background. For the past five years, several companies have tried to make them work for use in roadsign illumination with varying degrees of success. The problem that has previously held them back is the inability to

(Above) **Benefits of LED include very long life, low maintenance and low energy consumption** (Right) **Elumin8 signs provide a safe, evenly lit and highly visible sign surface, while reducing light spillage and pollution**

get a consistent level of illumination across the sign face, which is ironic when you consider that traditionally lit signs fail to achieve this with a single incandescent lightbulb. Nevertheless, it's been a big criticism of LED technology.

One product that really stacks up to the demands of the UK market – and should thus apply across Europe as a consequence – is the range of LED roadsigns from Elumin8. The company specializes in solid-state lighting using both electro-luminescence (EL) and LED and believes it has cracked what it refers to as the 'green nirvana'. Engineers within the company have taken the latest LED technology currently employed on streetlights and coupled it with a light dispersion layer to achieve a result that is clear, crisp and uniform. The result is a roadsign that performs better than standard roadsigns and other LED counterparts.

Saving somewhere in the region of 60-80% of energy consumption, these roadsigns are energy-efficient, while they can easily be retrofitted to existing poles and come with a light sensor for automated illumination – the latter of which has a further electrical saving because many roadsigns in the UK are actually lit 24 hours a day. In terms of durability, Elumin8 signs have a suggested lifespan of 50,000 hours, which at an estimate of eight hours a day equates to around 15 years.

Ticks all of the boxes

However, the real point to highlight is that these edge-lit LED signs provide a very crisp light and when placed next to a traditionally lit sign using the old candescent bulb, there really is no comparison – it's like putting an old BBC Microcomputer next to an iPhone! You get a better-looking product all round and save energy – as well as money – at the same time. So, for once, the green option is not only a better option for the environment, it's also better for the Local Authority's budget as well as general aesthetic appeal for any urban carriageway.

With all of these benefits, it raises the question, why are the streets of the UK not full of aesthetically pleasing, energy-efficient roadsigns? Experts in the industry will give you a variety of reasons, the main one being the installation cycle of a new product – from testing through decision-making to full installation. There is also the usual general reluctance to try anything new; Local Authorities tend to wait for another to make a leap before the rest follow. This in actual fact adds another irony to the point regarding other European countries replicating UK standards. As it stands, there are Elumin8 LED roadsigns on test and in implementation in countries that you would least expect – Spain, for one, has really embraced this new breed of lighting. For once, maybe this means that the UK will be a follower and not a leader, at least in the area of roadsigns.

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The award-winning VMC Pole eliminates the maintenance costs associated with fixed poles because work crews no longer have to bring in a manlift, or close lanes to conduct their work

READER ENQUIRY NO. 507

Safer access and less disruption

With the increased deployment of signs such as VMS and advanced motorway indicators (AMI) comes a need for more maintenance, which typically involves lane closure and the use of manlifts, with annual costs per sign running into several thousands of dollars. The risks associated with working at height, as well as disruption from closing lanes, should also be factored in.

The cost of maintaining such a piece of traffic infrastructure can actually be more significant than the capital cost to national road agencies. So anything that can be done to reduce ongoing costs allows further investment in other parts of the network. Moreover, removing risk of personal injury for roadside operatives is a prerequisite.

Simple but effective

A solution that reduces the overall cost, mitigates the risk to roadside operatives and reduces impact on the traveling public is required. In March 2010, Crown International unveiled just such a solution at Intertraffic – a totally new design of roadside pole, which won an award in the Infrastructure category of the Innovation Awards.

"It is a simple idea, it is being deployed, and it seems to boast impressive results in terms of ROI, safety and reduced disruption to drivers," commented awards chairman Fred Wegman on its ingenuity.

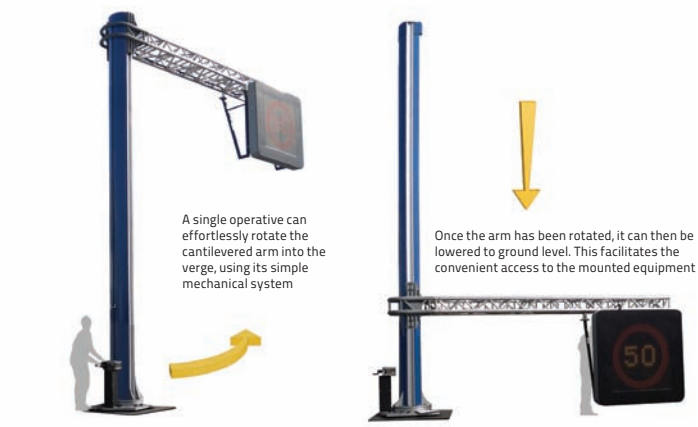
"We were very pleased because this was a culmination of a process that started with the Welsh Assembly Government looking to provide innovation into a showcase controlled motorway scheme," enthuses Mark Stacey, Crown's managing director. "We were part of their thinking early on when they identified that our existing expertise in cantilevered and counterbalanced technology could provide them with a successful solution."

The resulting work led to the design and build of the VMC Pole – a wind-up/wind-down cantilever pole that can be used for mounting VMS, CCTV, speed-monitoring equipment and other traffic management apparatus. The idea is that the pole can be swung into a safe working area off road, allowing equipment on the arm to be lowered to safe working height.

Quick and easy

Mounted off carriageway, a single operative can attend the site, access the VMC Pole and, having unlocked the safety handles, wind the pole around away from the carriageway and then lower the sign. Tests on the prototype showed it could be rotated and lowered in 90 seconds. In operation, it is expected this will be closer to two minutes. But it could mean that the operative is on site no longer than 15 minutes for routine maintenance of signs.

Having produced a solution that reduces lifetime costs, it is vital that the solution does not add extra maintenance costs. Sealed-for-life, self-lubricating components are being used wherever needed, and degreasing and regreasing some components in higher-specification grease has also helped to achieve this. All that is required is a visual check and



The wind-up/wind-down cantilever system ensures maintenance inspections can take place within 90 seconds without ever interrupting the flow of traffic on the road

Need to know?

A wind-up/wind-down cantilevered road-side pole to enable safer maintenance and reduced disruption to road users

- > Rotating and lowering counterbalanced cantilevered roadside pole
- > Used for mounting VMS equipment as well as traffic monitoring and enforcement equipment
- > Delivers significant cost savings over fixed posts, removing the need for lane possession and additional safety and access equipment
- > First implementation will be on a managed motorway scheme in the UK

occasional greasing under normal conditions – operations that can be performed while visiting the site to perform maintenance on the sign.

Cost-benefit analyses are favorable, with ROIs versus existing mounting structures showing positive returns after five years (based on independent analysis). When considered alongside the health and safety benefits, the VMC provides a real alternative.

So, has any authority got behind the concept yet? Yes, is the answer: the first 30 VMC poles are being provided to the Welsh Assembly Government for installation on the M4 between junctions 24 and 28.

As well as the VMC, Crown has also developed the AMI Pole, eight of which will be deployed on slip roads, allowing for ground-level access to the sign for a single operative. The design consists of a counterbalanced arm with a center-mounted frame that can be rotated to access the rear of the AMI. A locking bar secures the frame in position when the sign is in operation.

Both designs will be resplendent in blue, proudly displaying the Welsh Assembly Government dragon symbol, which Stacey says was added to the prototype as a bit of fun, but became part of the final design.

"We already have the VMC design being upscaled to mount larger signs or span multiple carriageways," he confirms. "Equally, a lightweight version principally for surveillance equipment can be made available. We are planning for further implementations as we see particular relevance to managed motorways schemes and to major trunk roads. Both will need highways to remain open as much as possible. The VMC provides the solution."

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This column has in part been inspired by the film *Gregory's Girl*, specifically when the lead character complains about the school paparazzi's pricing policies – "Not my fault – see the boss". The connection to the Vienna Convention on Road Traffic may be less obvious.

Readers in the UK will know we are entering a period of transport austerity when services will be expected to deliver more for less – more because demand is rising as the economy revives; less because there's less cash. A key to this delivery requirement is the adoption of Cooperative Vehicle-Highway System (CVHS) techniques, with drivers sacrificing some choice of time, place and speed in return for smoother flows, more consistent journey times and reduced fuel consumption.

CVHS can deliver many societal and commercial benefits. Better driver support and assistance equals fewer accidents, while better prediction and management of traffic flow will result in less congestion. Better management of traffic, meanwhile, will lead to reduced emissions and energy consumption. All of these combined will lead to new products and services for automotive manufacturers and the ITS industry.

So why aren't CVHS in routine use or at least being demonstrated? There are two reasons. First, the automotive industry doesn't talk to the telecoms industry and neither discusses design and deployment with highways authorities or ITS experts.

Second, there's the 1968 Vienna Convention, a big deterrent that states in Article 8: "Every moving vehicle or combination of vehicles shall have a driver" and "Every driver shall at all times be able to control his vehicle". The problem is familiar: technological innovation is ahead of legal and institutional change and potential retailers are scared of challenges about blame and liability because products do not comply with this theology of drivers being 'in control'.

CVHS deliver benefits by acting more quickly and reliably than the driver. It's not new: ABS helps drivers to steer by avoiding wheel lock-up in heavy braking; electronic stability control systems give drivers control by detecting skidding and automatically applying the brakes to help 'steer' the vehicle where the driver intends to go. Neither of these systems is 'controlled' by the driver any more than the driver can control activation of the airbag.

We need to refresh this 40-year-old legislation that is no longer fit for purpose. But where do we go for help? The answer, quite literally, is over our heads. For years, aviation has accepted that the 'driver' is not 'in control' but 'in command'. Operating the controls of a modern aircraft is too complex for the pilot, so computers translate commands into adjustments to the rudder, ailerons, flaps, and so on. There is duplication or triplication of safety-critical components, and the 'black box' recorder logs the pilot's commands so that in an incident, however minor, a distinction can be drawn between errors made by the pilot in issuing commands and errors from the support systems not working properly.

As with so many transport problems, the solution is already here; it's just waiting in disguise to be recognized and adopted.

> Technological innovation is ahead of legal and institutional change and potential retailers are scared of challenges about blame and liability as products do not comply with this theology of drivers being 'in control'
>
> **Professor Eric Sampson, Newcastle University/ITS-UK, UK**

New glass beads for better visibility

READER ENQUIRY NO. 508

Road construction zones, zebra crossings, tunnels and areas prone to frequent fog are particular focal points with regard to road user safety. Road markings at such locations are usually subject to special requirements in terms of visibility and/or color.

Understanding the interaction between glass beads, road marking materials and application procedures is essential to produce a stable and well performing striping, and as a result improve safety at such critical road sections.

Engineers at the Swarco Competence Centre for Glass Technology in Amstetten, Austria, have developed a new type of glass bead, Solidplus, that greatly increases visibility and durability of road markings over longer periods. Results from several long-term performance test decks on the beads are very encouraging.

Produced directly from molten glass, Swarco's new addition to the portfolio are special EN 1423 Class A reflective beads distinguished by high retroreflectivity and long-term durability, even in tough traffic conditions.

"When dealing with influences such as tire abrasion, spikes or winter services, the beads' resistance capability is heightened through the special glass composition," explains sales manager Hans Jesacher. Manufactured within specific gradations and with customized coatings and skid resistance particles, the beads outperform conventional types both in terms of retroreflection and resistance to traffic impact, even helping to extend the performance life of road markings beyond usual values.

In addition, they are appropriate for both solvent-based and waterborne paints, as well as two-component spray plastics and structured road markings. With typical bead rates of 400g/m^2, they achieve retroreflection values of 500-1,000mcd/lx/m^2 in the dry and up to 200mcd/lx/m^2 in the wet, outperforming the values of EN 1436 by a factor of five.

Tunnel markings

Solvent-based markings were combined with Solidplus bead gradations of 300-850μm and applied in the Katschbergtunnel on the A10 Tauernautobahn in Austria. The initial reflectivity readings of the centerline reached 700mcd. More than a year later, the value still reads 500mcd throughout all sections of the tunnel. Whether it is near the tunnel portals or in the middle of the tunnel, Solidplus will withstand contamination.

In the Flirscher Tunnel on the S16 expressway in Tyrol, Swarco standard beads (Swarcoflex 100-600μm) were directly compared with Solidplus 300-850μm. The initial readings for the standard beads amounted to 180mcd, while Solidplus reading measured 624mcd. After 278 days, the standard beads showed a reading of 169mcd with Solidplus at 506mcd. Although both featured relatively stable retroreflectivity, the brightness of Solidplus was still more than three times higher.

The degree of contamination by ambient influences was also examined after 278 days. The contaminated striping with standard beads reached 131mcd, which after cleaning increased to 169mcd. However, the contaminated striping integrating Solidplus showed 327mcd, increasing to 506mcd following the cleaning of the retroreflective component.

Zebra crossing markings

The beads also prove to be an interesting alternative to pavement marking tapes, for instance in highway construction zones where non-white markings are required. In Switzerland, tests were carried out at a zebra crossing, which in accordance with Swiss regulations must be marked in yellow. On canton road 221 in Uetendorf, a pedestrian crossing was applied as a structured marking. Dry readings started with 580mcd for Solidplus in a traffic yellow marking (RAL 1023) and still reached 380mcd after 313 days, whereas other systems remained at about 150mcd.

Even more impressive was the performance of Solidplus beads under wet conditions. Some 313 days after application, the yellow zebra crossing still provided 58mcd, with the alternative solution delivering no more than 12mcd; the Austrian standard for such

Need to know?

A new design of glass bead to enhance the quality of road markings for a variety of deployments

- High retroreflectivity and long-term durability
- Resistance capability heightened through a special glass composition
- Appropriate for solvent-based, waterborne paints, two-component spray plastics and structured road markings
- Economical alternative to preformed pavement marking tapes
- Achieve retroreflection values of 500-1,000mcd/lx/m^2 in dry conditions and up to 200mcd/lx/m^2 in wet conditions

Solidplus beads have been proved to offer much better visibility of pedestrian crossings in Uetendorf, Switzerland

These titanium-stabilized beads extend the durability of reflective road markings far beyond the usual performance life

applications prescribes a minimum of 35mcd in the wet.

The pigmentation of the yellow marking material also influences the quality of retroreflectivity, as tests with three different shades of yellow (RAL 1003, 1023, 1028) showed. In all cases, the markings containing Solidplus outperformed alternative systems from a competitor by a factor of about three.

Road authorities should not lose sight of the difference the bead quality can make when it comes to night-time visibility of road markings at such critical road locations.

"The tests show that Solidplus-based systems not only deliver superior retroreflectivity compared with conventional systems, but should be considered as a cost-effective alternative to preformed road markings," Jesacher concludes. "The key to a successful road marking system is a professional application with the exact harmonization of high-quality glass beads with a high-quality road marking material."

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It is commonly thought by road pricing pundits of the nationwide tolling persuasion that the USA is a decade behind the European Union in terms of readiness to execute. That's certainly what I thought in 2003 when the then Secretary of State for Transport, Alistair Darling, was pitching a national road pricing system in the UK, and when the London Congestion Charge was still flushed with early success. However, I no longer think this is true.

Of all the changes since EU optimism has dampened, two stand out. The EU has canceled, delayed, curtailed, or diminished more road pricing systems and proposals than it has sustained, and the focus has shifted from environmental sustainability (congestion, emissions, livability) to funding.

This sea change from the benevolent chirps of EU congestion pricing to the grizzly roar of a starving US Highway Trust Fund is decisive. Money speaks more loudly than livability – even as BP pours oil into the Gulf, anti-tolling newspaper comments from people who can't make the connection continue apace in Toronto.

This has a couple of implications. The first is that the USA is getting serious about national road pricing and, balanced against the EU's halting accomplishments, this has closed the execution gap to three or four years. I split this shrinkage evenly between the EU's faltering progress and the recent American awakening. Although that hardly predicts when a full shift will occur, it suggests the USA may close the gap completely in the next two years.

The second is that a panic-based focus on funding sustainability engenders poor system designs. A 'money-now, demand-management-later' criteria leads to solutions that serve to rob us of demand-management tools that transport economists have demanded for 55 years. Every dollar sunk into wrongly focused solutions will cost us US$10 to undo later on.

As an example, a draft US study in progress currently lists eight charging solutions, but only one provides the full toolset needed to address congestion, funding and emissions, while promoting a shift to electric vehicles. Although the well-respected team working on this understands the risks, cash-starved decision-makers acting on the final report may not. We run the risk of politicians selecting an expedient pathway to money, say by reading odometers or tolling only limited-access highways that will heavily mortgage our future ability to manage demand. It may even force us into the long-discredited view that we should try to build our way out of congestion.

We should think harder about why and where we are about to leap.

> A 'money-now, demand-management-later' criteria leads to solutions that serve to rob us of demand-management tools that transport economists have demanded for 55 years
>
> **Bern Grush, chief scientist, Skymeter Corporation, Canada**

Multilane radar for stop-bar detection

READER ENQUIRY NO. 509

When it was first announced that Wavetronix was developing a radar stop-bar detector, some people said radar simply wouldn't be able to replace traditional stop-bar detection methods. In just a year, though, the award-winning SmartSensor Matrix has proved them wrong.

SmartSensor Matrix generates 16 separate radar beams in close proximity, creating a 90° field of view with a 100ft radius. This matrix of radar creates a two-dimensional, high-contrast image that 'sees' the approach, detecting individual vehicles and continuously tracking them until they exit the sensor's field of view. "Using radar, SmartSensor Matrix can monitor the approach in two dimensions, and it can distinguish between lanes," says Mike Miller, a systems engineer at Wavetronix. "It tracks vehicles as they travel along each lane and provides accurate presence detections."

New approach

Wavetronix is marketing the new detection method as Radar Vision and it's being sold as a direct replacement for loops and video. Similar to video, radar is non-intrusive, so eliminates the problems and costs associated with embedded devices. Unlike video, though, radar operates through the transmission and reception of microwaves. As the electromagnetic wavelength of such signals is much larger than that of visible light, radar is able to propagate where visible light cannot, so continues operating accurately in all weather as a result. Also, as radar transmits its own signal instead of relying on a light source, it is unaffected by lighting conditions. And radar does not need to be cleaned like a camera lens, so dirt and bugs – even accumulated snow – have no effect on the radar's detections.

Proven performance

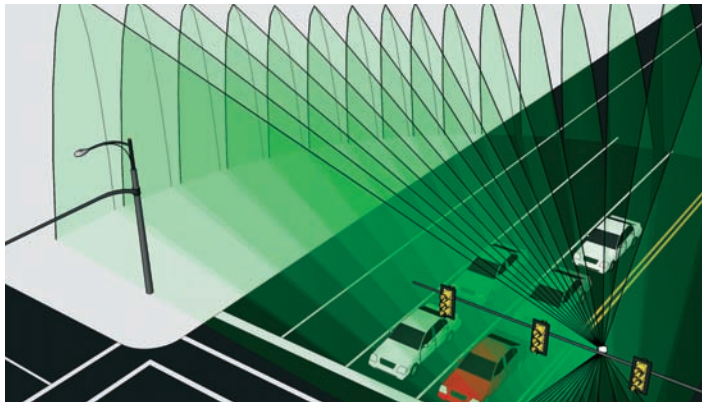
Nine years in the making, SmartSensor Matrix is built on proven technologies, adapted for stop-bar detection. Digital Wave Radar produces a digitally referenced transmit signal that does not drift over time or with variations in temperature. This highly accurate signal offers the best resolution for a given bandwidth and provides a quality of traffic measurements that remains consistent across seasons and over many years.

Continuous vehicle tracking improves detection accuracies by using the history of a vehicle's positions to predict where it will go next, which greatly increases the sensor's ability to determine the vehicle's current position. The memory of positions that is inherent with tracking is used in algorithms to prevent missed detections when vehicles become occluded. First developed for use on the forward-fire mode of Wavetronix's SmartSensor 105, it was later improved and used as the underlying algorithm for the SafeArrival technology available with SmartSensor Advance.

Need to know?

The first significant technology release in the intersection detection segment in more than a decade

- Important detection improvements over video and a great alternative to loops at the intersection
- Leverages proven technology, including true high-resolution Digital Wave Radar
- Improves intersection efficiency by reducing traditional vehicle passage times from two to three seconds to less than one second
- Accurate in all weather and lighting conditions



SmartSensor Matrix uses Radar Vision to track vehicles as they approach the stop-bar

Now, SmartSensor Matrix improves on this even further, combining it with Radar Vision to track individual vehicles over the full range of the sensor.

High-resolution radar is essential for per-vehicle detections, which are more accurate than lane-based detections – especially when traffic is congested and vehicles come to a stop. With high-resolution radar, a vehicle can first be detected and identified and then assigned to a lane. SmartSensor HD was the first radar traffic detector to employ high-resolution radar. As detecting stopped vehicles is routine in stop-bar detection, high-resolution radar is a must-have technology that SmartSensor Matrix has inherited from SmartSensor HD.

SmartSensor HD was also the first radar traffic detector to feature a multiple-radar design. Producing two separate radar beams, positioned with some space between them, the sensor measures the time that it takes for a vehicle to pass from one beam to the next in order to calculate highly accurate per-vehicle speeds that are comparable to the speeds generated by a dual-loop speed trap. With SmartSensor Matrix, Wavetronix has taken the concept one step further, creating a 16-beam matrix of radar capable of generating a two-dimensional radar image.

There has been an explosion of SmartSensor Matrix

SmartSensor Matrix delivers the reliability of radar and the simplicity of non-intrusive detection for stop-bar presence detection

deployments across the USA. Officials in Fort Worth, Texas, recently submitted an initial order for 78 sensors to be installed as part of a project that will eventually include hundreds of intersections in the city. Meanwhile, Utah DOT – which has been using SmartSensor Matrix for several months – has reported several notable benefits from this new stop-bar detector, revealed in more detail on page 54.

Total solutions

With SmartSensor Matrix in place, Wavetronix is now capable of providing complete coverage at the intersection: SmartSensor Matrix provides stop-bar presence detection for 100ft of an approach; SmartSensor Advance provides advance passage detection from 100 to 500ft; and SmartSensor HD can provide valuable mid-block traffic detection. With proven technologies and innovative thinking, Wavetronix is well on the way to creating safer, more efficient intersections.

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I admire those people who work tirelessly in public transportation policy to make alternative modes of travel attractive. Land-use policy, or lack thereof, and the 'American (or European or Asian or Australian…oh, lest I forget African and, erm, Antarctican) Dream' of a white picket fence, less-dense suburban lifestyle presents what is termed the 'Last Mile Problem', which in a nutshell is that transit systems can often deposit the traveler to within approximately a mile from home or work. But how does one resolve that last mile of travel to make systems attractive to the individual traveler and therefore beneficial to the collective travelers? This is a meritorious field, and hats off to those working in it.

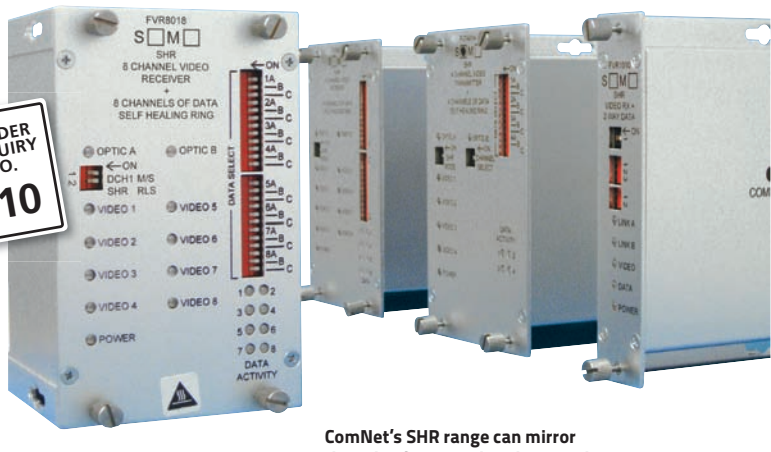
I note that there is an equally meritorious and quite vexing problem for those who design smart cars. And recently in Taipei at the 2010 IEEE Wireless Vehicular Communications/ Vehicular Technology Society Workshop, Venkatesh Prasad of Ford caught my ear by dubbing this the 'Last Inch Problem'. Although I may stretch credulity by calling this perfect analogy to the Last Mile Problem, let me make the case: smart cars must safely deposit the traveler – in this case the smart car driver – from his/her travel origin to travel destination with systems that are attractive to the individual traveler and to the benefit of society. This, the face of 'dashboard and smart phone use policies' that offer the 'Driver's Dream' of unfettered connectivity, infotainment and other telematics applications.

So how does one address this Last Inch Problem? There is no universal solution, but I am quick to note that there is a universal outcome: the last inch must be safe, efficient, reliable and attractive. Should it be based on standards? Well, maybe… if we have infinite time and if there weren't across our planet nearly one million annual road fatalities and 50 million injuries. (Those of you who are involved in standards activities, and in particular international standards, will understand: standards are wonderful, but they are the result of dialog and compromise.) Should it be based on common sense? Yes, because time and crashes tick ever upward. What are some solutions? I caveat the following by noting that I am no Thomas Edison, but there are some inch-by-inch solutions that make incremental sense: by acknowledging that there are more cell phones (greater than four billion) than toothbrushes (less than four billion) in this world; by also acknowledging that a cell phone is a fine communications gateway into a vehicle; and by realizing that humans are poor multitaskers, regardless of the protestations of our Twittering, Facebooking younger brethren. But driving is inherently multitasking…

So, some solutions from this non-automaker and no Thomas Edison… Don't control the communication link, but control the instrument panel and center console. Maximize those features that allow focus on the strategic, tactical and emergency tasks of driving, and minimize glances off the instrument panel and, of course, the road ahead. Communicate to the driver via audio and haptic means, and not via text. In other words, take over the dashboard, inch by inch…

> Smart cars must safely deposit the traveler – in this case the smart car driver – from his/her travel origin to travel destination with systems that are attractive to the individual traveler and to the benefit of society
>
> Jim Misener, executive director, California PATH, UC Berkeley, USA

READER ENQUIRY NO. 510



ComNet's SHR range can mirror the video functionality that IP video Ethernet networks offer without the inherent complexity

Flexibility and range for HA motorways

England's motorway network is currently undergoing a major expansion and improvement program, which includes the widening of several key areas of motorway, along with safety enhancements such as new concrete central reservations and traffic-spacing chevrons.

As a part of these works, the Highways Agency specified that during all major construction, the work areas should be monitored with CCTV for the safety of both workers and road users alike. In addition, during these essential works the CCTV systems are to be used for traffic flow monitoring to spot broken-down or stranded vehicles, allowing operators to arrange for their speedy recovery and ensure traffic and disruptions are kept to a minimum.

Specific requirements of the system are to provide real-time uncompressed video monitoring of the traffic conditions and to ensure complete coverage of all lanes, as well as both entry and exit slip roads throughout the whole construction area.

The Connecticut-based company, ComNet, has worked closely with Graham Firth Communications, one of the UK's leading providers of temporary motorway monitoring systems to ensure all the required objectives of the schemes were met and that the construction work could be carried out safely and on schedule while using a minimal fiber-optic infrastructure.

Technical solution

A new Self Healing Ring (SHR) system was proposed by ComNet to address the problems faced with this type of transmission application.

CCTV monitors workzones on the HA-operator motorways for the added safety of workers and road users

The systems called for a rapid deployment of cameras in a very flexible architecture, because each construction project would be of varying size and complexity. The distances involved could be from just a few kilometers long to over 20km in some cases, which called for between 15 to more than 35 cameras in some instances. With traditional solutions, such large numbers of cameras would require a huge amount of fiber and coaxial cable, subsequently making the installation and subsequent maintenance both costly and very time consuming.

"The nature of the work we do and the installations where our camera systems are used means that we are constantly battling system failures caused by the construction workers cutting through the fiber cable," explains Graham Firth, managing director of Graham Firth Communications. "With the traditional optical technology available to us, this meant that during a failure at a particular location we also lost video or data at other locations and made locating the fault very difficult. With the ComNet SHR system, these issues are a thing of the past as during a failure we can quickly diagnose the problem and locate the fault using the intelligent fault-location LED system. The simplicity of this system has been a huge benefit to our engineers who are now directed exactly to the location of the problem just by viewing a ComNet unit anywhere in the network without having to have a PC or other specialist test equipment. As a result, this has allowed us to drastically reduce our time on-site solving these problems."

Video quality/fault healing

A large number of SHR units were installed along stretches of the M6 and M62 motorway networks by Graham Firth Communications, allowing the

Need to know?

How a Self Healing Ring system is facilitating the efficient transmission of CCTV images over a fiber-optic infrastructure

- Up to eight video channels and multiple video receivers can be 'daisy-chained' on one optical fiber
- Interchangeable between standalone or card mount configurations
- Plug-and-play design ensures ease of installation and no electrical or optical adjustments are ever required
- Provides fail-safe operation in the event of loss of one fiber or one optical module

monitoring of more than 100 cameras. These systems transmit eight real-time digital video signals at 10 bit high-quality plus associated command and control data over a single fiber core. According to Steve Clarke, managing director of ComNet Europe Ltd, "The SHR product gives the end user much higher flexibility and resilience than that of a standard point-to-point solution. Our single optical fiber solution offers the fastest and simplest fault tolerant dual counter-rotating ring network in the industry with fault recovery time lower than 5ms over 48km between nodes.

"The fact that our SHR units do not use any form of video compression ensures that the quality of the image received back at the control room is far higher than any equivalent IP-based video system and allows for real-time monitoring of the fast moving traffic flows."

Futureproofing investment

The ComNet SHR product line is constantly evolving, adding new features and increasing the total number of signals that can be transported on each optical fiber. ComNet is aware of the importance of helping customers ensure a good return on investment, so the product line was developed to ensure that they did not have to replace existing equipment to increase the channel count or add new features.

"Having a system that allows us to expand and upgrade to tomorrow's technology without the usual expense of replacing the current products was key in selecting the ComNet SHR solution for our projects," concludes Firth. "This will ensure we can maximize our investment and stay ahead of our competition."

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I was in New York recently to attend a conference that followed the historic UN General Assembly Declaration, calling for a Decade of Action for Road Safety – a declaration through which governments across the world commit to reduce the 1.2 million killed each year on the world's roads.

Not only is it the home of the UN but New York is also a safe city – it has also just launched The 'Safety City Program' — designed to provide school children with traffic safety training – and a Pedestrian Safety campaign to increase the awareness of pedestrians backed by engineering measures to make the roads safer for them.

New York is a wonderful city with well-developed public transport systems in which taxis, buses, and the subway provide mass transit on a scale not found in many other places. Even as a pedestrian you feel as though you have some kind of priority. It is a world-class example of how ITS can make for much more efficient and safer travel for all.

New York is also an environmentally friendly city – all new buses are powered by 'clean' fuel and even the familiar gas-guzzling taxis are being replaced by hybrids under a plan launched by Mayor Michael Bloomberg in 2007, which requires all of the Big Apple's 13,000 taxi cabs to be gas-electric hybrids by 2012 – in doing so, creating the largest, cleanest fleet of taxis anywhere on the planet.

Mayor Bloomberg is keen on safety and sustainability at home and in the developing world too. To coincide with the UN General Assembly resolution, six organizations were awarded a total of US$125 million by the Bloomberg Foundation to implement programs in low- and middle-income countries to prevent death and disability from road traffic crashes. This is the largest single donation ever for international road safety. As well as making cities safer, the project will incorporate sustainable transport and reduced emissions in urban planning.

Arriving at JFK Airport, I was ushered to one of the new cabs. I put my own bag into the trunk and the driver grunted at me and started up while I squeezed myself into the back seat, with my knees pushed up hard up against the armored seatback which fitted behind the front seats, taking up valuable inches in what was clearly a family car not a cab! I pushed hard back into my seat and listened to a recorded voice which told me that the taxi company had the highest standards of service and safety – it suggested that for my 'comfort and safety' I should 'buckle up' – which of course I did. The ITS then took over - the display screen showed me exactly where I was and at what speed we were traveling. The cab driver also had a display, but to my complete amazement wore no seatbelt and talked for most of the journey on his handheld cell phone!

So much for safety and sustainability.

> This is the largest single donation ever for international road safety. As well as making cities safer, the project will incorporate sustainable transport and reduced emissions in urban planning
>
> **Adrian Walsh, director, Roadsafe, UK**

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Solar support off-grid

READER ENQUIRY NO. 511

Alpha Technologies has collaborated with traffic control and highway safety products distributor, Carrier and Gable Inc, to install solar systems that would provide 100% power support to a large, off-grid ITS application in Grand Rapids, Michigan.

Alpha's Solar Power Supply (SPS) solution would provide full-time power to remotely located, non-intrusive, radar-based RTMS. In all, 17 systems were provided for 17 individual loads. The RTMS is a microwave detector system that gathers data for real-time traffic conditions and travel times that exist in long-term construction sites within the city of Grand Rapids. The system gathers data to understand the ongoing traffic speed, occupancy and volume within the district at all times of the day.

The fully integrated system features a 260W Photo Voltaic (PV) array, 540 AH, 12V Gel Battery Bank, PWM Charger, NEMA 3R pole-mounted enclosure, adjustable tilt side pole PV module mount, DC circuit breakers, the sum of which provides a DC load output of 11.5 to 14VDC to the RTMS G4 detector system from Image Sensing Systems. This configuration used in the Grand Rapids installation would generally support 10 to 40W of continuous power at 12V, depending on location conditions. Other Alpha preconfigured systems are capable of supporting between 1W and 175W of continuous power at 12, 24 and 48VDC, or may be custom-configured to provide AC voltage and/or power for larger loads.

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Moving transport forward

READER ENQUIRY NO. 512

Iteris is to develop an Implementation Plan and provide Program/Project Management for the South Bay Measure R Highway Program on behalf of the South Bay Cities Council of Governments (SBCCOG) located in Los Angeles County.

The work will help move transportation projects forward rapidly in partnership with Caltrans. Iteris will also assist South Bay cities in facilitating document completion and streamlining the construction process. This project will employ a monitoring system to track progress and identify implementation obstacles.

The three-year contract – with funding provided from South Bay Measure R Highway funds through the Los Angeles County Metropolitan Transportation Authority (Metro) – has a total value of US$2 million. Measure R is a 54¢ sales tax approved by Los Angeles County voters in November 2008 to meet the transportation needs of Los Angeles County. Metro oversees the distribution of the funds.

The South Bay subregion is expected to receive around US$906 million over the 30-year life of Measure R. Although Measure R is expected to provide a significant amount of funding to the South Bay, the intent of this program is also to leverage the Measure R funds with other available and possible new revenue sources.

"Iteris has a long history of assisting the South Bay Cities on transportation projects," said Abbas Mohaddes, president and CEO of Iteris. "This contract award is an excellent example of how local transportation projects continue to receive funding in these challenging economic times."

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New Hampshire travels at free-flow speed

READER ENQUIRY NO. 513

New England's first ORT system has been inaugurated at the Hampton Mainline Toll Plaza in New Hampshire, for which Telvent has implemented its SmartMobility Tolling solution. The goal of the ORT system is to relieve the infamous I-95 summertime traffic congestion (pictured) and allow drivers to travel through at free-flow speeds. Telvent SmartMobility Tolling is a management solution for highway and tolls that enhances the efficiency and accuracy of toll operations, reduces travel times and minimizes drivers' and workers' inconvenience.

Telvent has also installed its Telvent SmartMobility Remote Operations and Maintenance System (ROMS) to improve maintenance and operations efforts, enhancing long-term system reliability.

The system opened to the public on Memorial Day Weekend for a full-scale test, and opened on June 17. The result was nearly five times as many vehicles processed as the conventional cash toll lanes and more than a 52% increase in throughput than a dedicated E-ZPass lane, in which drivers must slow down.

"Telvent has done a great job and we are delighted and proud of how well Open Road Tolling is working," enthused Chris Waszczuk, Bureau of Turnpikes Administrator. "This project will make a big difference for drivers, improving their safety, relieving congestion, particularly during peak tourism seasons, and will help to reduce harmful emissions from idling vehicles."

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Following the shelving of the Dutch nationwide road pricing scheme, what does the future hold for GNSS-based tolling?

"It depends on the willingness of road users to explore new charging systems, and governments designing systems that offer benefits as well as higher charges. A voluntary scheme in selected areas as an alternative to existing taxation systems with different systems running at the same time for an interim period is an option. Cash incentives could be offered as well as services such as PAYD insurance and better access to street parking. Trials would be easiest to introduce where feasible to offer fuel tax rebates to those agreeing to pay for road use on the basis of distance and conditions at the time and place of travel."

Gabriel Roth
editor, Research Fellow at the Independent Institute, Canada

"Its future is still bright – there are twice as many national GNSS-based charging schemes than there were a year ago, and Poland and France are well advanced in procuring what will almost certainly be GNSS-based national lorry schemes. If the UK government was serious in its coalition document commitment to "move toward" lorry charging, it could have a market-led system operational during 2011; and if it could grasp the nettle and realize that such a scheme does not have to be revenue neutral, lorry charging could be a positive step toward reducing the budget deficit, which is dominating current UK policy."

Ian Catling
Ian Catling Consultancy, UK

"France has already started the procurement, so they will probably be in the build or first operational test phase in 12 months' time. Also, the Belgian government will most likely have selected a supplier to implement its GNSS scheme for trucks. The same may be seen in the Netherlands and Denmark. In the Nordics, we will see tenders starting; we're talking to several cities that are extending what we've shown in Stockholm but moving to GNSS. There are also serious talks in relation to cities in Switzerland. We'll be closer to implementations, but the tender processes take time and people are presently waiting for their EETS standards. Ultimately, most countries will in some way have a GNSS-based road charging system in place within a few years."

Eric-Mark Huitema
mobility solutions executive, IBM, the Netherlands

"The good news is that we'll have a critical rethink. The consensus had been that the Dutch may have had it right. Unfortunately, even if it had flown, dedicated GNSS telematics to collect a couple of hundred euros per year has no business case. Tax-centric telematics mistakenly smells like Big Brother, even when anonymous, making this approach unacceptable in most countries. Already in the Netherlands and in the USA, there is a growing awareness of the potential of a service-oriented approach that relegates tax collection to a low-cost tag-along riding on the coat-tails of safety, parking convenience, insurance discounts, eco-rewards, traveler services and infotainment. This approach has more value to drivers and governments.

The bad news is this will serve to feed atavistic throwback proponents of vignette and DSRC, afraid of next-generation technologies. They will use this to frighten timid politicians who have a diminished understanding of complex sustainability issues."

Bern Grush
chief scientist, Skymeter Corporation, Canada

"Projects in France and Poland, show the market is there and expanding. As the requirements of public authorities are becoming more complex, GNSS/CN systems seem to be the way to go. The Dutch approach tried to define too many technical aspects. It might be better to leave the implementation to the suppliers and for the public authorities to focus on the business and procedural aspects. This sharing of tasks limits the risks for the authorities and facilitates cost efficient and stable implementations."

Erich Erker
mobility division, Siemens, Austria

"There is going to be huge growth in GNSS tolling as it will be affordable and there will be a business case. You can do so much with the technology once it's in the car. For road pricing, political decisions and user acceptance are key. This is why technology is crucial as there has to be a high level of confidence in security, privacy, etc, for the users, but politicians must be confident it will collect all of the taxes and do so accurately, as it could be the difference between a minister having a job or not!"

Maurice Geraets
business development, NXP, the Netherlands

Readers are invited to answer the Burning Question for the August/September issue:

In light of the recent backlash against speed/red light cameras, what can be done to restore public confidence in the value of enforcement programs?

email answers to:
l.smyth@ukipme.com

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