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Traffic law enforcement special focus, p47!

traffic technology INTERNATIONAL

APRIL/MAY 2010

Raise the alarm

From radar to video, putting incident detection into practice

Texas rangers

TxDOT's Amadeo Saenz Jr takes you on an ITS tour of the Jumbo State

Tolled you so

Siemens' Karl Strasser looks back on a job well done in Slovakia

In the zone

Strategies to enhance safety and keep traffic flowing in workzones

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What a show!

Visitors to this year's Intertraffic Amsterdam got to see why many people are excited about the potential of cooperative systems – and they didn't leave disappointed…

LLOYD FULLER

Amsterdam, Netherlands The Cooperative Mobility Showcase went off with a bang at the 20th edition of Intertraffic Amsterdam at the end of March, at which the final results of the COOPERS, SAFESPOT and CVIS projects were presented via what was undoubtedly the biggest demonstration of cooperative vehicle-highway systems seen to date.

"Cooperative systems and services such as those in our 'talking' cars stand to bring real added value for Europe's drivers," Neelie Kroes told the delegates at the opening ceremony. The EU digital agenda commissioner added, "They can help to promote safe and smart mobility in Europe, leading to fewer fatalities, injuries, and a lower CO_2 footprint." As well as the environmental benefits, Kroes suggested the projects were a good example of the kinds of investment that the European authority should be backing to combat the global economic situation. "Such projects stimulate the active involvement of business and contribute to meeting the Europe 2020 Strategy's objective of smart growth based on knowledge and innovation."

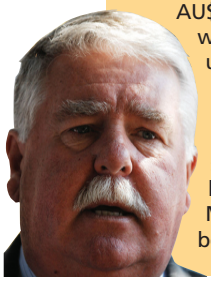
COOPERS, SAFESPOT and CVIS have been funded to the tune of around Euro 52 million (US$69 million) since 2006, the fruits of which were highlighted on roads in and around Amsterdam airport. The premise behind such intelligent cars is that vehicles exchange data with other vehicles and the road infrastructure, using a combination of WiFi and GNSS systems. As a result of this communication, cars would thus be able to see beyond what drivers can

Main: An image taken at the safety demonstration
Below: Neelie Kroes, EU digital agenda commissioner

Safer systems

Sydney, Australia The Australian state of New South Wales' Transport Minister, David Campbell, has announced a AU$170 million (US$156 million) package of road safety measures after the state's 2010 road toll hit 100 fatalities.

AU$50 million (US$46 million) will be spent on safety upgrades, including installing audio-tactile lines, wire-rope barriers and widening road shoulders at sites with a history of head-on crashes. Mobile speed cameras will be reintroduced.



9.0 …million pounds (US$13.5 million) is the amount Speed Check Services (SCS) has secured in development funding from private equity firm LDC to accelerate its expansion strategy. SCS is a leading provider of average speed camera systems with Home Office Type Approval, which is required for legal enforcement. As part of the transaction, LDC will make the investment in return for a stake in the company. SCS now plans to accelerate its new product development program and expects to double its £12.2 million (US$18.3 million) annual sales over the next five years.

Moving on...

Pleasant Hill, California Caltrans director, Randy Iwasaki, is leaving his state post to become executive director of the Contra Costa County Transportation Authority (CCTA). A licensed civil engineer, Iwasaki has been with Caltrans for more than 26 years, serving in a number of high-profile engineering and management positions. He also serves on a number of transportation panels and is a past chairman of ITS America.

see and hear, and even respond to potential dangers on the road or traffic congestion.

"Our goal was ambitious," explained Paul Kompfner, coordinator of the CVIS project. "We have to prepare the foundations for safer, more efficient and sustainable mobility, enabled by innovative solutions for vehicle-to-infrastructure communication and cooperation. The aim was for visitors to walk away from the Showcase with their own vision of how we can achieve a better future in the transport and travel domain, and with the intention to work together to realize that vision.

"On every continent," he continued, "part of the spectrum has been reserved for cooperative vehicle systems; 5.9GHz in the USA and Japan and 5.8GHz in Europe, so this subset of ITS is certainly coming."

A particular achievement of CVIS is its flexible and open implementation platform and associated development tools. Using this universal solution, anyone can develop and market a CVIS-compatible application, in doing so, paving the way for innovative products and services.

In the knowledge that standards could present a challenge, the EU announced that the European Standards Organisation would start development of technological standards for vehicle-to-vehicle and -to-infrastructure communications, expected to be ready by the end of 2013. This will enable the market introduction of cooperative mobility systems, while car-makers could also start to include the technology in their vehicles as early as 2015.

Enhanced situation awareness, travel information, parking guidance, smart intersections, intelligent routing, and in-car traffic management were shown

There is still a long way to go before the cooperative vision becomes a reality, but these three projects have brought us much closer to seeing cooperative safety and efficiency applications on European roads. Widescale FOTs are on now on the horizon to validate the project results.

Sensors prove worth in winter weather

Jefferson City, Missouri A new weather information system in Missouri has proved successful in providing drivers with safer roads during the winter season, simultaneously saving the state's taxpayers money. MoDOT installed 13 Environmental Sensor Stations along I-44 as part of a statewide RWIS, which gave MoDOT maintenance crews critical information that helped them decide how to treat road surfaces before, during and after winter storms. In fact, in one recent example, they helped crews determine that they only needed to treat bridges along I-44 with salt and chemicals as pavement temperatures were above 32°F. Without that information, the snow crews would have treated the entire route. "These new weather sensors are additional tools to help us operate more timely and effectively when winter weather hits, enabling us to minimize hazardous road conditions for travelers," stated Don Hillis, MoDOT's systems management director.

FOREWORD

One of the strangely compelling quiz shows on UK television in the 1980s was *Bullseye*. An amateur darts player was paired up with a non-darts player to throw darts and answer (not particularly challenging) questions on their way to a final. If they failed at said last hurdle, they were forced by the host to see the star prize regardless: "Let's have a look at what you could have won…" From behind a curtain, a caravan, car or speedboat would be revealed – the latter of which was always handy for an aquaphobic pensioner from Nuneaton.

I'm not sure if the phrase translates into Dutch, but I can't help feeling that by once again shelving their proposed nationwide road pricing scheme, Anders Betalen voor Mobilitiet (ABvM), the Netherlands has lost out. But rather than see what they could have won, the contestants in this show will have to settle for the booby prize – more delays, frustration and emissions from congestion.

After the February collapse of the Dutch government and elections set for June, something as emotive as road pricing (particularly using GNSS) is apparently too much of a hot potato to handle when votes are at stake. It's a shame. ABvM would have been the trailblazer in the road pricing arena. But all is not dead. A revised proposal will be included in the Christian Democrats' election manifesto, and hope remains in the ITS sector that the decision of Camiel Eurlings is just a temporary setback – "I want it to be introduced fairly and with wide support," the caretaker transport minister said. Perhaps we shouldn't be surprised. As Egis Projects' Rik Joosten comments (*p64*), we've been down this road before – and ultimately we're further forward than we ever have been. "It will come," he assures me. "They need it in the Netherlands – there are no other options." Maurice Gereats from NXP, which was involved with IBM in the 2009 Eindhoven trial, was in agreement when I spoke with him at Intertraffic, a few days after Eurlings' announcement.

With at best a lukewarm reception to the concept from the voting public, the results from the Eindhoven trial are perhaps something to cling on to. The majority of subjects changed their driving behavior purely because they could see how their mobility decisions – routes, modes and travel times – impacted on their wallets. So, if any doubters would care to see what they could have won, some clues are in the results of this trial. Next contestant please…

Nick Bradley
Editor
Traffic Technology International

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THE INCREASED RISK FROM ROADBUILDING

Safety must be a priority at roadworks, but it's not all down to traffic management – a smarter approach that regards such maintenance as part of an overall system is necessary

by Adrian Walsh, director, Roadsafe, UK

Recently while visiting a road safety auditor's course being held as part of a government-backed capacity-building program in India, I traveled along what was described as Delhi's most dangerous road – more than 300 were killed or injured on it last year. But the road is being widened and new safety features such as bicycle lanes are being installed, so why should a safety-inspired project make a road more dangerous? The main cause was simply that it was a badly managed site, with poor signing, no speed management and no discipline about how to pile construction materials.

The problem is not confined to India. Every year roadworkers are killed or seriously injured on UK roads, with more sustaining slight injuries. This does not take account of the near-misses, cone strikes and accidents that occur within traffic management. Good site management is the key to safety at roadworks. But this goes further than traffic management.

Last year, the Highways Agency-led Road Worker Safety Forum (RoWSaF) won a Prince Michael International Road Safety award for effectively tackling this problem. The forum – with representation from government, local authorities, HSE and the construction industry – has the sole aim of improving safety of roadworkers and the driving public while at roadworks. The Forum developed a toolkit of resources, including a range of different media options – video, radio and supporting artwork that enables a mix to be used based on available local budgets. A shorter film also has a PG rating so can be shown at the cinema, and both films have been approved for TV and internet viewing.

But of course speed has to be controlled. The M1 in Hertfordshire is one of the most congested sections of the UK motorway network. During a four-year road-widening program completed last year, temporary speed limits were implemented via average speed control, which proved to be effective and non-intrusive to drivers.

SPECS average speed cameras were central to this program but local and national PR as well as strict site discipline and good signing played a vital role. Throughout the program, vehicle speeds were effectively managed, traffic flows maintained, and injury-related accidents reduced by 54% compared to the three years preceding the project. The annual benefit to the economy associated with this casualty reduction was £6.8 million.

Following this success, the practice has become standard at major roadworks across the country. It would not take much to replicate these approaches in India and indeed across the world! ■

Adrian Walsh is director of RoadSafe and the Road Safety Theme Champion of gTKP, the global Transport Knowledge Partnership. Log on to www.gtkp.com

Closing the gap

Karlsruhe, Germany German traffic technology provider, PTV, has announced that it has been chosen by ViaMichelin, the wholly owned subsidiary of Michelin, to provide real-time traffic information throughout France, by means of floating car data (FCD). Normally, the main source of data for ViaMichelin's traffic information services is provided by detector equipment installed along motorways and trunk roads. However, the detectors do not cover the entire road and information network. In order to close this information gap, the company will now use FCD provided by PTV, which is transmitted from vehicles on the road, thus turning cars into mobile sensors. The technique delivers precise information about the driving speed on a specific route and converts it into detailed traffic information for the entire road network of France.

Smarter parking

California, USA Two of California's largest cities are experimenting with 'smart parking' schemes to inform motorists where spaces are available and at what price. San Francisco and Los Angeles are beginning two-year pilot projects that will use supply-and-demand principles to determine parking prices. Both are installing sensors in spaces in areas selected by their high usage, which will give real-time digital information about whether a space is occupied and for how long. The idea is to set the pricing at a level that will keep 10-30% of spaces in a given area vacant, which is intended to curb the fuel usage caused by motorists circling blocks looking for spaces.

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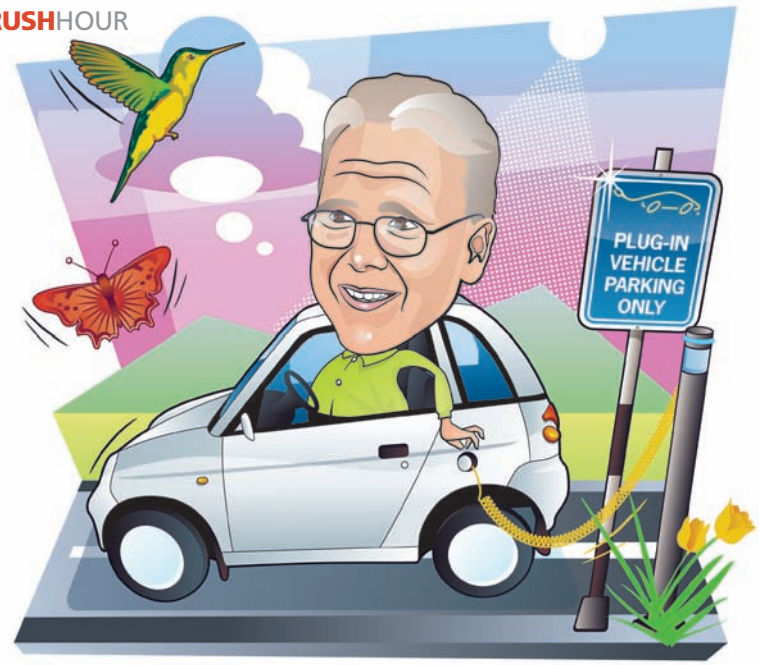

A JOLT FOR THE VEHICLE-MILES TRAVELED CHARGE

Discussing the balance between encouraging the switch to electric cars while ensuring that road use still gets paid for, Grush regards parking as a good starting point

by Bern Grush, www.grushhour.com

The evolution toward electric vehicles raises two questions. How do we encourage people to switch over to these new greener transportation modes and how will they pay for road use after they have made the switch?

Not far from now, family-scaled, rooftop solar or wind energy collectors will feed into the power grid at premium market rates. Ontario's new Feed-in Tariff (FIT) renewable energy regulations – which are designed to phase out coal-fired electricity generation by 2014, boost economic activity and the development of renewable energy technologies, as well as create new green industries and jobs – are a first step in the return to a distributed power-generation infrastructure. Other intelligent governments will follow. Citizens can invest in their own subsidized power plant, sharing the risk of critical infrastructure.

In the same timeframe, e-cars that one can power at home will become commonplace. Power will be essentially free to those with roof-top generation, and 'free gas for life' is a powerful incentive to engage in programs such as FIT.

How will drivers of these near-free-energy automobiles pay for road use? The only thing missing from this scenario to make a new market ecosystem for personal surface transportation is road pricing. The green energy, green car evolution is the ideal driver for pay-for-use according to when, where and how a vehicle is used.

The Danes recently elected to encourage the uptake of electric cars by offering free parking in Copenhagen. This alarmed parking reform advocates who know underpriced parking induces vehicle miles traveled and congestion. But the Danes are on to something. If you want people to switch to e-cars, offer them something. Even something naughty such as free parking.

According to a December 2009 report there are 500 electric cars registered in Denmark. Out of 2.7 million vehicles, that is just 0.02% of the fleet. I suspect similar statistics in most western countries. If a country wants to move its e-car fleet from essentially zero to say 15-30%, can we find a way to incentivize this and eventually recover user fees? Is there an e-car on-ramp and a fuel-tax off-ramp in a single package? Denmark provided a hint.

Consider a 10-year parking-reform program in our cities. New York, London, Amsterdam, Seoul. Provide a public parking discount for e-cars starting at 100%, declining 10% per year so that it is zero after 10 years. Use satellite-based time-distance-and-place meters to manage this payment system. At some point in the program – perhaps when e-cars account for 10% of automotive population – phase in a road-use fee on these same meters, so that at the end of 10 years, e-cars are paying a fair road-use fee and a fair parking fee. ■

Any comments to bgrush@skymetercorp.com

Leading the way in LED lighting

Sveta Nedelja, Croatia Telegra has launched its new Lightway IQ range of LED street lamps. The new range has a claimed lifecycle that is 300% longer than conventional lights and is combined with the highest efficiency on the market – 140 lm/W. The Telegra lamps are expected to last for +50,000 working hours to 70% of their initial luminous output and offer low operating and installation costs. The units can be integrated with the topXview, which is a complete ITS software platform that helps to eliminate unnecessary costs by use of adaptive light-intensity controls according to traffic and environmental conditions. By using the adjustable power consumption features of the topXview controller – together with traffic and environmental data – it is possible to save up to 50% on operational costs.

Teaming up for safer roads

Washington, DC, A coalition of road safety advocates has formed the Partnership for Advancing Road Safety (PARS) and vowed to make roads safer by raising awareness of traffic safety initiatives. The new organization has said it will work to send a clear and consistent message to the driving public – 'It is not okay to speed, run red lights, drive while distracted, or in any other way endanger the lives of others on roads and highways'.

Partners include American Traffic Solutions, LaserCraft, Redflex, Traffipax and Redspeed Illinois. Between them, they account for more than 88% of North America's more than 4,000 installed safety cameras. "Our mission is to create safer roadways in our communities, using education efforts and law enforcement strategies that increase intersection safety, and reduce excessive speeds and distracted driving," said PARS executive director, David Kelly (*see p51*).

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HOT contract

Washington, DC Raytheon has been selected by Transurban (USA) Inc as systems integrator to deliver an advanced tolling and traffic management system for a 22.5km (14-mile) section of the I-495 Capital Beltway in Northern Virginia. The Capital Beltway HOT scheme is adding four lanes and replacing US$260 million of aging infrastructure. More than 58 interchange bridges and overpasses will be rebuilt. Due to open in late 2012, it will have real-time incident detection and a new DMS to provide travelers with extra safety information.

The voice of better route guidance

Dearborn, Michigan US drivers hitting the road in a new 2011 Ford Lincoln or Mercury vehicle equipped with voice-activated navigation will be able to tap into nearly 2,500 miles of highway and interstate lanes designed to help get them where they need to go quicker and with less hassle. For 2011 models, Ford will be adding a new high-occupancy vehicle (HOV) lane routing preference to the navigation menu; drivers traveling with passengers will be able to set the HOV guidance option on the preference menu. Once engaged, the system will map routes using HOV lanes where appropriate when a destination is entered. Users will know that routes contain HOV lanes when they see a white diamond icon illuminated on the map during route selection. The HOV guidance option is one more tool in the Ford system's traffic-fighting portfolio that already includes traffic reports, incident alerts and rerouting prompts to avoid congestion, all of which are supported by SIRIUS Travel Link.

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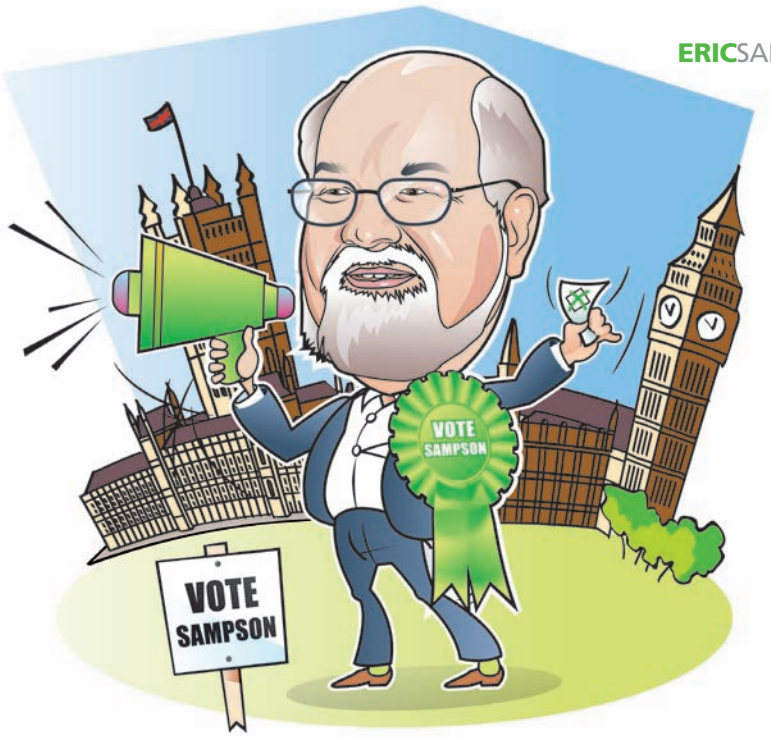


SIGN HERE FOR SAMPSON!

by Professor Eric Sampson

As England gears up for a general election, Sampson considers the changes he'd make to improve road and rail if he were blessed with political powers in the transport arena

At the time of writing we know that we're a matter of weeks away from a general election and I sense the same attitude as in 1997 – something along the lines of 'this lot will be voted out and the other lot will come in'. Setting aside the national accounts and the economy, what might we want an incoming administration to do for transport? What would I do if I were to become Secretary of State for Transport? If I had five times the column inches, I'd set out my full plans, but for the moment I'll focus on the top priority – greater value for money.

Programs seem to cost more in the UK than overseas. One reason is a tendency to buy bespoke systems. Nobody goes into a car showroom with a specification that they invite the company to make – we look at catalogs of options then choose the combinations we like and can afford. Yet we still buy trains and trams the bad way. And why is the Department for Transport wedded to the daft hybrid approach for the InterCity Express? The relatively simple problem of no electrification to Aberdeen has distorted all planning: go to the market for modern all-electric sets and stick a diesel on the front to take them further North.

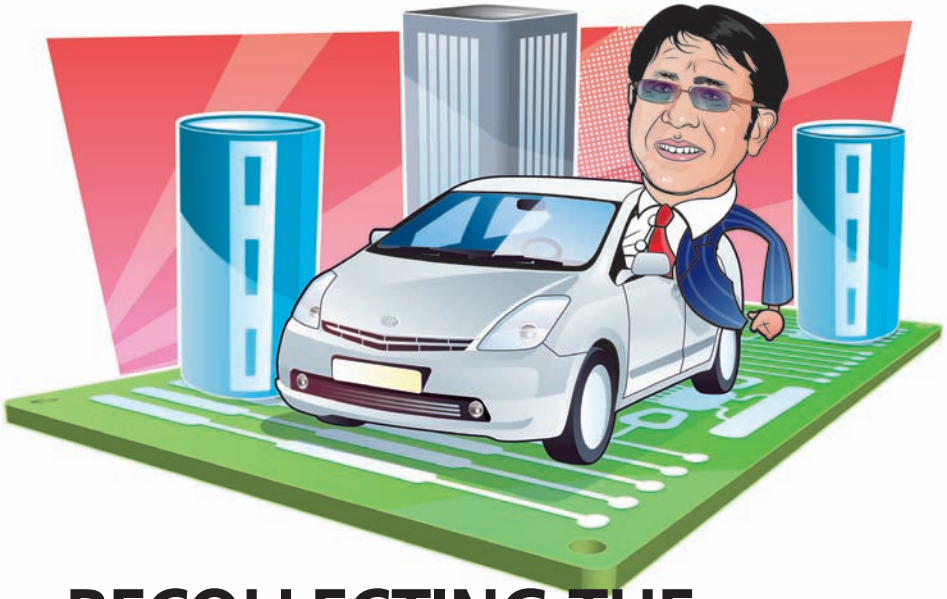
The Highways Agency in England has a good track record on using competition to drive down unit costs that puts Network Rail to shame – time for some wiser market testing, perhaps?

As we buy in small packets, we don't get benefits of scale. The villain here is the excessive number of transport authorities – 100-300 players depending how you count, comprising integrated transport authorities, Transport for London, London boroughs, districts, unitary authorities and other oddities the majority of whom have too small responsibilities. The essence of transport is a seamless journey which is hampered – not helped – by this fission.

If it were my choice, I'd reduce to a more manageable 40 or so – for comparison, there are 43 police authorities in England and Wales and most people think that is too many – and expect significant cost and efficiency gains by aggregating into fewer, larger units.

Now let's take the axe to the planning process. A typical large transport scheme takes approximately 15 years from start to finish, of which three years are actual construction and 12 years are planning arguments. Let's streamline this and adopt the French approach to compensation on compulsory purchase. For £3 million we'll offer the market value of the property plus 15% and after that, market value minus 15%. With this philosophy we might get High Speed Two (HS2) in five years rather than 25.

I realize I haven't solved everything but this package would be a sound start. More in the next column! ■



RECOLLECTING THE ELECTRIC AVENUE

The road to smart cars is not an easy one by any means, but it's not being helped by negative naysayers. Misener asks that we join him in a (reggae-style) chorus of positivity

by Jim Misener, executive director, California PATH, UC Berkeley

Apologies in advance to Eddy Grant, but consider for a moment the lyrics in his 1982 hit *Electric Avenue*: *"We gonna rock down to Electric Avenue/And then we'll take it higher…Who is to blame in one country/Never can get to the one…* Chorus: *Oh no... Oh no... Oh no... Oh no...*

Recently, smart cars have taken a literal and figurative hit, with Toyota recalling perhaps six million cars, ostensibly with faulty floor mats or brake pedals or something… Perhaps the root cause was faulty 'smart' design. Whatever the case, the chorus of 'Oh no…' resounds. Cars are becoming ever more complex, with up to 100 different, specialized processors replete with embedded programs, working in synchronicity to help us drive these 3,600 lb (1,600kg) behemoths in and amidst a plethora of road users. The current hue and cry is that fail-safe and fault-tolerant designs are becoming ever more difficult, even impossible. These systems are too complex. Life is so precious. Oh no…

Rubbish, says this intrepid voice. I contend that like Eddy Grant's fleeting contribution to, erm, culture, these shrill concerns regarding the safety of electronic systems add to a one-hit wonder. As a case in point, the advent and widespread adoption of but one system, electronic stability control, can by some estimates reduce fatalities by up to 15% on dry surfaces and 35% on wet or icy surfaces.

Add to this the various advances to smart cars sometimes extolled in this column and described objectively in *Traffic Technology International*: forward collision warning/avoidance, blind-spot detection, lane-keeping aids, pedestrian detection, cooperative vehicle-highway systems. The list goes on – and it will continue. In the past 10 years, electronic content in average vehicles sold has increased from about 15% of the price of a car to more than 35%. With this content comes complexity, but with complexity and good engineering also comes comfort, convenience, and safety.

Some of the future promise and contribution of electronics to safety is so compelling that we should fervently hope that the current naysayers are drowned out by competing choruses of 'Oh yes…'. More and more smart cars will be connected, will be able to sense and diagnose their systems, and will be aware of their surroundings. And in the end, more and more lives will be saved.

Certainly, the problems encountered by Toyota and the threat to safety are real. But let's get real: they are most likely a bump in the road. These problems should not dim the lights on our electric avenue. Indeed, the roadway is clearly lit and well-equipped for smart cars of all makes and models to travel toward a safe future.

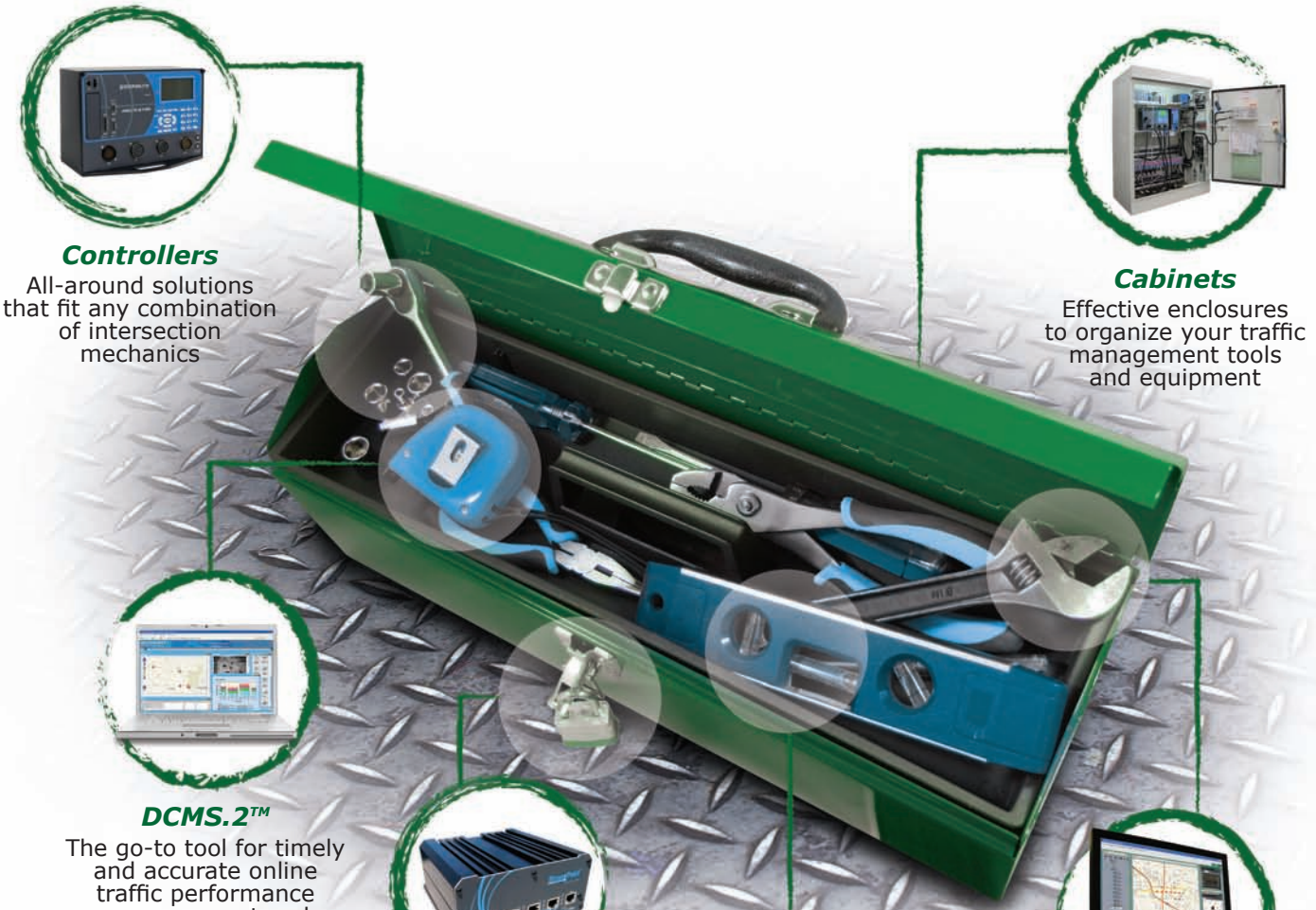
So let's recall the lyrics, not the car. *Oh we gonna rock down to Electric Avenue. And then we'll take it higher…!* ■

200 …thousand people have downloaded a new iPhone app from the Highways Agency. Drivers using their iPhones to check motorway traffic reports on the HA's Traffic Radio service have increased the station's audience figures by more than 500% in some areas, as more road users listen to round-the-clock travel updates from the HA's National Traffic Control Centre. The app pinpoints the user's location, gives a breakdown of any planned roadworks and displays live traffic updates, as well as letting users tune in to the HA's DAB radio service.

Linked in

Brisbane, Australia Kapsch TrafficCom has been appointed by BrisConnections to supply the electronic, free-flow tolling system for Brisbane's Airport Link. Dr Ray Wilson, the CEO of BrisConnections, said Kapsch was selected by prime contractor Thiess John Holland – which is designing and constructing Airport Link for BrisConnections – after an extensive competitive tender process. BrisConnections' tolling system will be fully interoperable with all other tolling systems in Queensland, as well as Australia. "The specifications for the tolling system are among the most comprehensive of any system installed in Australia to date," Wilson said. "Kapsch has been selected based on its expertise and experience in designing and delivering tolling solutions for toll roads worldwide, including Australia and New Zealand."

How complete is your congestion reduction toolbox?



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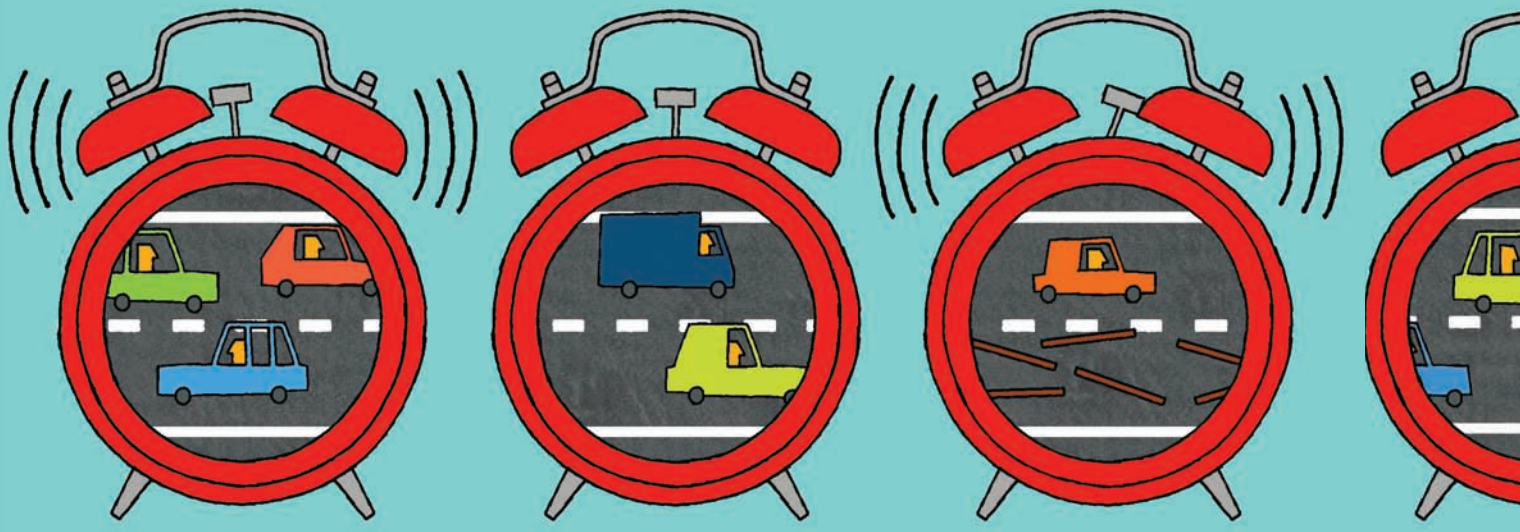


RAISE THE ALARM

Although technological developments in incident detection make for interesting reading, **Louise Smyth** looks beyond the componentry and alerts to see how they are improving safety and increasing efficiency in the field

Illustration courtesy of Tim Ellis

Although many articles within these pages explain the theory and technology behind certain systems, sometimes it helps to approach things from a different angle. For sure, technical papers have their place in disseminating knowledge and experience, but as product vendors will only be too aware, potential customers are keen to discover who else is using a system – and vitally, what it's allowing them to achieve.

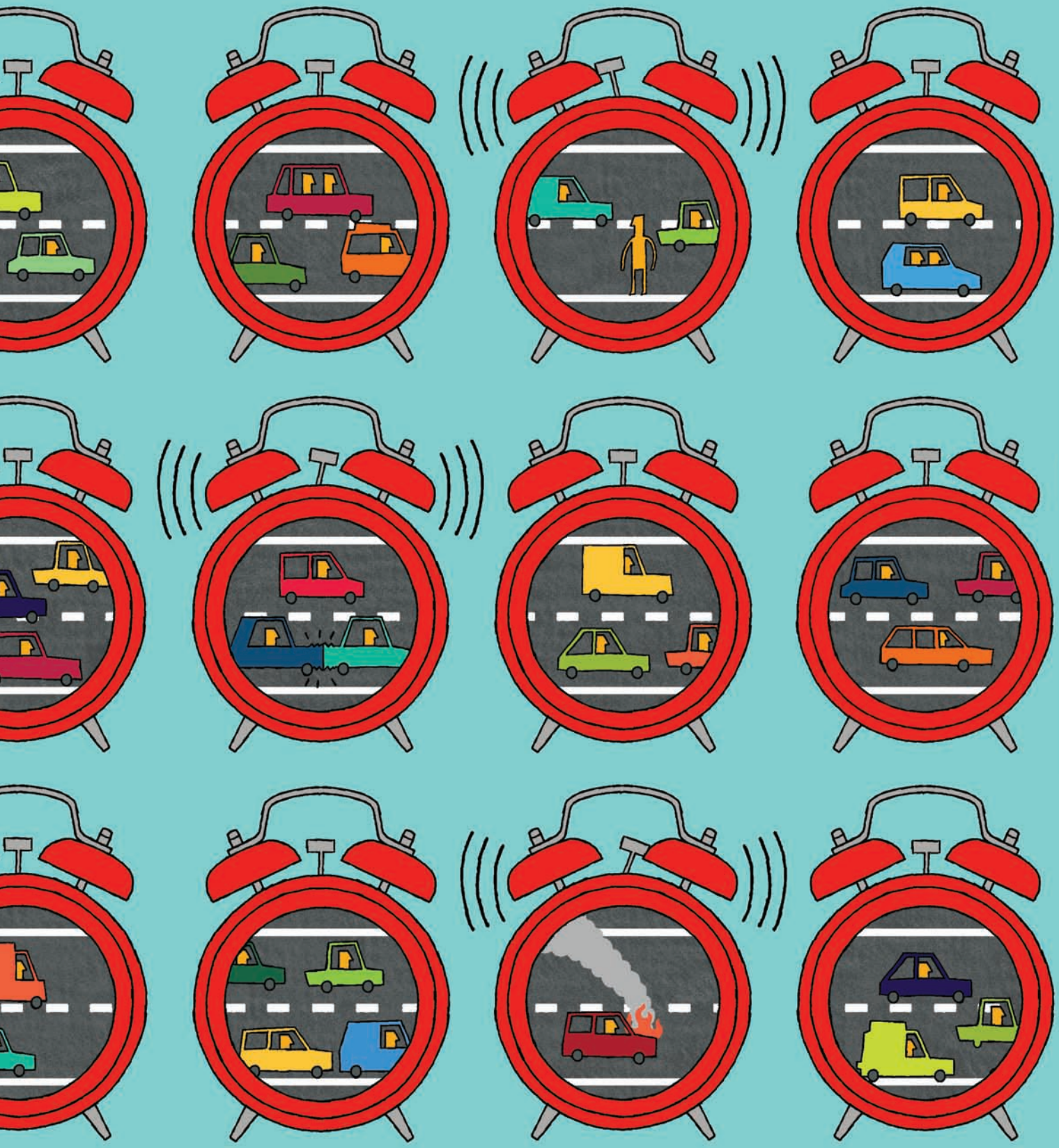
This is particularly true in the field of incident detection, in which stories from end-users regularly provide the best way of showcasing the merits of the technology being deployed. As Traficon's Eddy Vermeulen suggests, such feedback is as invaluable to vendors as it is to their potential new customers: "You need knowledge and understanding of customer requirements to create new products; it's one of the golden rules of development!" he states. "The only place to get that is by going into the market and talking to the people who use the technology every day."

As product manager of Traficon's VIP-T range of video-based automatic incident detection (AID) products, Vermeulen has formed a close customer relationship with the authorities managing the Antwerp ring road – a flagship AID project for the Belgian video detection specialist. "This went live in 2004 with an order for 300 VIP-I detection boards and has expanded every year since," Vermeulen reveals. "Today, the incident detection coverage also encompasses the Flemish part of the Brussels ring road and almost 500 modules are being used, the most recent being our VIP-T boards."

Traficon's technology is used around Antwerp for alerting authorities to the usual incidents that occur on busy roads – stopped vehicles, shed loads, accidents, and so on. But it's also used for an additional purpose that provides the authorities with a rather useful 'added-value function' – measuring vehicle flow, speed and occupancy, in doing so allowing the Flanders Traffic Control Centre to set VMS to inform drivers of real-time traffic conditions as well as any incidents. Speed limit information on the VMS is adapted automatically based purely on data from the detection modules, aptly demonstrating just how much faith the operators have in the accuracy of the data.

UNDERGROUND MOVEMENT

Traficon's AID bread and butter has long been in tunnel deployment and the company has recently been busy on a new project a little further afield – Australia's newly opened CLEM7 tunnel in Brisbane, which links five existing major motorways and arterial roads on the north and south sides of the Brisbane River. Andy Ivett from the Clem Jones Tunnel feels that the Traficon technology contributes to making CLEM7 one of the safest tunnels in Australia. In all, 190 cameras were deployed together with VIP-T modules, ensuring real-time data on traffic flow as well as automatic detection of all traffic incidents. Such functionality enables Ivett's colleagues in the operations room to see immediately any variations in normal traffic flow, therefore providing a critical window of opportunity to enact emergency operations, such as activating variable speeds and message signs to notify drivers to



any problems and broadcasting advice on a radio rebroadcast system.

SITUATION CRITICAL

Another European outfit with an eye on the AID sector might be better known within these pages for its work in the ETC field, and Kapsch TrafficCom's Rudolf Benedik, key account manager, echoes Vermuelen's feelings on the value of communicating: "It's a complete value chain," he suggests. "I deal with people from the very beginning to the end of the entire solution, including everyone from legislators to operators."

Kapsch's IDS (Incident Detection System) is being deployed on roads, bridges and, of course, in tunnels – basically anywhere regarded as 'critical infrastructure'. At the heart of the system is the company's detection algorithms, whose software modules run (via Linux) on the industrial PCs that are also provided by Kapsch.

"Experience shows that it is better to warn the other road users – via real-time VMS, for instance – rather than warn the wrong-way driver"

Jean-Hubert Wilbrod, *president, Neavia Technologies, France*

When prompted for real-world examples as to how Kapsch's IDS is faring, Benedik takes no time at all to recall a slightly older installation that has repeatedly proved its worth with regard to one of the most dangerous events that such systems can detect – 'ghost' or wrong-way drivers. "In the Strenger Tunnel in the Tyrol region of Austria, we built a system some years ago. In 2007, it accurately detected a wrong-way driver, allowing ASFINAG (the Austrian road operator) to prevent an horrific accident within a very confined area. I use this example a lot as it shows that even back in 2007 our technology was sophisticated enough to accurately detect these types of events in real-time. ASFINAG has long had the system set up so that if a ghost driver is detected, the tunnel automatically and immediately closes to traffic – no mean feat in itself – which goes to show the trust that they have in the accuracy of our technology."

This strategy has proved incredibly valuable in more recent times too, as Benedik reveals: "One ghost driver is shocking enough, but there is a modern phenomenon that's causing an increase in these incidents. Inaccurate sat-nav systems have been ordering drivers to make an about turn inside the tunnel. Some drivers have so much faith in these systems that they ignore what their own eyes are telling them and start doing what the sat-nav has told them to do. The latest such event – which our system successfully detected and dealt with – was two months ago."

A more recent project in which Kapsch has been involved is currently being rolled out: "We're working with a global player in automation management in Italy, together with the University of Salerno on a project that blends incident detection with real-time traffic information," Benedik outlines. "The layout of the system is an open stretch of road with four gantries, a small tunnel and then another gantry. On the first gantry we measure the speed of the cars and pass the data to the university's fuzzy logic system. Then at the next gantry, VMS display the license plates and speeds of drivers breaking the limit. In parallel to this, we conduct exactly the same incident detection as we would in a tunnel – stopped vehicles, shed loads, ghost drivers, etc." Benedik predicts the project will be of great interest to anyone interested in getting the most from incident detection systems in terms of using them as a part of a wider traffic management strategy.

Neavia Technologies' system in place for wrong-way driving detection

GHOSTLY APPARITION

Another man only too familiar with the horrors of ghost drivers is Patrick Leweurs, deputy MD at Conseil Général des Côtes d'Armor – a regional entity in Britanny, France. "We had been working on this

Proven sensors for safer highways

One of the big players in this sector is the US company, Image Sensing Systems (ISS), whose main market for incident detection is in tunnels – with more than 85 tunnel projects operational today. The company's vice president of product management, Craig Anderson, describes the technology behind the system: "We process the incident detection via our Autoscope RackVision Terra detector card," he states. "Each card processes one camera, and we also have a 19in rack in which we can place 16 of these cards, known as the RackVision System 16. It's convenient for operators to get a lot of cameras going into just one rack.

"The output alarms from our system feed into the tunnel's overall management system, usually a SCADA system, so the operator can then pull up video from specific cameras to see any incidents that are occurring. Time is everything here: the time to detect is a critical component of an effective tunnel management system."

So where is ISS's technology being used today? Graham Heywood, ISS Europe's general manager, provides the answer: "We've got many incident detection systems in use throughout Europe. Two recent UK sites are on the congested M25 London orbital motorway (left). Both are using the RackVision Terra technology. Not only do these systems detect incidents (stopped vehicles, wrong-way drivers, etc), they are also ably performing smoke detection as well. On another M25 project, the Holmesdale trial, there was a public safety test and our smoke detection system proved to work extremely well."

This positive response is supported with evidence in the form of more business from the Highways Agency in England. Within 12 months of the Holmesdale project being delivered, a new contract was issued to supply ISS equipment into the Bell Common Tunnel, also on the M25 motorway.

It's not only the UK market where ISS technology is being deployed, however, as Heywood reveals: "We have highway incident detection using our Autoscope RackVision running on roads in Croatia and in Slovenia, as well as more tunnel projects. In fact, in one tunnel in Croatia a vehicle caught fire and our system worked perfectly and actually saved the life of the driver as the incident response team could get to him and his truck quickly and close the tunnel."

And it's not only video detection where ISS has a share of the market. Since acquiring what was known as EIS (now ISS Canada), the company is also deploying the RTMS radar system, with a noteworthy contract encompassing almost 350 G4 sensors for incident detection and real-time traffic

Navtech Radar's ClearWay uses high-frequency radar to scan the whole road surface, both up and down stream

problem for a long time and intuitively realized that detecting wrong-way drivers on exits was not enough, and that detection on the speedway itself and automatically warning road users were crucial to having an efficient and safe system. We decided to equip a 26km section of speedway with triple technology devices from Neavia Technologies, coupled to VMS. On October 25, 2009, we had confirmation that our instincts were right – even though the system was not rolled out on the entire stretch yet. At the merging point of two speedways, an 80-year-old lady – realizing that she was not traveling in the expected direction – took the speedway in the wrong direction instead of going ahead. She was detected several hundred of meters along." Further confirmation came just six weeks later when a driver who Leweurs can only assume missed his exit simply drove backwards – for more than a kilometer!

Jean-Hubert Wilbrod, president of Neavia, expresses no surprise at this type of driver behavior; he hears of such examples every day. "The baseline is that wrong-way drivers are either completely unconscious or extremely conscious of what they are doing wrong," he says. "And experience shows that it is better to warn the other road users – via real-time VMS, for instance – rather than the wrong-way driver." Leweurs is meanwhile counting his blessings for Neavia's video-based solutions: "In both of the cases I mentioned, the drivers did not cause any accidents. We are now accumulating data and working on the best messages we have to deliver to road users in order to avoid accidents and maintain this record."

BEAM OF HOPE

Although video-based incident detection is a big trend in the ITS industry, it is not the only solution capable of achieving good results in this field, and the adoption of radar-based systems is testament of this. Often proven in equally challenging surveillance applications in the industrial and security sectors, radar is fast becoming an indispensable component of ITS. Navtech Radar is a UK organization capitalizing on this movement. Dr Stephen Clark, the company's co-founder and director of incident detection systems, explains how the company became involved in the traffic market: "Our background is in industrial automation, but a while ago we moved into the security market with a wide-area surveillance system. This received a lot of interest from customers wanting to detect traffic flow, stopped vehicles, pedestrians, debris on the road, and so on. The first traffic project we did was a trial on the M4 motorway for the Highways Agency (HA). We subsequently worked on a number of motorways conducting trials that were a mixture of incident detection across the whole carriageway and hard shoulder monitoring for managed motorways."

At the end of 2008, the HA requested that Navtech demonstrate the abilities of its solution in a tunnel environment. A trial in Southwick Tunnel using two radars has now led the HA to order six ClearWay radar systems in each tunnel bore for the new Hindhead Tunnel on the A3 in Surrey.

Clark attributes the HA's enthusiasm for his company's technology in part to the low false alarm rate offered by radar. "Radar is not affected by rain, fog, dust, smoke or even bright sunlight, which can be a problem for video-based detection systems at tunnel portals," he says. "Also, our radar is quite different – even from other radar systems, which tend to use side-fired radars. Ours scans up and down the surface of the road and it covers the whole road, whereas a single-point system loses any vehicle that stops after that point. We offer a longer detection range, which ultimately means that fewer sensors are needed." Clark views his system as being supplementary to video coverage however. "Most operators will still want to see an incident for themselves but using radar sensors to detect that incident means they'll need fewer cameras."

Unsurprisingly for a company with a background in security, Navtech Radar is now picking up ITS contracts in regions such as the Middle East. "We've been working on a project in Kuwait for which we've sold a radar-based incident detection system for a security application," Clark explains. "It's being used to detect incidents next to some oil field infrastructure. This particular part of the perimeter is a multilane highway and a single radar covers the hard shoulder, the lanes in the first carriageway, the median strip and the lanes in the second carriageway. It also provides control messages to a pan/tilt/zoom (PTZ) camera so that any incidents it detects can be viewed by operators." The project went live some months ago and Clark is proud of how well his technology is performing in some very challenging environmental conditions (the radar was rated to 70°C before being installed). "Aside from the fact it's very hot, there's also a lot of dust and sand," he says. "Radar works very well as a detection system in that environment, whereas other above-ground sensors would struggle." ■

"Radar is not affected by rain, fog, dust, smoke or even bright sunlight, which can be a problem for video-based detection systems at tunnel portals"

Dr Stephen Clark, *co-founder and director, Navtech Radar, UK*

information on the whole ring road around Istanbul, Turkey.

Heywood regards radar-based systems as being pretty complementary to video-based ones and plans are in the pipeline for ISS to make the most of this relationship. "The future market will make use of many technologies to supplement and manage the positive benefits of video and radar, as well as ALPR, to provide ever-increasing robustness and deliver what clients want: proven sensors for safer highways."

TEXAS RANGERS

Ahead of ITS America's 20th Annual Meeting in Houston, Texas DOT's executive director, Amadeo Saenz Jr, takes an hour out to speak with **Nick Bradley** about the challenges faced running the USA's biggest transportation network

Image courtesy of Duncan Walker

Although to many people Texas is the Lone Star State, for a period in the 1880s it came to be known as 'The Jumbo State', after the circus elephant, Jumbo, which became the main attraction of Barnum's 'Greatest Show on Earth'. Folks back then probably had no idea how jumbo this southern state would eventually become. "If Texas were a nation in its own right, the state's economy as measured by GDP would rank 12th largest in the world," explains Texas DOT's executive director, Amadeo Saenz Jr, whose job it is to ensure mobility on the state's massive transportation system.

With an enormous 80,000 miles of roadways, Texas boasts by far the largest highway network in the USA, and with some 50,000 bridges – 40% more than any other state – it's as complex as it is expansive. But as TxDOT's top man reveals, the biggest challenge lies ahead and revolves around how to finance the state's future transportation needs. Once totaled, the state and federal gas taxes, vehicle registration fees, taxes on items such as oils and lubricants, and a general revenue bond program approved by the state legislature in this biennium brought in about US$7-8 billion this year. "But we spend around US$2.5-US$3 billion alone just maintaining the roads on that 80,000 centerline mile network," Saenz adds. "On average our highways are around 45 years old, so half of my money is just going on maintenance!"

MISSION IMPOSSIBLE?

In 2009, the 2030 Committee – comprising business and civic leaders appointed by the Texas Transportation Commission – produced the *Texas Transportation Needs Report*, in which it was estimated that transportation funding needs between 2009-2030 would amount to US$315 billion. "When you take those 2008 dollars and stretch them out over time – applying an inflation factor of say 3-4% – that increases to somewhere in the region of US$487 billion, which shows you the scale of the problem."

Saenz – who began life at TxDOT as an engineering assistant in 1978 before working his way to the top of the transportation tree – admits to what appears to be an impossible situation. "Based on the expected population growth (set to increase by 47% to 36 million by 2040) and VMT, we projected that the amount of money that we could generate from our current revenue sources (gas taxes, vehicle registration fees, etc) could perhaps raise around US$150-US$160 billion, leaving us with a US$300 billion shortfall."

Saenz doesn't hide the fact that the funding mechanism might be flawed in this day and age. "The state gas tax is set at 20 cents per gallon and has been that level since 1991; the federal gas tax is 18.4 cents per gallon and hasn't changed since 1993. It's never been adjusted for inflation, so as gas prices have gone up and up, we're now playing catch-up." Compounding that, Saenz notes the high gas prices have led to more and more people seeking alternative forms of transportation. Fewer vehicle miles traveled means fewer taxes collected and nowhere near as many bucks to play with

– a situation that will never be reversed. "Just yesterday, I saw that President Obama signed an executive order requiring that vehicle miles per gallon (mpg) standards raise to 35.6mpg by 2016 – that's almost 10mpg more fuel efficient than today. It's great for the environment, but a further decrease in the revenues that we're gonna get because you're going to be selling less gasoline to drive those vehicles." On a similar theme, Saenz points to Nissan's push on its all-electric LEAF. "That car will still drive on our roads, contribute to highway damage, add to congestion, yet won't contribute one cent to transportation funding because it won't need fuel. We have to account for that. The big challenge we face is how to address the expected increase in population with this unreliable funding source in order to meet the future needs identified by the 2030 Committee."

PERFECT PARTNERS

Ultimately, Saenz's job is to make his appropriations go as far as possible in the state of Texas, which is perhaps why he embraces the concept of PPPs. "In the early 2000s, the state legislature gave us the authority to pursue public-private partnerships," he says. "This has helped us develop two major projects, the first of which is the new LBJ Freeway in the Dallas-Fort Worth Metroplex – one of our most congested areas in the state. As a result of our air quality requirements, we have to utilize managed lanes or HOV lanes to help address emissions – it's one of our mitigation tools – but we're also converting those HOV lanes and selling the extra capacity as a managed lane or a toll lane, helping us to address air quality as well as some of our congestion needs."

The cost of the new LBJ is US$2.5-US$3 billion, which Saenz quite freely admits is a check TxDOT couldn't afford to sign. "We put in US$500 million through public investment and the private sector stumped up the rest. Cintra and its partners are

Combined forces

Jack Whaley, executive director of the Houston TranStar TMC, takes us on a tour of this multi-agency facility

Keeping traffic on the move in the Greater Houston area is down to Texas DOT, the City of Houston, Harris County, and the Metropolitan Transit Authority of Harris County. At one time, these agencies worked separately to plan for or manage traffic growth. But when the region's population exploded in the late 1980s and early 1990s, increasing traffic congestion was the by-product, so the four agencies combined forces, and in 1996 the Houston TranStar was born. A first of its kind, this multi-agency platform has since become a model for TMCs across the USA.

"The product here is really time," explains Jack Whaley, executive director of Houston TranStar. "In years gone by, if there was an overturned vehicle on one of the interstates, someone would call 911, who would in turn call the police. The police dispatcher would send somebody up to the scene, who would then report back about what resources were needed – fire, ambulance, etc. Then his dispatcher would coordinate with the other dispatchers and eventually you'd get what was necessary to the incident." When a call comes into TranStar, though, the image is displayed on the videowall for all to see, affording those who need to be involved the chance to coordinate operations on the spot. "You've got to get things moving quickly," Whaley stresses. "Some of our interstates are running 220,000-340,000 ADT, so it doesn't take long for a free-flowing freeway to get seriously backed up."

TranStar staff have access to 660 cameras deployed in the area. Traffic management is assisted by synchronized traffic signals, speed sensors, ramp meters, and other ITS. "In terms of obtaining real-time traffic information, we're experimenting with Bluetooth," Whaley reveals. "A lot of the ITS we have is on the interstates, so we are trying to get more onto the surface streets. That will be how we expand things in the future, by deploying more ITS to all roads, not just freeways. Bluetooth is a fraction of the cost of current technologies, so we're really hopeful about the potential."

Various methods are utilized to pump travel information back out to the public, ranging from close relations with the media (radio and local TV) to Highway Advisory Radio, DMS, website/email, and even new social networking tools available on smartphones.

Operations within Houston TranStar help keep traffic flowing on the streets and highways

During a hurricane, TranStar really moves up a gear, evidenced most recently during Hurricane Ike. "I came to work on a Tuesday and didn't leave until the following Wednesday," Whaley recalls. "You need to conduct operations in preparation for the storm, during, and in the aftermath. There were always around 300 people here at any given time."

It is during such operations that the multi-agency platform really pays dividends. "One of the things I like to point out about Hurricane Rita – and something they didn't have in Louisiana – was that both the city mayor and the county judge were on-site and able to see that the evacuation was not going according to plan, so they were able to contact the Governor to take steps at a state level," Whaley says. "We had a big crowd and lots of traffic, but it was all cleared before the hurricane hit due to that communication."

TranStar uses a number of emergency management tools, including CCTV, Doppler radar imagery, satellite weather maps, and an automated flood-warning system to monitor developments. "We communicate both transportation and emergency messages on our website," Whaley explains. "A real-time speed map provides a quick overview of the region's traffic conditions. On another web page, still photos from more than 350 cameras stationed along state highways and major county roadways let visitors see exactly what traffic looks like at that precise moment." The speed map and photos can also be accessed on smartphones. Another link provides a single location for watching developing weather conditions, telling visitors what to gather for personal disaster kits, as well as planning, timing, and mapping evacuation routes.

"ITS America visitors who take the tour will get to see how we do things up close," Whaley says. "We'll take them up to our emergency operations center as well. Hopefully we won't be in the middle of a crisis at the time – we want to show off our capabilities, but there's a time and a place! Hurricane season starts in June, so we should be okay at the beginning of May."

A major player in PPP road projects and managing customer services across a range of tolling/road pricing sectors and stakeholders

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egis projects has unrivalled experience in all types of projects having completed 20 since 1993 for a total value of €10 billion:

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Strategic developments for Road Driver Services focus on expanding core business activities into projects covering:

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In addition to responding to international tenders, **egis projects** is also developing in-house independent tag/OBU service provision including back- and front-office management: **Easytrip Services** is already operational in Ireland and The Philippines.

egis projects Road Driver Services key business references include:

- Information Exchange Agent (IEA) project in Ireland (covers ETC interoperability)
- ORT system for the Golden Ears Bridge in Vancouver, British Columbia
- Enforcement services in Ireland

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going to design it, build it, maintain it and operate it for 52 years and will collect tolls on just the managed lanes portion to recoup their investment. We also have a similar project at the other end of the Dallas-Fort Worth Metroplex, the I-820 and I-35W. It's another US$2.5-US$3 billion project that we couldn't possibly finance. Again, we used the same kind of PPP model, and as a result we're getting a major facility entirely reconstructed connecting Fort Worth to Dallas and to Dallas-Fort Worth International Airport. For those two projects alone, we invested a billion dollars but I'm getting US$6 billion worth of assets built as a result. Such programs have the potential to help us address the funding gap."

There was a mixed reaction to allowing the private sector to maintain, operate, and collect tolls on these facilities, and in August 2009 (when the legislative session ended), the legislature decided to take a step back to have a look at PPPs in a little more detail. TxDOT, at least for the moment, has lost the authority to pursue further public-private partnerships across the state. "But if we didn't have these PPP tools," he stresses, "neither of those major megaprojects in the Dallas-Fort Worth Metroplex would ever have been built.

"Sometimes I get asked, 'How many projects did you have to delay because you put in US$500 million on the LBJ?'" Saenz often responds with a question of his own: "These projects have been identified as top priority for these regions, regardless of how they're financed. So the question should really be, 'How many projects would have been delayed had we had to pay the entire US$2.5-US$3 billion?' In the state of Texas, it's proven time and time again that a good transportation system will lead to the economic well-being of the community. If you build the facility, people will develop around and use it. If you don't have a good

Big time in Texas

ITS is helping the City of Arlington to herd fans up and move 'em out as safely and efficiently as possible

Everyone knows things are done *big* in Texas. It's the second largest state in the USA, as measured by acreage and population, and the third largest measured by its budget. It's also home to eight major sports franchises, including football, baseball, basketball, and hockey.

In Arlington (between Fort Worth and Dallas), the entertainment district is *big* – so big in fact that among other attractions it includes the Rangers Ballpark (home to the Texas Rangers baseball team), the all-new Cowboys Stadium for the Dallas Cowboys football team, the Six Flags Over Texas amusement park, the Arlington Convention Center, Hurricane Harbor water theme park, and the Lincoln Square Shopping Center.

The City of Arlington has historically been aggressive in its approach to traffic management, but with the opening of the new Cowboys Stadium in 2009, its ITS were elevated to a whole new level. Arlington has a population of around 370,000 people, but the entertainment district regularly draws people from over 100 miles away. The intersection of north-south Texas SR 360 and east-west I-30 forms the northeast corner of the district, while there are several major surface street thoroughfares that provide direct access to the entertainment venues.

Concurrent with construction of the new Cowboys Stadium, TxDOT was making improvements to I-30 in the form of a new continuous one-way frontage road system, access improvements for the mainline interstate, and new HOV lanes. In addition, improvements to State Highway 360 at Division Street were started in May 2009.

These roadway improvements are vital to reducing congestion along the corridor, but it's the ITS on surface streets that play a huge role in the management of the entertainment district traffic. Fully aware that vehicles traveling to events at the Cowboys Stadium could snarl traffic, this improved traffic management infrastructure would allow the City of Arlington to get the most capacity out of its roadways.

Dallas Cowboys' new 100,000 capacity stadium

Arlington already had about 20 traffic control CCTV cameras at key intersections around the city, although none in the entertainment district. A city-wide fiber-optic communications network links the cameras to the traffic command center, which allowed staff to remotely control the signals. The system was monitored for routine events, but aggressively managed for traffic during the Texas Rangers' games. Certainly there was some experience in dealing with game crowds, primarily consisting of some lane reversals, closing lanes for pedestrians, and adjusting signal timing on the fly.

In July 2008, the City of Arlington issued PBS&J with a challenging 'must-do' list of ITS improvements for the district, which needed to be in place before the first major event at the Cowboys Stadium – a concert featuring country stars George Strait and Reba McEntire on June 6, 2009. In the six-month period between January and June 2009, PBS&J designed and oversaw installation of 64 CCTV cameras, 16 portable dynamic message signs (PDMS), changeable lane assignment signs, and other ITS technology. PBS&J staff also led the development of an entertainment district-wide wayfinding/guide signage program, establishing a consistent look and feel for directional signage to the different venues. The city also asked PBS&J to develop an interactive traveler information system – a mini-511 system that would give people directions to the stadium, information about how to buy tickets, and up-to-date traffic reports. The city originally envisioned a Highway Advisory Radio system as an AM radio-based broadcast. However, as radio is difficult to advertise – and usage difficult to assess – PBS&J suggested using a phone-based dial-in system with a hierarchy of recorded messages that can be adjusted to fit different events and circumstances.

Around 60,000 people attended the Strait/McIntyre concert – and traffic control went off without a hitch. But those people involved in the project knew there was still a great deal of work left to be ready for the first Cowboys kick-off in the new stadium. New traffic control technology was used to observe traffic flow at the concert and subsequent smaller events, and then signals, barricades, cones, and traffic control personnel were adjusted accordingly. At the same time, a reversible lane system (RLS) was designed for installation at three major surface streets.

The RLS – with the red Xs and green arrows over each lane – are programmed to allow the travel direction to be reversed to accommodate heavy incoming and outgoing traffic. The RLS was a long lead time effort from a design, manufacturing, and installation perspective. It is currently under construction and will be operational by the start of the Cowboys' 2010 season. The first game at the Cowboys Stadium on September 20, 2009 attracted 105,121 people, yet traffic was remarkably manageable, with people getting in and out just as had been planned.

Keith Melton is the assistant director of Public Works & Transportation/Operations for the City of Arlington, while Paul Iwuchukwu is the city traffic engineer. John Hibbard is PBS&J's national ITS division manager. He can be contacted by emailing jhibbard@pbsj.com or calling +1 678 247 2585

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transportation facility, you simply won't get businesses moving in. Right now, we have a lot of people and businesses moving in because we have a fairly good system, but that's going to put an extra strain on our future needs – and at this time I really don't know how we're going to deal with that."

A SHIFT IN THINKING?

Surely this shows the need for a paradigm shift from what is clearly shown by Texas's funding gap to be an outdated system? "A VMT tax is one of the options," Saenz says. "But we're not in favor of one method over another, whether it's increasing the gas tax or indexing the gas tax so you can at least apply inflationary factors. That's something the legislature will have to deal with." As far as a VMT tax goes, Saenz reveals that TxDOT is working on an ongoing research project with the Texas Transportation Institute (producer of the *Urban Mobility Report*) to look into the potential impediments or otherwise of a change of approach.

While funding will present many hurdles in the years to come, the here and now is all about Texans spending on average 32 hours a year stuck in traffic congestion, costing US$6.7 billion in terms of travel delays and wasted fuel consumption – not to mention the emissions. Reductions here could at least make some form of a contribution to the chasmic funding gap facing Saenz and his TxDOT colleagues. Using figures sourced from the Texas Transportation Institute, he suggests that in real terms that US$6.7 billion is equivalent to a congestion tax in itself, roughly US$570 extra per commuter every year. "And the cost per commuter in large metropolitan areas, such as Austin, Dallas, and Houston, can be as much as two or three times more," he adds.

"We invested a billion dollars but I'm getting US$6 billion worth of highway assets built as a result. PPPs are one of the ways that we've been trying to address this funding gap"

MAKING THE TECHNOLOGY LEAP

A look at how AET is benefiting North Texas drivers, communities and agencies

On the north side of the fast-growing metroplex that is Dallas, an innovative tolling agency is blazing a trail with the latest traffic technologies. The North Texas Tollway Authority (NTTA) is in the middle of a US$92.6 million project to convert its 65 miles of toll roads, bridges, and tunnels to a system of all-electronic toll (AET) collection – a solution that can cost a fraction of cash collection. The project is being paid for with capital funds derived from toll revenues.

This process began in 2007 and reached a crucial milestone in 2009 with the AET conversion of the President George Bush Turnpike (PGBT), which processes 400,000-450,000 toll transactions a day. The conversion of the entire system is targeted for completion by the end of this year. Once the conversion has been achieved, the vast majority of NTTA customers will be debited via in-car transponder or toll tag. Video cameras, meanwhile, will capture the license plate images of drivers who lack transponders and the agency will use that information to locate them and send them a bill. Those who pay through this method, however, will be charged 50% more than those with transponders.

Although this scenario is highly logical, it is no easy task to convert to a system that totally eliminates cash collection. Challenges must be overcome in areas such as technology upgrades, public education, employee impact, and communication with the financial community.

But the experience to date demonstrates that AET provides significant benefits to drivers, agencies, and surrounding communities. Many agencies are expected to go down this route in the next decade or so. At the very least, tolling agencies should study this model to learn about the potential benefits and determine if AET is the right road for them to take. Along with other considerations, AET must support an agency's charter and demonstrate financial viability before it gets the green light.

It all starts with the customer. Above all other considerations, >

People in the Metroplex are on the move at all hours of the day and night

INTELLIGENT APPROACH

This is where Saenz sees ITS coming into play, hence his enthusiasm about Houston hosting ITS America's 20th Annual Meeting, May 3-5, 2010. "We try to use ITS along our transportation system to provide reliable information to motorists," he explains. "An informed motorist is a better motorist; a much happier one in any case! If he is made aware that there's congestion on a particular portion of the Interstate then he's prepared for it and can take steps – it's when they're not prepared that they get upset.

"Under one roof at our Houston TranStar TMC, you have staff from the city, county, police, and sheriff's department, as well as emergency operations. You can see how we are deploying ITS across the state. Everybody is there to address the issues that happen on our highway corridors. We also have TMCs in Dallas-Fort Worth, Austin, and San Antonio, and the idea is to put together an ITS platform that can ensure they all communicate and share information. We will become more efficient if we have good communication lines.

Seamless communication is particularly important for Texas. "We're along the Gulf Coast here and we get hit by our fair share of hurricanes – sometimes more than we would like," he states. "We work closely with the Department of Public Safety – they're the lead agency – but we're here to help and assist however we can, to put in place reversible lanes for emergency evacuation operations, etc, to make sure that people can move away from storms safely and smoothly. Hurricanes Rita and Katrina being back to back in 2005 was a challenge for us. We wouldn't normally evacuate Houston, but due to the sheer size of these storms – and the fact that folks were evacuating into Houston from Louisiana and they just kept on coming – we put those contraflow lanes into action for the first time. They worked – maybe not as well as we had hoped – but we learned a lot in terms of where the bottlenecks would occur, and how to relieve those bottlenecks in the future."

> "Under one roof at our Houston TranStar TMC, you have staff from the city, county, police, and sheriff's department, as well as emergency operations"

According to Saenz, the key to an evacuation if it's going to be enacted is that it needs to be enacted early and needs to be somehow coordinated – instead of everyone attempting to hit the road simultaneously. "That's where our coordination with the county officials and other state officials has proved worthwhile," he says. "This last time, with Hurricane Ike, a mandatory evacuation wasn't in place, but we were able to accommodate the people who did

< AET provides a safer driving experience. As drivers aren't pulling over to pay cash to toll collectors, accidents that can happen amid the stopping and starting and merging and weaving that accompanies cash toll collection can be eliminated. At the same time, eliminating all that stopping and starting reduces vehicle emissions, which helps the environment and saves fuel. With about 45% of an agency's budget going toward labor costs related to cash handling under the traditional model, AET offers a great way to save money for many agencies.

However, AET does involve risks, and those risks must be considered. There is a risk of greater loss from non-paying customers. And even if they ultimately pay, it takes significantly longer to bill and collect money from video image customers than if they had paid with cash at a toll booth.

But when NTTA and HNTB conducted a risk-based net revenue simulation, the two organizations estimated that AET would save the agency around US$10 million a year in operational costs – and based on what has been seen so far, that figure is probably very conservative.

In addition, it is expected that the agency will achieve savings through reduced capital costs by eliminating the need for toll booths that require wider right-of-way and additional infrastructure.

Another factor in the decision to go to AET was the fact that about 80% of NTTA customers were already using transponders. And with other Dallas-area toll roads converting to AET, it was felt that a conversion would provide a more seamless driving experience for the whole region.

A successful conversion to AET requires comprehensive planning and a series of well-coordinated steps. The importance of performing a risk-based net revenue simulation has been covered already, which must be undertaken before a final decision is made. It should be noted that AET works better on roads that are more heavily traveled by frequent commuters, as opposed to tourists who live outside the region, because commuters are more likely to use transponders.

Tolls paid on an NTTA roads do much more than pay for the construction of that road

As with any advancement such as this, the most reliable technologies available must be utilized. Before it began converting, NTTA operated video cameras for violation enforcement that had been in service for 10 years, and with the proportion of video transactions increasing from 6% to 20%, the agency had to update that equipment.

Agencies converting to AET must make the system easy to use. NTTA does not charge for

AET making more inroads

Around the globe, more and more tolling agencies are making the transition to open road, all-electronic tolling (AET). In London, cashless tolling has cut traffic congestion by 21%, increased traffic speed by 25%, improved air quality, and boosted bus ridership.

In the USA, some facilities that have implemented or are considering AET include the Central Texas Regional Mobility Authority, Harris County Toll Road Authority, North Texas Tollway Authority, Colorado's E-470 Pubic Highway Authority, Florida's Turnpike Enterprise, Miami-Dade Expressway Authority, North Carolina Turnpike Authority, and the Port Authority of New York and New Jersey.

The Central Texas Regional Mobility Authority opened the 183A toll road as a hybrid of cash collection and electronic tolling in 2007. In 2008 – once transponder use topped 80% – video tolling was implemented and cash collection subsequently eliminated.

AET has enabled CTRMA to improve safety and reduce operating costs. The key thing is to understand there are customer service challenges associated with video tolling. To be successful, any agency contemplating video tolling must establish an appropriate balance between payment compliance and customer satisfaction.

By Steve Pustelnyk, director of communications, Central Texas Regional Mobility Authority

evacuate very well. ITS plays a key role in our emergency operations, helping us assess the situation to deliver evacuation information via news releases, dynamic message signs, and web postings for up-to-the-minute transportation news and local traffic information. We're also utilizing social media a lot more now, such as Twitter and Facebook, to get the message out."

Houston TranStar is the information portal during such a situation. "I would recommend attendees to this year's ITS America Annual Meeting pay it a visit," Saenz advises. And if you want to escape from ITS for a few hours? "Well, I'm a baseball fan, so I would check out the Houston Astros and Minute Maid Park – the Diamondbacks are in town during the conference. Also, Discovery Green park has also become a great gathering place and both are just outside of the doors of the convention center!" ■

Amadeo Saenz Jr will be speaking during the ITS America Awards ceremony and welcome reception at the 20th Annual Meeting, May 3-5, 2010 at the George R. Brown Convention Center in Houston

transponders, although customers are required to deposit a prepaid balance in their electronic debit accounts, with a suggested starting balance of US$40. The NTTA also offers a web-based management tool that allows customers to pay online.

North Texas drivers have accepted AET with little resistance. But no matter what the circumstances, a strong public education program is crucial to the success of an AET conversion. The NTTA held public meetings, distributed newsletters, continually updated its website, ran radio spots, and provided information for newspaper stories.

Another element of public education is informative signage on the roadway. NTTA signs at the point of payment inform drivers that video customers pay 50% more than transponder customers. Customer invoices also point this out, thereby encouraging greater adoption of transponders.

And although electronic tolling does away with face-to-face contact between drivers and toll collectors, it enables agencies to know who their customers are and how to contact them, whether the customer pays via transponder or video toll.

AET conversion raises the possibility of a communication challenge with debt rating agencies. As a relatively new concept, it will have to be proved successful in numerous locations before debt rating agencies will be convinced that it is financially viable on a consistent basis.

Furthermore, tolling agencies must give serious consideration to employees who stand to lose their jobs with the elimination of cash collection. Fortunately, however, NTTA has been able to reassign most of its cash collectors to duties involving roadway maintenance and customer service.

Through the experience with AET so far, the NTTA believes that the advantages of this model strongly outweigh any potential disadvantages. Greater safety, cleaner air, lower fuel consumption, and cost savings to tolling agencies represent a win-win-win for customers, agencies, and residents of surrounding communities.

Looking toward the future, the NTTA expects AET to enable the agency to pursue plans to launch High Occupancy Toll (HOT) lane and congestion pricing projects by 2014-2015 – initiatives that should help it realize even greater efficiencies on its roadways.

Rick Herrington is vice president and toll services director for the Western USA, HNTB, while Clayton Howe is assistant executive director of the North Texas Tollway Authority

CHECK POINTS

Many people take it for granted, but our highway infrastructure is the lifeline that keeps society ticking over. As such its security should be paramount. But, ask **Dan Faust** and **Bill Sewell**, are we protecting the unprotectable by attempting to secure where the rubber meets the road?

Illustration courtesy of Mark Stay

Highways in the USA are desperately vulnerable to catastrophic events. As demonstrated by recent history, those threats can come from terrorists, hostile weather, or even simple aging of the infrastructure. But security – or the lack thereof – is a common denominator. And in the words of pre-eminent computer security specialist Bruce Schneier, "Security is not a product, but a process." He recognized that in the perilous world of cyberspace, attacks probably will come from the most unlikely direction, and be targeted against previously unidentified vulnerabilities. So to defend an entire system, your design process must ensure that all security measures will work together. And what's true for cybersecurity is equally true for the security of our highway infrastructure.

Unfortunately, highways are not easy to secure. By definition, they are public structures that must be open to everyone. In addition, highways are built where they are needed, not where they are safe. A highway can't just be relocated because it runs through a dangerous or sensitive area. So our highways are terribly vulnerable. But as Ben Franklin said, "Ships are safest close to shore, but that's not what they're built for." We must build them where they need to be and protect them to the best of our abilities. And how exactly can we do that?

There are no cookie-cutter solutions, no panaceas when it comes to security and safety. What works best on one highway network may not work at all in another region. And although techniques, methods, and principles can be exported from one region to another, rarely are they a perfect fit. So, in developing security profiles and strategies for a given roadway, two fundamental tenets apply.

EXPERT OPINION

First, get help. Unless security is your métier, seek out experts who know how to bring safety and security to infrastructure assets – under many different circumstances. Objectivity and expertise are vital. As Bruce Schneier noted, effective security can only be developed and maintained through a persistent and concerted effort. Let experts help guide that effort with some universal tactics, common approaches that can benefit any agency or organization that is looking to create the safest and most secure roadways.

Second, task those experts with determining exactly what threats exist and what danger a particular road or road network faces. Although they are tough to defend, roadways are also generally hard to attack effectively. Terrorists are fiercely interested in three things: a large loss of life, major economic losses, and mass media attention (and the ensuing widespread terror). Subways, transit facilities, bridges, and tunnels generally offer terrorists higher profile opportunities to achieve those aims than most highways do. That does not mean highways could not be targeted. It just means that risk must be assessed appropriately and addressed accordingly.

For example, the likelihood of a terrorist attack on I-94 in Pipestem Lake, North Dakota, is somewhat different from the threat level for a stretch of I-10 in Los Angeles, or for Manhattan's Westside

Highway at rush-hour. Not all roads are equal when it comes to threat protection and security.

By the same token, I-94 in Pipestem Lake faces safety issues of its own, such as the heavy North Dakota snow. Although a blinding blizzard is a force of nature rather than a force of man, it can still cause substantial fatalities. Security and protection take many forms, but life-safety concerns must also be included in any security evaluation and protection profile. So the first step is to create a threat or risk profile, defining precisely the risks a particular stretch of roadway can face. Know what might be coming down the road.

The next step in virtually every security protection endeavor is assessment. Learn what you have so that you can determine what you need. Examine thoroughly and exactly what you're trying to protect. Drive the highway from the user's perspective, then take a step back and examine it from a distance. Look beyond just the roadway. Are elements encroaching on or near your route? Could any of them pose a potential threat? Is anything changing in the landscape that could positively or negatively affect roadway volume or safety?

A highly collaborative process, risk assessment must be both comprehensive and objective. Again, for that reason it is imperative to get outside help, expertise that can dispassionately evaluate a given infrastructure from both the engineering and security perspectives. And don't go it alone. Involve maintenance and operations people in any assessment. Query capable employees at different levels. Gain a complete, accurate picture of exactly what you're trying to protect. After the assessment team has examined the roadway – and indeed, all of a DOT's individual elements needing protection – they can develop a risk-factor number. Used to prioritize assets, the risk-factor number helps determine where a DOT should spend its security funds.

When entering the risk-factor numbers into a matrix, priorities become readily apparent. So the team must next determine what would happen if each of the key elements in the matrix were somehow disabled. After developing emergency plans for each potential contingency, individual elements are then viewed from a cost-benefit analysis perspective. How much would it cost to secure that element and what is the impact of a loss of that asset? That in turn leads to the development of high-impact, low-cost security improvements. But once a risk assessment is complete, threats are identified, and priorities are established, then what?

Three factors must be immediately addressed. The first element is detection. DOTs need eyes on the road, and that means cameras. Fortunately, many DOTs already have traffic and traffic light cameras in place. Use them. If they need to be upgraded, make that a part of the plan. If multiple video streams need to be better integrated into a system, then do so. But start by using what you already have so that funds can be stretched to cover other security purposes.

"The key is close coordination and communication with first responders who are capable of addressing any situation – be it a terrorist attack, a traffic accident, or even a flood"

STRAIGHT TO VIDEO

Video information usually feeds into an emergency operations center or a traffic management center. In either case, the key is close coordination and communication with first responders who are capable of addressing any situation – be it a terrorist attack, a traffic accident, or a flood. Ideally, all necessary emergency departments should be housed in one unified center. If that isn't possible, departments housed in different locations should be in close communication (both video and audio) with the primary center. And all communications links and protocols should be redundant, uninterruptible, and regularly tested.

If a DOT has no cameras – or too few to cover a given stretch – then cameras should be installed. It is vitally important, though, to position those cameras strategically. Why not cover every inch of road with cameras? Well, for most DOTs, that's not practical. Not only does it cost a lot of money to cover entire roadways, it also means that video operators must scan too much information, covering ground they probably don't need to cover. Allow us to illustrate the point.

At one airport, the powers that be wanted a camera on a corner section of fence because they wanted to 'see who comes over the wire'. But the corner they wanted in view was at the edge of an impassable swamp; it wasn't a viable way into the airport under any likely threat scenario. So a camera was superfluous. The advice was to place the camera in a different location that would pick up a wider range (including the corner). The optimized placement saved time and money, and still provided necessary coverage. And that speaks to another issue.

Each DOT, organization, or agency should put together a concept of operations. Part detailed emergency operations plan, part operations and maintenance review, a concept of operations forces a process of self-examination that can prove invaluable. It reveals strengths and weaknesses in both daily operations and emergency plans. And it will provide answers to a whole range of strategic questions. What do we need to sustain functions at the most basic level? How do we respond to an incident? What can we do if we lose a particular asset? Where should we put cameras? Are there route redundancies we can exploit if we lose an asset?

Be strategic. Think through your concept of operations and then buy only the technology you need and can afford to support your assets. Resources are finite. Don't waste them.

Matter of perspective

Picture the USA without its network of highways – it's virtually inconceivable. Although generally less inspiring and majestic than bridges and tunnels, highways are arguably the most important component of the nascent infrastructure that shaped the nation. But although romanticized in song and story – from *(Get Your Kicks On) Route 66* to *On the Road Again* – highways are largely taken for granted.

People don't much care about who actually designed them, or paid for their construction and maintenance; it's as if the roads just evolved naturally from cow paths and old Native American foot trails. About the only time Americans even think about highways is when the roadways they want to use are jammed with traffic, blocked by construction, or suddenly subjected to a new toll or user fee. In short, highways get little respect. Yet they are the backbone of US commerce. And as such, their security is paramount.

Existing traffic cameras could be used for the security monitoring of roads

Monitoring the roadway is critically important. Enhancing security by having eyes on the ground improves life-safety protection as well. But detection alone is not enough. The next layer of protection has to do with perimeter security.

Creating perimeter security for highways is an odd notion. In practically every instance, there is simply too much roadway to protect with a secure perimeter. At the same time, drivers must use the highways. Again, priorities should dictate strategy. What are the critical elements to your roadway? Are there any sensitive areas where an attack would prove devastating? Is there a maintenance area storing heavy equipment or chemicals that could be used in an attack? Is there flood-control apparatus that can be used for other means? Is there a relatively small overpass at a critical juncture? Identify, prioritize, and protect sensitive elements. Create a perimeter around these features to keep everyone and everything at a safe distance. Of course, these sensitive areas must also be monitored by video cameras. But they should also be physically off limits to non-DOT personnel.

HARDEN YOUR DEFENSES

Once you've created perimeter security around these areas, harden them. They must be able to withstand an attack should a terrorist get through primary defenses and be "prime on target." Again, tap available force and blast-protection expertise to design physical security elements that will minimize the damage a terrorist can do – even if he is able to penetrate initial defenses.

The costs of failure to prepare for a terrorist attack that affects your nation's critical transportation infrastructure – in terms of loss of life and economic disruption – could be catastrophic

Having taken care of the basic security building blocks, the next concepts are across-the-board absolutes in making any security effort effective. Though we can only cover them very briefly here, they are most worthy of further examination.

The first absolute is communication and collaboration between the personnel who gather and interpret data, and the emergency first responders. The value of timely, clear, comprehensive communication and collaboration cannot be overstated. Emergencies breed chaos and those agencies that have pre-existing, tested communication infrastructure and coordination protocols fare best under extreme pressure. Effective communication and collaboration do not simply happen. Suitable procedures must be carefully vetted before an event occurs. And effective preparations require something else: commitment from above.

For any security and protection plan to work, top management must demonstrate their commitment to effecting change. Without complete commitment and buy-in from an organization's leadership, many of these efforts don't work, work only temporarily, or work only in part. That will not do. Not only should top management support the effort, they should lead it. If you are in a leadership position, demonstrate to your rank and file that you take their value, the value of your assets, and the value of the public you serve most seriously. But getting buy-in doesn't stop there. Funding largely depends on political will. Cultivate politicians and public figures who can help your organization receive the funding it needs to strengthen its security.

Finally, the last mandatory piece of the puzzle is training. Train, train, and train again. Conduct tabletop exercises. Conduct field exercises. Make sure that everyone knows what to do should an attack or other crisis occur. Make sure that everyone knows what everyone else should be doing when an emergency erupts. Then train some more. Test plans, and revise them as necessary. Although nothing can match the intensity of an actual emergency, training provides the familiarity, skills, and capabilities necessary for handling the real thing. An ounce of prevention is worth a pound of cure, and training provides a ton of prevention.

Just picture the USA without some of its essential highways. After all, many terrorists have probably fantasized about creating just that problem. Since highways are an essential infrastructure component, their security is paramount. So we must build them where they must go, and protect them to the best of our abilities. But there is no panacea. As Bruce Schneier advised, "Security is not a product, but a process." ■

Daniel Faust is a vice president in the national toll practice at AECOM; he once served as chief engineer of the Delaware River Port Authority of Pennsylvania and New Jersey. Bill Sewell, RCDD, is a senior vice president and practice manager with AECOM

EXTREME MEASURES

Pekka Leviäkangas from Finland's VTT outlines the aims of EWENT, which hopes to ascertain the costs associated with the impact of severe weather on transportation

Illustration courtesy of Design All Done

Recent events hitting the news headlines clearly show how Europe's transport system suffers when severe weather comes to town. Resulting from climate change, such phenomena should be expected to increase in future years. Operators and infrastructure managers must prepare for such a risk, especially as it will be third parties most affected should the performance of the transport system collapse, with the resultant costs falling upon the shoulders of Europe's citizens and industries.

EWENT – the acronym for 'Extreme Weather Impacts on European Networks of Transport' – will use its Euro 2 million funding to assess how much of a cost extreme weather is to European transport. The cost assessment relies on historical records relating to bad weather impacts as well as statistical data. But the term 'extreme' is challenging as it may vary according to time, place and context – after all, extreme snowfall is something different in Norway than it is in Greece – while some phenomena are chronologically extreme if they occur more often than once a year or perhaps once in a decade. Also, the preparedness to meet and manage the different types of extreme weather varies in different parts of Europe and across modes. EWENT's one critical task is to define what 'extreme' means and how the extremes could alter as climate change continues. Even while the impacts of climate change and their magnitude are hotly debated, what is difficult for anyone to question is the increased risk from having more severe weather in the years and decades to come.

COST FACTORS

EWENT's climatologists from, for example, the Finnish Meteorological Institute and the World Meteorological Organisation, are tackling the climate change scenarios in order to present a viable picture about how risky extreme weather can get. The probabilities of phenomena that negatively affect transport system performance are assessed using multiple climate models and combining the results with past experience.

Cost assessments are subsequently made based on unified costs on time delays, accidents and material damages that occur today already, but which might increase as a result of the more frequent occurrence of extreme weather. Cost estimates are made across the 27 member states within the EU, covering all modes of transport.

Using a generic risk management approach (the IEC 60300-9 risk management standard), EWENT analyzes the phenomena (what is extreme), assesses their probabilities (what they are and how they are going to change) and finally estimates what the consequences will be in terms of transport system reliability, traffic safety and functionality of supply chains. In the short-term, strategies managing extreme weather must focus on maintenance operations and alert services, so that the transport system functions as seamlessly as possible, even in extreme conditions. Aspects focusing on infrastructure resilience are long-term issues that might even require stricter design and engineering standards.

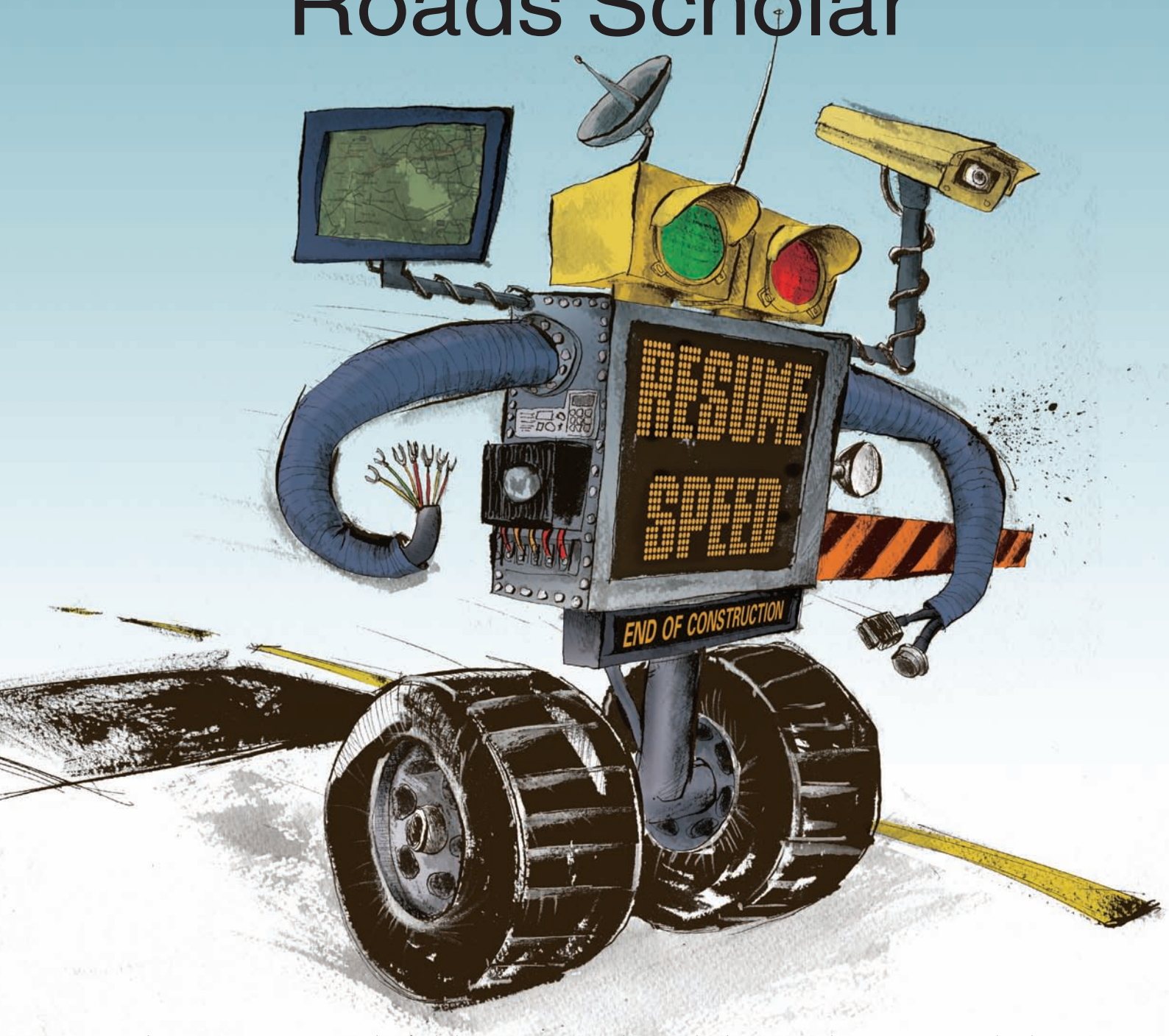
As the spectrum of mitigation strategies starts to be visible during the course of the work in EWENT, the effectiveness of strategies must be evaluated in terms of costs, benefits and feasibility. New authority functions and cooperation models could be required to tackle extreme weather impacts, which might be national or supranational in nature. New types of public and private services could prove to be useful, whether they be targeted directly to transport system users or have a supporting role in strengthening the capabilities and preparedness of authorities.

The corporate sector should have an interest in climate change impacts. Project financiers, for instance, must ensure that their investments have the resilience to cope with the impacts, while insurers need to know if weather-based compensations are on the rise and, if so, by how much. Great financial interests are involved as the risks of extreme weather events are assessed.

A number of similar studies are ongoing, but few address the costs as explicitly as EWENT. Joint meetings and workshops are expected to take place as these projects start to present their first results. ■

For more information visit http://ewent.vtt.fi/

Roads Scholar



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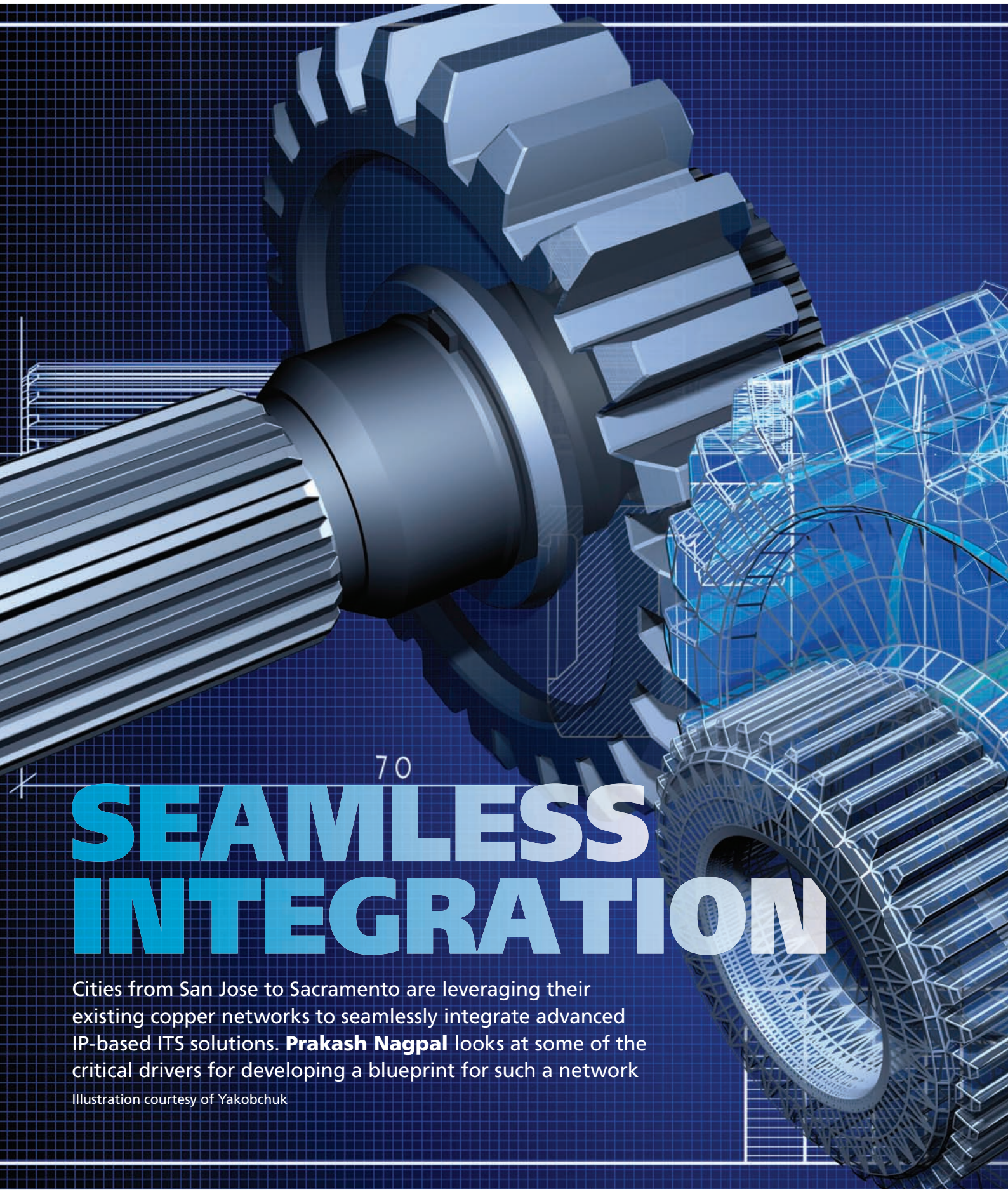
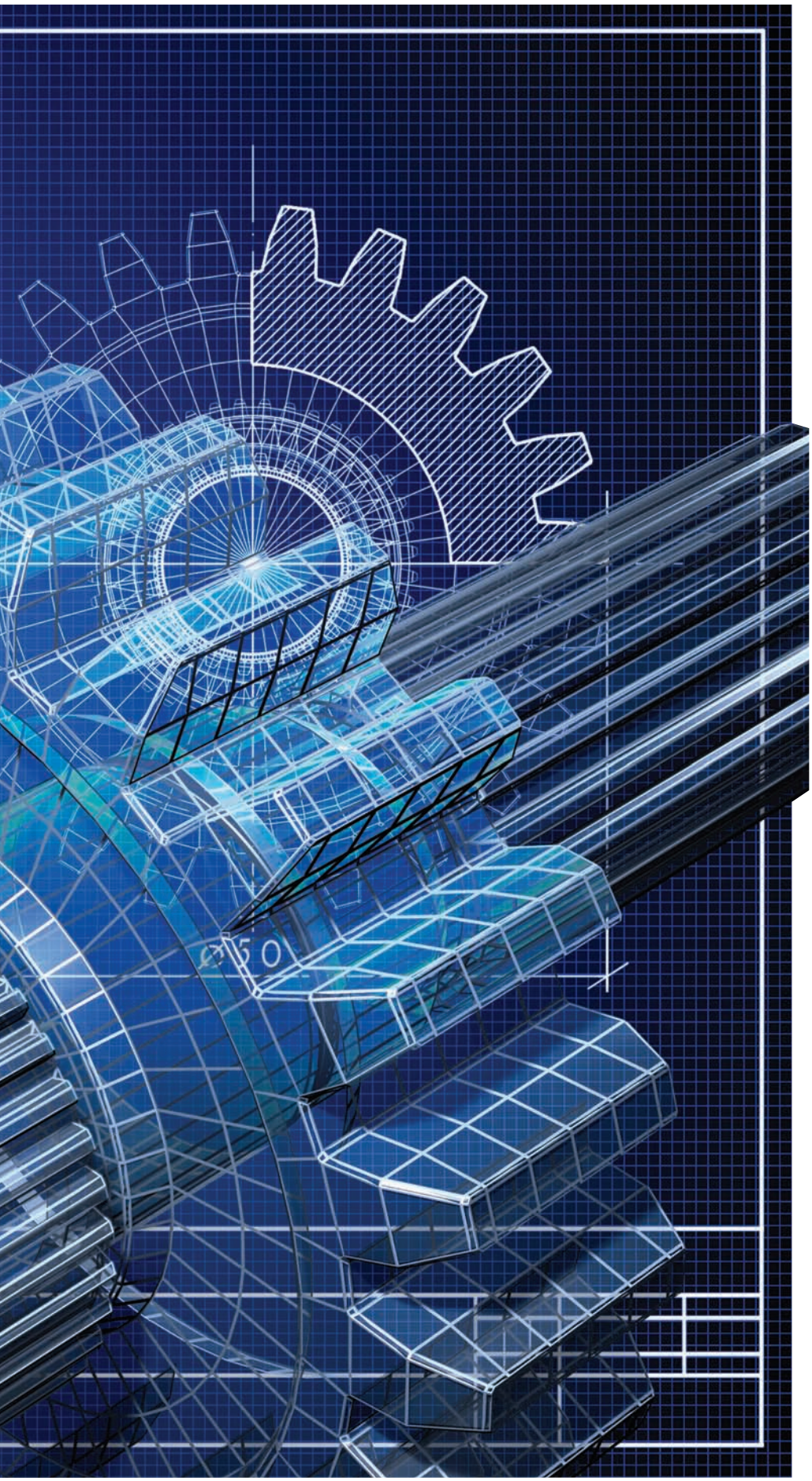


SEAMLESS INTEGRATION

Cities from San Jose to Sacramento are leveraging their existing copper networks to seamlessly integrate advanced IP-based ITS solutions. **Prakash Nagpal** looks at some of the critical drivers for developing a blueprint for such a network

Illustration courtesy of Yakobchuk



At the core of the definition of ITS is a complex network of integrated and actively managed roads, highways, vehicles, public transportation and freight systems. For John Q Public, the monitoring and management of this complex network manifests itself as traffic controllers, dynamic message signs, parking guidance systems, video surveillance cameras and sophisticated smartphones and GPS devices that provide him with the quickest route from point A to point B.

Advances in Ethernet over bonded copper technology are now allowing cities to take advantage of these applications by implementing sophisticated IP-based ITS networks over their legacy networks without the need for trenching expensive new fiber. But studies show that ITS deployments have been slow. For instance, only 1.5% of Michigan's roads use ITS networking, indicating that ITS has not yet reached widescale adoption. But there is a renewed focus and energy devoted to reversing the statistic. Emerging from that focus, strategy discussions, and white papers are a set of priorities that seem to be universal.

PRIORITIES

Increasing safety: Safety takes many forms and is impacted by traffic flow patterns, compliance with speed limits, road behavior, pedestrian and cyclist use of roads, and response to emergency situations. Applications include IP-based traffic lights, cameras that monitor intersections, speed sensors and emergency response systems.

Decreasing emissions and improving air quality: The impetus for reducing congestion and ensuring the smooth flow of traffic includes reducing emissions and improving air quality. Most major city intersections are controlled by traffic signals, so synchronization can alleviate traffic delays and reduce travel times. According to some sources, this improved monitoring and management can lower fuel consumption by 10% to 15% in the USA alone.

Increasing driver information and awareness: Although individual systems are useful, an integrated view across multiple systems is exponentially more valuable for commuters. If there is a collision on a highway, for instance, it is not enough that emergency assistance is dispatched to the incident – traffic approaching the scene must be closely monitored and redirected, if necessary, using DMS that will help reduce congestion and backups. This approach improves safety, traffic flow and decreases emissions from idling vehicles.

It is noteworthy that there is consensus on emerging strategies to achieve these objectives. Consider the integration of systems and applications. The term 'application' includes cameras at intersections, roadway sensors, signal light synchronization and software used to view and analyze traffic patterns. Providing a comprehensive view and then converting

raw data into information does not require that all applications become part of a monolithic system. On the contrary, using specialized technologies that communicate with each other to exchange relevant information provides the best of all worlds. It is therefore a requirement that the underlying 'network' connecting the specialized applications be reliable.

Another strategy would be to focus on real-time monitoring. The adoption of navigation devices, reliance on mobility and the ability of stakeholders to respond based on real-time information has placed greater emphasis on building systems that provide immediate and accurate information. Access to real-time information can only be achieved if the systems deployed track such data and continuously feed it back through a robust network.

Future-proofing your systems is important. Although it would be ideal to find and deploy an ITS solution that will never become obsolete, the pace of technological advance makes this goal impractical. Future-proofing involves anticipating trends, making informed assumptions on potential future applications and, importantly, building flexibility so that replacing one component does not require replacement of all components. It is essential that components selected comply with relevant standards and not rely entirely on proprietary protocols.

Achieving objectives cost-effectively is a must. There are two aspects to this strategy, the first being an emphasis on clear objectives and the second on being cost-effective. Goals should be established for any project before it is initiated. Countries and governments are funding initiatives to invest and improve infrastructure and that money is accompanied by unprecedented scrutiny and responsibility. Spend wisely and invest in proven technology where the benefits are clearly aligned with the goals.

It is paramount to initiate the planning and implementation process now. paramount. Stimulus funding has created a pool of money that enables funding projects immediately, as long as implementation can begin rapidly. Selecting the right set of technologies allows an almost immediate implementation and a quick return on investment. But the lack of access to stimulus money does not automatically translate to an inability to make progress. By choosing standards-compliant technology, projects can be phased and standards-compliant components can be integrated as funds become available without any danger of incompatibility of components.

SIMPLY THE BEST?

Underlying the above strategies – from creating a framework that integrates disparate systems to the need for rapid and reliable, real-time communication – is an assumption that a reliable transport network is essential to moving data rapidly, reliably and cost-effectively between applications. Without that network, specialized silos will be unable to provide the comprehensive view, essential to meet the goals described.

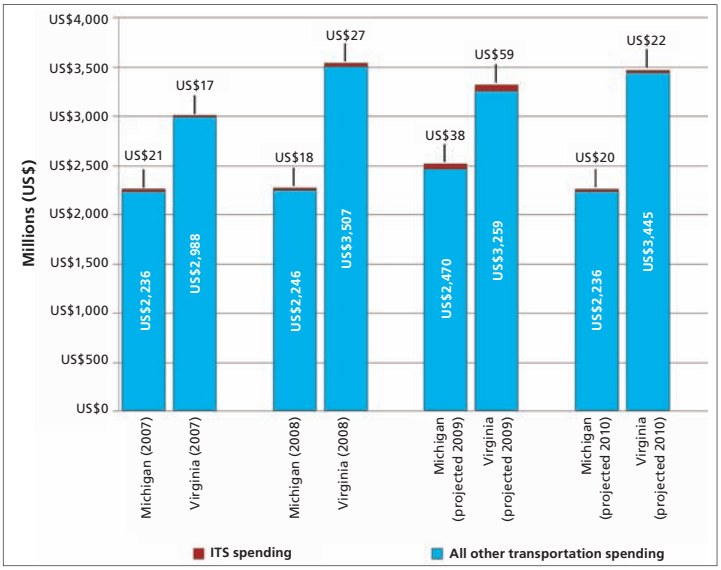
An analysis that describes emerging priorities and strategies without providing some of the guiding principles for building that network would be incomplete.

The place to start in designing the network is aligning objectives, applications required to meet the objectives, and the requirements the applications place on the network. A network designed to support only traffic signal synchronization will be different from one designed to support video surveillance. Some of the differences include network response times, amount of information (capacity) transported, need for real-time controls, security standards and reliability. Documenting such requirements is critical to designing the right network.

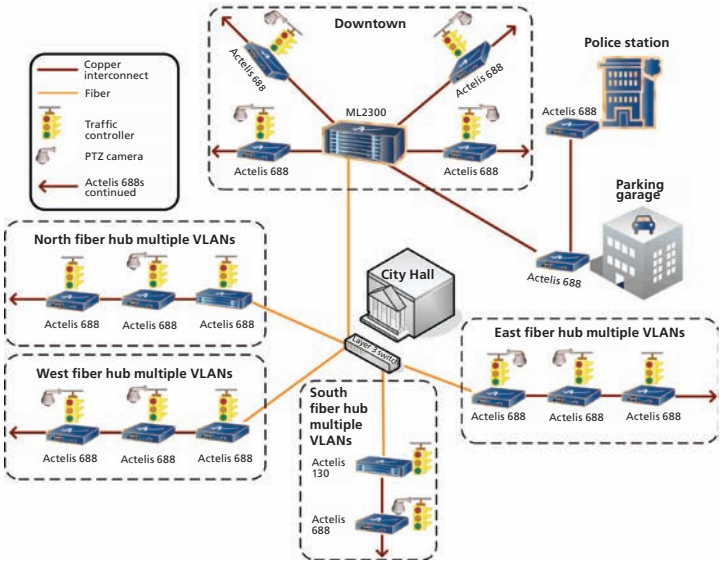
The right size capacity is important. Capacity needs are driven by applications currently used and needs driven by potential future applications. These approaches yield deployment of cost-effective and efficacious technology, instead of buzzword-compliant technology. Innovative technologies should be considered, such as Ethernet over copper, which utilizes existing infrastructure to provide adequate capacity for current and future ITS applications.

It is recommended that you should use what you have first. If technology allowed you to use your current car for another 20 years, would you still buy a new car? The answer is, it depends. The critical considerations are how you use your car, the 'capacity' of the car and maintenance cost. The current economy demands a rigorous and complete examination of such parameters. One such a choice is whether to lay fiber-optic cables or re-use existing copper. Many cities and municipalities either own or have inexpensive access to existing copper plant. The maintenance cost on existing copper is low and available Ethernet over copper technology can meet current and future needs. Under those circumstances, there isn't justification for expenses associated with laying fiber.

Although it is vital to make optimal use of existing equipment and 'right size' your network, it is as vital to build the network to accommodate growth. The time horizon to consider while building for



ITS is used only on 1.5% of the roads in Michigan and about 1.6% of Virginia's roads, making every dollar extremely valuable and the need to direct every dollar to the most deserving application critical



A typical example of an ITS network

growth varies by application and location. Growth assumptions made in San Francisco will obviously be different from growth assumptions made in Duluth, Minnesota.

Fundamental to having the right network is the ability to measure and monitor its performance, which ensures performance against objectives for the project. This requires effective translation of high-level policy objectives into meaningful and measurable goals for the network. For example, establishing an objective for round-trip delay without the context of the specific application would be meaningless.

Building the right foundation for an ITS network can accommodate changes in objectives and the applications selected to meet those objectives. With rapidly evolving technologies and needs, flexibility is essential. Of course, one of the best ways is to learn is from the experience of others. There are several examples of cities that have applied the above principles and implemented IP-based ITS solutions that leverage their cities' existing copper networks. They include large metropolitan cities in California, such as San Jose and Sacramento. These cities have done a remarkable job of leveraging what they have to quickly and economically accomplish their policy objectives. ■

> "The place to start in designing the network is aligning objectives, applications required to meet the objectives, and the requirements the applications place on the network"

Prakash Nagpal has spent 20 years in various roles in engineering and marketing, working at companies selling into carriers and enterprises and at carriers and enterprises launching and implementing broadband and cloud-based services. At Actelis Networks, he is responsible for assisting carriers and enterprises in defining and marketing Ethernet services

IN THE ZONE

Roadworks are the bane of many a motorist's life, so when the cones are out, it's up to authorities to ensure minimal disruption. But as **Louise Smyth** discovers, other factors – not least safety – come into play, creating a tense game of strategy, in which the wrong decisions could prove fatal

Illustration courtesy of Magictorch

Effectively managing traffic at and around workzones is in everybody's interest – from the crews and motorists in and passing through the zones to the road authorities and construction firms. Yet there is a relatively poor level of safety in such areas (835 fatalities in 2007 in the USA), while the congestion caused by road maintenance is something we all experience regularly. What's apparent is that there is a lack of communication between parties on both sides of the zone that hinders efforts to incorporate construction work into wider traffic management and safety strategies.

Part of the problem is simply the complex nature of road workzones; they are busy, noisy, constantly changing environments, with the ever-present threat of errant drivers careering through the barricades and with high levels of interaction between workers on foot and off-highway vehicles. That ongoing interaction between players in the workzone sets the stage in which one wrong move and it could be game over.

DANGEROUS LIAISONS

Brad Sant, VP of safety for the American Road & Transportation Builders Association (ARTBA), has spent the past 11 years dealing with worker and traffic safety on the roads and suggests the basic set-up of workzones poses the greatest danger to the men at work: "If we look at the data provided by the Bureau of Labor Statistics, around half of the workers killed on US construction jobs are run over or backed over. More than half of those incidents are caused by construction equipment," he says – less than half are struck and killed by errant motorists. "The big culprits here are the large dump trucks used to deliver construction materials. They are subcontractors coming in and out of the workzone and not spending enough

Guiding light

Some workzone experts are now thinking outside the existing toolbox. Roelof Speelman from HOKA Verkeerstechniek, part of the BAM Group, has devised a new method to help conduct roadworks more efficiently. During maintenance, exits and traffic lanes are closed, meaning that destinations on road signs must be covered up. This is currently done via tape or magnet strips, which wastes time allocated for the road closure.

Speelman had the idea of using a laser projector mounted onto a mobile traffic sign to beam a stripe through existing destinations – an instant solution that means no more time wasted sticking tape to signs, or disrupting traffic while workers alter destinations. The system can be regulated and controlled from another location (such as a control room) via specialized software. The laser strength is automatically adjusted when it gets dark. In addition to 'covering' the destination from a distance, it is also possible to project a letter, word or arrow. Projections are visible during the day and at night, as well as in different weather conditions.

"We are still in the development phase," Speelman says, but he – and may others – are optimistic about the time and cost savings such a product could provide.

time there to understand the normal traffic patterns relating to where the workers are. They're doing a lot more backing to unload, with site workers approaching them as they take tickets to determine how much weight or product they're transporting.

"We're grappling with the interaction of multiple contractors. One challenge is that the construction site is constantly moving, and the entrance and exit points for vehicles are forever changing as the project moves down the roadway. It's a communications issue at the heart of the problem. How do you effectively communicate between a core of independent truck drivers, a contractor and workers on foot to orchestrate the traffic patterns inside the workzone?"

SMART MOVES

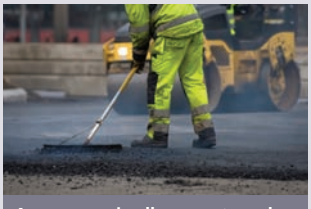
The ARTBA is trying to encourage those parties within the workzone to learn from solutions that are successful outside of it: "We have been researching and creating models for what we call Internal Traffic Control plans," Sant reveals. "The concept is to take the same ideas in ensuring traffic moves past a workzone safely and applying those principles within the workzone to make sure the construction vehicles know where to expect workers to be and vice versa, to ensure they all understand blind spots, know to stay out of them, and so on."

Sant regards technology as an important part of the solution on both sides of the barricades and he praises the 'Worker Present' alarms and various camera and radar sensors that are being deployed on construction vehicles to alert drivers to the fact workers are in their blind spot, as well as systems being used to alert workers themselves that they're getting too close to a vehicle. But he feels there is more to be done on the motorist side. "I think there tends to be a bit of apathy from motorists about a workzone being a dangerous place," he says. "They'll drive past one day and see no work ongoing so the next day might think it's fine to travel through at highway speeds."

"ITS and real-time information are the key here. Instead of just an orange sign saying 'Construction Work Ahead', we will see more deployments of changeable

ORCHESTRAL MANEUVERS

Dave Fosbroke is a statistician from the National Institute for Occupational Safety & Health (NIOSH). Part of his job is to assess the numbers of deaths and injuries in workzones. He agrees that the main challenge is the very nature of road workzones: "It's more difficult to implement certain types of injury prevention strategies compared with the manufacturing sector, for instance, or any stationary work platform where we can predict behavior and outcomes, so one of the biggest issues is the complexity of the work itself. "We need to consider a highway workzone as a system. In the USA, we have transportation safety people who look at improving the safety of the motorist going through the worksite, then we have occupational health and safety people who look at trying to improve working conditions for workers in the zone. And the number one limiting factor for both is that space is finite: if you want to optimize safety on the road user side, you would crowd the construction worker side and vice versa. I really don't think that workzones have been traditionally looked at as a system to be optimized. That's one of the remaining challenges – how we get people on both sides of the barrels talking and working together to solve their mutual problem of workzone safety."



Awareness is all: men at work must know when they are in danger from their own vehicles

Fosbroke's particular focus has been focused on preventing workers from being run over by construction vehicles. "We've been looking at a combination of radar and camera systems on dump trucks," he explains. "The basic concept is that the radar provides an alert to the driver and the camera system provides them with a way of checking to see if it's something that they need to worry about.

The cones, flashing lights and signs at workzones represent a lot of new information for drivers to absorb

message signs that display 'Construction Work Under Way – Workers Present'. Messages that alert drivers to 'Construction Vehicles Entering and Exiting Lane' are another real-time information tool to help them to make better decisions. The other thing we need to explain is that out of the total fatalities that occur in workzones, around 80% of them are motorists. We've done a good job of saying 'slow down for workers' but we still have a way to go in saying 'slow down for your own safety'."

But is slowing down the key to improving safety around workzones? Brian Zimmerman, workzone administrator at Michigan DOT, is not so sure: "The perception is that 'slow is safe' when in reality the only truly safe workzone is one where there is no traffic at all. The biggest challenge I see is to convince the construction industry that posting the workzone at a higher speed is safe. In Michigan, motorist and worker interaction is actually quite low, averaging one worker death a year by a motorist, and usually this is a worker who has stepped into a live lane of traffic. On the other hand, though, we average 18 motorist deaths a year in workzones, primarily due to the speed differential, which is why we have been focusing efforts on speed limits."

"I think there tends to be a bit of apathy from motorists about a workzone being a dangerous place"

Brad Sant, *vice president, American Road & Transportation Builders Association, USA*

In 2005, MDOT attempted to get back in line with what is required in the USA's national *Manual on Uniform Traffic Control Devices*, which recommends that speeds in workzones are only reduced by 10mph if they must be reduced at all. "We were asked to post all of our workzone speed limits at 45mph," Zimmerman recalls. "Between 2004 and 2005 crashes went up 8%. If we were designing appropriate geometrics for the roadway with proper lane width shoulders, distances from objects, reasonable separation for workers, then we wouldn't choose to reduce the speed limits at all."

This is not to say that Zimmerman is dismissing the 'speed kills' argument, rather that common sense ought to prevail. "In 2006 we modified our speed limit policy, keeping in mind the sensitivity to the safety of the worker. As well as the 10mph maximum reduction in workzones, we also reduce an additional amount in the vicinity of the workers. So on a freeway where our speed limits are normally 70mph, we're posting our workzones at 60mph. But by the workers, we place signs that say 'Workers Present: 45'. In a long workzone with workers concentrated in small areas, we don't feel it's necessary to ask motorists to drive at a greater reduced speed throughout."

Given that modern construction trucks are able to travel at regular highway speeds, where exactly are the 'speed differential' events occurring then? "The intersection occurs when the contractor has to egress or ingress through traffic. That's when we get speed differential slowdowns that can cause turbulence and create the opportunity for rear-end crashes," Zimmerman explains.

SMART SYSTEMS APPROACH

Encouraging smarter (not necessarily slower) working methods is the goal of Noah Jenkin from ASTI Transportation Systems, a software company known for its portable workzone ITS. "Technology is the answer to creating a safer, more efficient workzone. Our goal is to provide real-time, accurate information that makes drivers pay attention and look at what they're driving into."

Another area that holds promise is using tag-based systems, where you place a tag on the worker or something else that you don't want to have struck, and you get communication feedback – you can have a warning to the driver as well as to the worker on foot."

Similar to the ARTBA, Fosbroke says that NIOSH is also researching traffic control plans, taking solutions from the traffic management sector and applying them to workzones. "We're trying to take the concept of controlling traffic that you would have for the motorist going past the worksite and applying it on our own side of the barrels so that we can choreograph the movement of ground workers and the equipment moving around on the construction site."

Workzones are locations where the movements of all players must be safely choreographed

Fosbroke's recent work has been on blind zones – a long-running problem for drivers of construction vehicles. "We needed a measure of worker exposure, so we decided to put GPS receivers on workers and on equipment so we could map every second where the worker was and where the equipment was. To get a case definition of when someone was at risk, we assumed we could go to any operator's manual and find a diagram of the vehicle's blind spot: this was not the case. So we arranged for some blind area diagrams to be generated for us to model the locations where workers are at risk."

Fosbroke's research led to a far greater understanding of part of the problem associated with the perception of danger. Fosbroke feels that while equipment operators are fairly knowledgeable about what they can and can't see and behave accordingly, the guys on the ground who are so comfortable working around this equipment didn't have the same level of understanding about when they were in danger. These blind area diagrams are now used to ensure that workers on foot and in vehicles are adequately trained.

Construction equipment itself can be used to display safety warnings

ASTI's products enable DOTs to keep a steady eye on what's happening around workzones. Most devices are polled every minute to feed back data relating to speed, volume, occupancy and classification – exactly the same parameters you'd see in fixed ITS. "You're protecting the worker and motorist and creating a more efficient workzone. It's about bridging the gap between the road and motorists by enabling efficient communications," Jenkin adds.

A recent project ASTI has been involved with is on SR 295 in New Jersey. "They have 18 portable message boards, 12 of which the contractor purchased from ASTI," Jenkin explains. "There are 35 portable mobile sensor trailers using Wavetronix technology, and we also have six solar-powered mobile video cameras out there. We also provided four ConSAM (Construction Speed Awareness Monitor) trailers, which show what the speed limit is and what speed the motorist is actually driving at."

BETTER BEHAVIOR

Any technology that can help to influence driver behavior is key to improving safety and traffic flow at workzones, believes Doug Steele from Applied Research Associates (ARA). The company's area of research typically involves a great deal of fieldwork collecting data from workzones, particularly those with mobile lanes closures. Steele has a harrowing story about the importance of influencing motorist behavior: "Around four and a half years ago a co-worker of ours was killed when a truck driver fell asleep and crashed into his workzone," he recalls. "This led a colleague (William Vavrik) and myself to pursue a state government-sponsored research project to evaluate mobile lane closures and see if we could recommend improvements. Our recommendations are now being summarized in a final report for the client."

A key challenge at workzones is getting drivers to pay attention

As well as the obvious need to keep educating drivers not to drive when tired, drunk or otherwise impaired, Steele regards another key challenge as the tendency that drivers have of being on 'auto pilot' for much of the time. "The nature of any workzone is that it is a disruption to routine. What one day was an open road is now a construction zone with cones, drums, signs, lights, workers, and equipment. That's a lot of new information for motorists to digest and everyone reacts differently. A good requirement for driving licensure would be to stand along a highway construction zone for an hour. I've noticed that people with connections in the highway industry tend to be far more vigilant around workzones than they may have otherwise been."

Of course, any efforts to encourage safer driving are always hampered by a number of motorists who for whatever reason simply don't comply with guidance. "I believe there is a large proportion of drivers who *are* willing to comply with traffic instructions if they are provided sufficient information in advance, clearly and in the right amount," Steele says. "For these drivers, technological solutions are available to communicate what lies ahead and what actions they should take. CMS, both portable and permanent, are a good example of these. They offer visibility and flexibility advantages, as well as the ability to integrate with real-time ITS, that standard traffic signs don't. This is especially important for mobile operations."

Mobile lane closures – where the time it would take to conduct the activity is less than it would take to set up a static closure, or where the work is continuously moving at slows speeds – are a particularly dangerous element of construction. They are also an area where ITS technologies are not widely deployed as yet. Traffic control is normally performed via a series of large trucks with arrowboards and signs following closely behind the work crew. Although this sounds like a low-tech approach, Steele's research suggests that it still has a place: "Motorists are influenced by the way these convoys are deployed, sometimes much more so than you would expect. The number, spacing, and configuration of trucks, their outfitting with arrow and message boards, and the visibility of the work crew all effect when drivers slow down, how much, when they vacate the closed lane, and how long they stay in it before re-entering beyond the workzone. There is a subtle but clear cause-and-effect relationship (not unlike a chess match) that can be used to optimize safety for workers and motorists, as well as keep traffic flowing through these zones."

Putting a price on delays

In the UK, government data suggests that roadworks represent a huge financial cost to the economy – in the region of £4.2 billion (US$6.3 billion) a year. The Highways Agency (HA), responsible for trunk roads and motorways on England's network, estimates that 10% of all congestion is caused by roadworks. Such figures show that it's not just a matter of improving safety at workzones; there are serious cost and time savings to be made too – and if an extra benefit is fewer accidents, that's the icing on the cake.

Although not often heralded as particularly progressive in many areas of ITS, workzone management is something that England is tackling hard and fast. As well as focusing on better incident detection and management – and getting more accurate information out to motorists across the whole road network – there is another traffic management solution being widely deployed specifically at roadworks – average speed cameras.

Systems such as SCS's SPECS3 are designed to be traffic flow tools as much as they are enforcement tools. The HA is finding that using average speed cameras at roadworks improves compliance with speed limits, reduces delays and the uniform speed they encourage helps traffic flow by enabling more vehicles to get through the system.

Drivers are also reaping the benefits in a tangible way, as the smoother flows and improved behavior resulting from average speed schemes is enabling the HA to post higher speed limits through major roadwork schemes – 50mph rather than the previous 40mph.

"The nature of the highway workzone is that it is a disruption to a routine. There is a lot of new information for motorists to digest and everyone reacts differently"

Doug Steele, *senior engineer, Applied Research Associates, USA*

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A SILVER BULLET?

The three Es of traffic safety have paid dividends in terms of saving lives and reducing injury on our roads. Over the next 10 pages, **Nick Bradley**, **Louise Smyth** and **Saul Wordsworth** delve into the world of one of them – enforcement

Main image courtesy of SciencePhoto.com

Traffic law enforcement is widely regarded as the most important tool to reduce KSIs. This is hardly surprising, as there is a direct link between countries with good levels of enforcement and those with a good road safety record.

When done properly, enforcement of road safety rules leads to a quick and huge reduction in road deaths. Statistics prove that many drivers involved in traffic crashes do not comply with speed limits, blood-alcohol levels, and rules relating to seatbelts. In fact, in the past few years, the EC had a cost-benefit analysis carried out relating to the three enforcement areas of speeding, drunk driving, and seatbelt use, which concluded that increased enforcement would result in a total annual reduction of 14,000 road deaths and 680,000 injuries, equating to a net benefit of Euro 37 billion or 0.44% of GNP. Specifically, in the case of speeding, 5,800 deaths could be prevented, 3,900 in the case of drunk driving, while more than 4,300 of those killed could survive if seatbelt use was better enforced.

Enforcement, while controversial, is becoming more accepted by the public, particularly as schemes these days are more visible. Enforcement is a means to prevent collisions from happening by way of persuading drivers to comply with the safety rules, based on giving drivers the feeling that they run too high a risk of being caught. Efficient strategies are therefore not in the first place about increasing the actual amount of enforcement, but increasing the risk of being caught as perceived by the drivers. The products, people, and policies over the next 10 pages provide just a snapshot of where the industry is heading in the future…

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Slow down, you're moving too fast!

TISPOL's vice president, DCC Adam Briggs, on the balance between automated and human enforcement

DCC Adam Briggs is one of the UK's most senior police officers. Aside from being Deputy Chief Constable for the North Yorkshire Police, he has a national role as Deputy of the Roads Policing Business Area and is an executive member and vice president of TISPOL. His chairmanship of various other traffic committees and partnerships would make even the busiest among us shudder with indolence.

"As part of any strategy you need to have a balance between automatic enforcement and human input," he says. "Technology is important but you must start off by asking what the strategy is trying to achieve. The answer is to reduce lives lost or people hurt on the roads of Europe. That's a starting point for us."

By way of corroboration, Briggs draws on a relatively recent example. Back in 2004, France was experiencing a high number of roadway fatalities. The president decided enough was enough, so a large national enforcement technology structure was introduced and casualties were reduced by 40%. "The culture that enforcement is trying to achieve is not one that catches people out," Briggs adds, "It's one that achieves compliance and leads to improved safety."

In the UK, inappropriate speed contributes to 24% of overall road fatalities – 700 deaths. Briggs hopes the level of debate will be raised to the point where speeding is seen in the same light as drunk driving – i.e. highly antisocial. In both his national and European capacities, he is an advocate of average speed cameras, as they increase compliance and decrease the number of enforcement penalties, "which after all is what we are trying to achieve". Although he asserts that there is no relationship between cameras and revenue streams in the UK – "I am confident about this as I have worked with the government on this matter" – he is aware that this may not be applicable to all countries within the European community.

> "We know using enforcement technology will save lives; it is a case of getting as many as possible to buy into that message"

"I am most interested in targeting the high-end offenders, the most dangerous drivers," Briggs says. "The people who trip over the speed limit – yes, we encourage drivers to be careful – but these are probably better suited to driver improvement than punishment. We are dealing with the consequences of excess all the time, and I think as an enforcement agency we have a responsibility to make sure we do everything we can to save lives. We don't want to be a nanny state but we do want people to take their driving responsibilities very seriously."

All generations of enforcers have been concerned about young drivers, with 17-24 year olds particularly attracted to taking risks. Briggs has examined much research about how the brain develops, particularly in young men. "The brain is not fully formed even by the early 20s in terms of susceptibility to risk," he explains. "There are casualties and offenders throughout the age groups, but this is a disproportionate area in terms of risk-taking and speeding."

Speeding remains a great public concern. Briggs oversees 46 community consultative groups in North Yorkshire and the principal issue for each is excessive speed, particularly the more dangerous variety. "The message is

Policing a glass half full…

Finland has Europe's most strict policy when it comes to drunk driving, Chief Superintendent Pasi Kemppainen reveals some of the positives of the campaign

When under the influence of alcohol, drivers are prone to any number of errors and misjudgments, from not wearing a seatbelt and jumping lights to speeding, and even passing out at the wheel. Common to all drunk drivers is the gap between the perception of their performance and its reality. Recent figures suggest that around 10,000 drivers die annually on Europe's roads as a result of DUI (driving under the influence) – and that at any one time, 1.5% of its drivers are under the influence of alcohol. One country focused most intently on addressing DUI is Finland. With a mere 0.15% of road users being DUI drivers – and with only 80 people killed on its roads every year due to alcohol – Finland paves the way in drunk driving policing.

"From my first days on the force, the problem of DUI become far too familiar to me," explains Chief Superintendent Pasi Kemppainen, one of Finland's most senior police officers. "It seemed that in almost every shift we faced a drunk driver and even today with DUI numbers decreasing we still catch a drunk driver every 20 minutes. "

Unlike most other countries, Kemppainen and his colleagues have the right to carry out random alcohol and drug testing at the roadside. "Our main strategy is to conduct a lot of breath tests in a visible way," he says. "We also breathalyze every stopped driver regardless of the reason for detaining them."

Aside from his daily police duties, Kemppainen is second vice president of TISPOL. As such, he often gets asked by his European counterparts how his country maintains its high level of breath testing – currently around two million tests per year out of 3.4 million license holders.

"The first reason is our enforcement strategy with intelligence-led policing methods," he explains. "Another is our highly motivated police officers and the third is our alcohol screening devices. The devices we use give results in a couple of seconds and the drivers' feedback we receive is very positive. According to surveys, they urge us to carry out even more DUI enforcement."

At present there are around 100 evidential breath analyzers in police stations throughout Finland. Plans are afoot to bring them to the roadside by deploying them in squad cars. "This will result in less need to transport DUI offenders to stations to take a breath test or to hospitals for blood testing," Kemppainen says. "I believe that in the future more countries will gain the right to enforce random testing without any preliminary suspicion of driving failures. I am certain that in the future, blood alcohol content (BAC) levels will decrease in Europe to as little as 0.5 per mille. In Finland, the current level is 0.5 and the Chief Police Commissioner recently stated that he wishes this figure to be as low as 0.2 per mille. A zero-level BAC, however, would be too challenging as some human bodies produce alcohol by themselves."

As an alternative to license withdrawal, the use of alcohol interlocks is increasing in

it is not worth being excessive as the threat of prosecution is high. If you are not excessive but there are issues with your driving, you should be dealt with another way, hence why education is vital to help people understand the consequences of their driving behavior."

Financial restrictions across Europe are currently hampering the deployment of large-scale enforcement technology, mainly due to the high cost of the initial investment. This is why political support – as exemplified in France – can make all the difference. Political will still relies for the most part on public support, which can only be generated through education and understanding. "What we're trying to do at TISPOL is show good practice and encourage learning," Briggs adds.

"We continue to try and increase this culture of habitual compliance," he concludes. "Where we have compliance, we don't need to enforce. By using technology, we know we will save lives – it's a case of getting as many people as possible to buy in to that message."

DCC Briggs is concerned about the impact that driver distraction, from cell phones for instance, is having on road safety

Europe's Traffic Police Network

Established by traffic police forces across Europe, TISPOL aims to improve road safety and law enforcement, thereby reducing the number of people killed and seriously injured on the road. Through pan-European operations, its 27 member states encourage enforcement and education based on research, intelligence, and information. DCC Briggs is an executive member and vice president with TISPOL.

"The executive meets every month to six weeks," Briggs says. "We also have a council and conference, and work with the EU and other stakeholders. It's a strong organization and I think the best thing about it is that national politics are left outside the door. You have police officers from 27 countries who are committed to sharing technologies and strategies as part of their *raison d'être* – reducing casualties. A current example of that is our Life Saver project, which aims at an integrated approach that benefits all TISPOL members and focuses on six countries in particular. This means the exchange of good practice and of police officers, and encourages learning."

Current trends that TISPOL members are especially concerned about include young people and motorcycles, and the aging population – "something we are all trying to understand better," according to Briggs – and in-vehicle distraction. "Part of this is cell phone use, but with the amount of technology in vehicles today, our cars are becoming more like the Starship Enterprise," he says. "We are concerned about distraction because one momentary loss of concentration may carry a high risk."

Random breath testing at the roadside in Finland

Finland and throughout Europe. Once fitted to an ignition, they enforce strict limits decreed by legislation, preventing the car from starting if the driver is over the limit.

"If the local court approves an alcohol interlock period, the driver must meet a doctor, their vehicle must be MOT-tested after installation, and they must pay all costs occurred by these actions (circa Euro 130 a month). We then monitor the driver's behavior over a one- to three-year period and if there are infringements – for instance blowing more than 0.2 per mille before or during the drive, or driving without the alcohol interlock – their license may be taken away and a driving ban enforced."

Finland's Ministry of Transport recently passed a bill to introduce the compulsory use of interlocks on vehicles used for school transportation. The law, set to come into effect in August 2011, will require interlocks for between 7,000 and 10,000 vehicles. A plan to introduce alcohol interlocks in all public vehicles is also being finalized.

"I believe alcohol interlocks are an excellent solution to prevent drunk driving," Kemppainen says. "The use of these devices will increase. There are some models that even detect alcohol from the driver's skin when steering the vehicle or using the gearstick. I hope in the future some devices could detect drug-intoxicated drivers, too."

Kemppainen remains deeply concerned about Europe's rising drug use, particularly when combined with alcohol. According to the European Monitoring Centre for Drugs and Drug Addiction, around 20 million Europeans use cannabis and 3.5 million use cocaine every year. "I think that what we see now is just the tip of the iceberg," he says.

Kemppainen also accepts that to an extent there will always be problems with alcohol, whether it is the social pressure placed on young male drivers to conform, or the greater social malaise of alcoholism.

"In too many cases a young man isn't strong enough to resist," he says. "When other occupants in the car are drunk and they urge the driver to drink and take unnecessary risks, far too many are unable to resist." As for alcoholism, around 50% of Finnish drunk drivers have a drinking problem and 8-9% of all drunk drivers will commit the same offense during the next 12 months. "These problems are more questions for society than matters of policing," Kemppainen admits.

Although it may be impossible to stamp out DUI entirely, Finland has gone further than any other country to reduce it to a bare minimum.

"Our main strategy is to conduct a lot of breath tests in a visible way. We also breathalyze every stopped driver regardless of the reason for detaining them"

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Technology cannot work in isolation…

David Kelly, founder of the newly established Partnership for Advancing Road Safety (PARS), speaks with *Traffic Technology International* about the coalition and its objectives

There are few people better qualified to discuss traffic enforcement than David Kelly – a man who has spent the past two decades educating the US public on the benefits of safe driving. Starting off with an impressive record in seatbelt compliance at the National Safety Council, he later joined the Bush Administration and was acting administrator and chief of staff for NHTSA. Under his leadership, the agency implemented traffic safety strategies that led to the country's lowest fatality rate in history. He has also been director of the National Safety Council's Air Bag & Seat Belt Safety Campaign and, in his spare time, head of Mothers Against Drunk Driving (MADD) at local, state, and national levels.

"My focus has been to get people to wear belts, to improve drunk driving laws, help accident victims and ensure children are properly secured in their seats," Kelly says. "My priority is to legislate and educate."

However, since the end of the Bush Administration, Kelly has established a coalition of road safety advocates known as PARS (Partnership for Advancing Road Safety). Its intention is to make roads safer by raising awareness of traffic safety initiatives. Partners include American Traffic Solutions, LaserCraft, Redflex Traffic Systems, Traffipax, and Redspeed Illinois. Between them, they account for nearly 90% of the 4,000 intersection safety and speed cameras installed in North America.

"As a group we intend to focus on things that haven't been focused on before," he explains. "A lot of attention has been paid to seatbelts and drunk driving but not so much on speed, intersections and pedestrian safety. Speeding causes as many fatalities as drunk or distracted drivers. Of the 37,000 fatalities on our roadways in 2008, 31% were speeding-related – and in the same year, nearly 800 people were killed and 137,000 injured when running red lights."

Kelly hopes that PARS's championing of intersection camera technology will help prevent the most serious kind of crash – the side-impact or T-bone. As for speed enforcement, he is keen to promote the use of both fixed-pole cameras and those that are deployed in unison with a mobile van, the theory being that once drivers change their speeding behavior in one spot, it can be addressed in another. "What we are trying to do here is simply solve a problem," he says. "The best way not to get a ticket is not to speed or run a red light."

One thing that Kelly has certainly learned over the course of the past 20 years is that you cannot just pass a law and expect people to obey. "It doesn't happen that way," he insists. "You will get a little bit of compliance with any law but you really need to have the law enforcement officer out there and visible." Kelly believes it is vital to devise an enforcement program that encompasses and educates the general public. This means being open about any technology being deployed. "Visibility is key," he feels. "Without visible law enforcement every part of your strategy is susceptible to criticism. People need to know when the enforcement will happen, where the cameras are, and the process by which tickets are issued. When using enforcement technology, stating 'This is how the process works and it's a fair, open process' will help get buy in. If you try to deploy technology in isolation you are asking for trouble: people may paint over cameras or dismantle them. Moreover, authorities shouldn't be concerned that visibility makes enforcement less effective."

It is not as if Kelly and his colleagues are trying to achieve something that is without support. Around 80% agree with the use of intersection safety cameras and 67% support speed cameras. Yet a great barrier to progress is the vociferousness of the anti-camera minority lobby, confusing people into believing that most people are against this kind of technology.

"When people don't agree with an enforcement action, they certainly engage more actively in opposition than those who support it," Kelly states. "The ones who don't support camera technology are vocal and everyone assumes they are the majority. You can have the best policies in the world,

Visibility of enforcement is vital to ensure buy-in and support from the general public

but if they don't have the perception of public support they will just sit in a box. With PARS, we want to communicate to everyone and have a national discussion, making it clear that there is support for traffic safety issues generally – and speed enforcement – and try to create a dialog. There is a lot of new technology being used to combat drunk drivers and there is plenty of support for this as everyone wants them off the road. It's a case of getting to the point where people are comfortable with where the technology is and what it does. That's education."

PARS is currently working with some of its partners to develop just such a campaign. "The best way to get a safety program to work here is to get the Federal government involved," Kelly says. "They provide most of the funding through grants to states, and a successful program must include traditional, highly visible enforcement."

Congress is debating an Authorization Bill that will set the transportation priorities for the next five years. This will earmark funding for things such as roads, but there is plenty of scope for safety expenditure. "I have been focusing on the safety aspect of the bill and speaking with the people at PARS about their goals," Kelly reveals. "We are never going to be able to get away from the traditional enforcement aspects that we have in traffic safety, but we can do a better job of supplementing the technology."

Seatbelt campaigns have ensured better compliance

"We are never going to be able to get away from the traditional enforcement aspects that we have in traffic safety, but we can certainly do a better job of supplementing the technology"

Who watches the watchmen?

David Laizans from SGS Australia explains why independent testing and verification of enforcement technologies can bring about a greater acceptance of safety camera schemes from the general public – leading to safer roads for all

In an issue that is showcasing several vendors of law enforcement products, we thought it prudent to also look at what happens when these products are in operation and what's being done to ensure they are not misused.

Speed enforcement in particular has long been a controversial issue. You can pick almost any country that has widespread enforcement programs and discover news stories relating to operators tweaking equipment to obtain more violations (of which they then take a cut of the revenues), of authorities plotting to increase violation rates for financial gain, of fixed cameras being set up in hidden or otherwise inappropriate locations... the list goes on.

In 2003, Victoria, Australia proved to be an unfortunate example of how speed enforcement can go badly wrong. Faulty readings were brought to police attention and all fixed speed camera infringement notices across the state were suspended, as well as 90,000 motorists being reimbursed for inaccurate fines they had already paid. One camera vendor, Poltech, went into administration and the whole sorry story raised the issue of who's responsible for the maintenance and testing of these systems. The Victorian government did what it had to do to restore public confidence: it brought in independent experts.

"SGS took the lead in that project and it involved a nine-month investigation into all of the systems," explains David Laizans, business manager for testing services company SGS Australia. "We produced a report for cabinet in Victoria and on the basis of our findings, they refunded a lot of fines, and then decided they wanted to instigate a comprehensive testing program to ensure that sort of thing couldn't happen again. So we worked with them to design that program and we've been providing those services in Victoria ever since."

How the work that SGS conducts differs from other testing (Type Approval processes, for instance) is that it's not about checking products (or claims made about them) before they hit the market, it's about ongoing routine testing once a product has been purchased and installed.

Laizans reports that public confidence in Victoria has improved greatly and admits that SGS may well have played a pivotal role: "A lot of companies involved in this industry generally might be receiving a certain percentage of the fine revenue or number of infringements," he says. "But we just charge a fixed price to do a test and it doesn't matter financially to us whether it's compliant or non-compliant – we just report it as we record it with no financial interest."

"We produced a report for cabinet in Victoria and on the basis of our findings, they refunded a lot of fines and then decided they wanted to instigate a very comprehensive testing program"

Using the services provided by SGS also ensures that operators are not using equipment that they don't even know is faulty: "It's not just a black and white issue of 'compliant' or 'non-compliant'. There is a lot of 'soft criteria', so a system may well still be operating within specification but getting close to the point of being outside. We're able to give them a heads-up on this before it gets to the stage where systems are operating inaccurately. It also offers the government and operators the ability to say, 'This has been done independently and transparently; you cannot accuse us of operating systems out of specification'."

Laizans refers to the scandal associated with red light cameras in Italy over the past couple of years, which saw a product vendor, police, government authorities, and private companies being investigated on accusations of reducing the amber phase to increase violations. "SGS also conducts evaluations of red light systems, confirming things such as amber times. In that instance, I think independent testing certainly would have assisted for two reasons. First, people are less likely to try things like that when a system is constantly checked, and secondly, if they were still stupid enough to do it, they'd get caught a lot quicker."

One European country that Laizans regards as offering a better example of how to run enforcement programs is France. "They have changed their legislation to require periodic verifications of the speed cameras and installation verifications for the fixed sites – which all have to be carried out by an independent company designated by the French government," he explains. "Previously it was conducted by equipment suppliers and overseen by a government department. SGS was approved to provide those services from January 1, 2010."

As well as work on fixed, mobile, camera, radar, and LIDAR solutions, SGS has been especially busy of late working on average

To ensure accuracy and confidence in enforcement programs, equipment must be regularly tested

speed systems, and Laizans regards these schemes as a very effective solution for certain situations: "As well as on motorways, roadworks is another deployment where I've spent my fair share of time working on-site on speed camera locations. It really is quite scary – some people completely disregard roadworks speed limits and you see people exceeding 80km/h (50mph) per hour in a 40km/h (25mph) zone. So enforcement in roadworks is without doubt a good idea."

In an average speed system, what exactly is SGS testing? "We are confirming the accuracy and consistency of the system, so for average speed cameras that's the timing, the synchronization of the timing between the various points and the trigger points at each location. We look at the whole process end to end, so if it includes ALPR, then we will assess that, too."

The company is also active in tolling enforcement, with a number of free-flow roads in Victoria coming under its umbrella. And Laizans feels there is even more to come from the traffic market: "SGS is a very diverse testing company – you name it, we test it somewhere in the world. It would certainly be logical for us to extend to other areas in ITS. A good opportunity for us needs to be in an enforcement area – it's an area that must have comprehensive testing and where I think independence is a real bonus. So perhaps congestion charging schemes, for example, could be an area where we see some opportunities in the future."

The power of the pixels

Toni Marzo from Italy's Intertraff reveals why his D-Cop higher-resolution safety cameras deliver much more than just a better quality picture

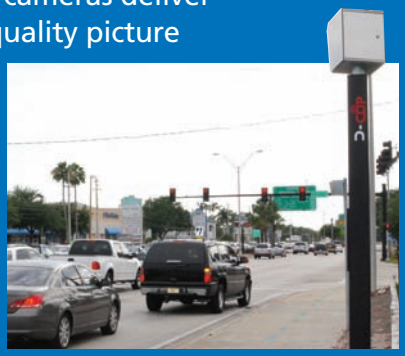
As back-up to traditional law enforcement, red light and speed enforcement cameras have proved their worth time and time again. Although opposition is sometimes vociferous, it emanates from a minority. With increasing support for programs, the technologies to make our roads safer are continually being enhanced, leading to better compliance.

One such product, D-Cop, is a fixed and mobile digital speed and red light enforcement system. Comprising a head unit installed on a pole around 4m high (13ft), no base cabinet is needed as all cabling is connected to a terminal within the vertical pole itself. Additionally, D-Cop supports violation enforcement functions with standard vehicle presence detection (via in-ground loops or piezoelectric actuators). Laser detectors can also be integrated to monitor four lanes of traffic simultaneously.

D-Cop's manufacturer, the Italian company Intertraff, has modified the

system to further enhance the quality of images captured. The models offered on the market currently are equipped with a 12.5 or 24 megapixel camera, both of which deliver a resolution of the highest quality and return sharp and clean violation images, even in extreme conditions. In fact, one of Intertraff's 24 megapixel D-Cop systems was recently deployed in Fort Myers, Florida, USA, and is capable of capturing images over five lanes of traffic – the first time that such a large camera sensor has successfully been employed in the red light enforcement market (although 16 megapixel cameras have been deployed by some vendors).

In terms of technology, Intertraff elected to move forward in the opposite direction to some of its competitors, which have been providing multicamera images solutions, housed within a single camera unit. "Our experience suggests that an 11 megapixel or lower camera sensor is not suitable to cover four lanes of traffic, especially in the USA," explains Toni Marzo, managing director and founder of Intertraff. "We equipped the first system installed in the USA



containing an 11 megapixel camera, and the results enabled us to see that this sensor could not monitor vehicles traveling on the fourth lane under all weather and light conditions." This was due mainly to the fact that US license plates are a third of the dimension smaller than Italian or UK license plates.

With a 24 megapixel camera, Marzo insists the resolution is at least 72 times better than any analog CCTV camera. "It boils down to a simple fact: higher megapixel means higher resolution," he says. "Higher resolution also means more detail, increasing the possibilities for identification of either the driver or the license plate."

To record a violation – especially when a red light violation is detected – two images are captured. The first picture is captured when the vehicle is prior to the stopline and the second 10m after. "One of the advantages of using a 24 megapixel camera is that the camera is capable of reading the license plate in both the first and the second picture," continues Marzo. "Employing a unique camera gives the possibility to read all the license plates contained in the picture, regardless of what lane vehicles have been traveling in, while the systems that rely on multiple cameras record only the license plate image of the vehicle that committed the violation. This may be a problem for those early systems especially when two vehicles commit a violation at the same time or either vehicle detected is traveling between lanes."

Marzo feels that some vendors started to misrepresent enforcement cameras based on megapixel technology, in order to discourage the migration away from what he feels are "obsolete" systems. "One of their main arguments was that a megapixel camera required infinite disk space to record the violations," he says. "The size of a single speed violation captured with a 24 megapixel camera is just 1.5MB. A 500GB hard disk – which nowadays costs about €40 (US$58) – can thus record more than 350,000 violations before the download of the infringements becomes necessary."

Safer, smoother, greener, fairer

Average speed systems are the future of enforcement – on motorways, workzones, and in our urban areas. The point-to-point pioneer, SCS, speaks with *Traffic Technology International* about the benefits of the system and the road ahead

It has been a busy time for SCS (Speed Check Services). The success of SPECS cameras with more than 250 installations is well documented. Added to this, SPECS3, the new generation of networked cameras, has now received Home Office Type Approval, while SCS itself has received an injection of investment that could mean SPECS3 is coming to a highway near you soon…

With backing from the mid-market private equity firm LDC, SCS recently became part of the newly formed Vysionics Group. "Under this new ownership, we expect to rapidly grow our position in the traffic market, with a key part of this strategy being to extend our existing portfolio toward a wider range of related, more flexible products and services," explains the company's Geoff Collins. "We are actively planning new product developments and are considering a number of potential acquisitions." To accelerate this process, the SCS management team has been widened to include additional business development and service-based skills. Developments are expected to be announced soon.

SPECS has now been operational for 10 years, covering virtually every county across the UK. Indeed, right now there are 48 temporary (roadworks) installations and 42 permanent schemes operating, with a further 12 permanent schemes being installed – almost 900km of carriageway controlled by SPECS average speed cameras.

Based on casualty reduction alone, a well-designed average speed system would typically pay for itself in only six months, with a 60% average KSI reduction seen across all sites. But as Collins is keen to highlight, casualty reduction isn't the only benefit, with improvements in traffic flow/congestion, a reduction in CO_2 emissions, and much greater acceptance from the traveling public – probably due to the high compliance/low offense levels seen.

"In the past two years, the number of permanent SPECS installations has increased considerably," he says. A recent example is the A14 in Cambridgeshire, a road that carries high daily traffic volumes, is congested at peak hours, had significant casualty histories and suffered from serious delays when collisions occurred. "SPECS cameras were proposed to not only improve safety/reduce casualties but act as a traffic-calming solution. The results now show that the road is considerably safer and peak time journey reliability has improved." The annual KSI casualty reduction is running at 68.6%, which equates to an annual saving to the economy of £4.3 million (US$6.5 million), so the system can be considered to pay for itself every few months. "On top of this, the number of tickets issued is fewer than 100 a month, which clearly demonstrates that the system isn't a revenue raiser," Collins adds.

Now that the benefits of average speed control have been proved, it is fortunate timing that the latest generation of networked average speed cameras are available and Home Office-type approved. SPECS3 was almost five years in the approval process, but it is now operating at a number of locations in the UK, with more than 14 permanent systems expected to be in place by the end of the year. "The fundamental concept behind SPECS and SPECS3 is the same, with the exception that SPECS3 is now a network of remote camera units," Collins explains. "Rather than running one-dimensional links between paired cameras, SPECS3 allows any camera to link to any other appropriate camera. So a much larger area or section of road can be covered without the need for costly hardwired communications links." The system can be controlled from a remote central location, removing the need for regular site access.

Safer roads, higher compliance and low violation levels

The use of new technologies offers a number of enhancements to the previous SPECS generation. For example, vehicles will be monitored from any lane in to any lane out (this issue was addressed for SPECS1 in 2008) and rear-facing cameras can be configured, meaning PTW riders can be detected. A new feature is the ability to operate fully in complete darkness, using infrared floodlighting to capture an overview image along with the ALPR capture. This proves very useful in non-lit areas, where the use of a white floodlight at night could dazzle drivers or distract them from the road.

"The number of tickets issued is fewer than 100 a month, which clearly demonstrates that the system isn't a revenue raiser"

To the driver, the technology appears to be identical and this is just as well, as the vast majority of its impact is its appearance. "By simply passing an average speed camera and an average speed check sign, drivers modify their behavior; they drive at a uniform speed, don't jockey for position and this maximizes roadway capacity," Collins explains further. "A reduction in speed differential means they are less likely to collide (and cause casualties) and the road will flow better. As a final benefit, driving at a uniform lower speed delivers considerably better fuel economy, which saves the driver money but also cuts down on CO_2."

It is highly likely that a number of 20mph systems will be operational within 12 months, controlling vehicle speeds within residential environments. Rural routes – which suffer from disproportionately high KSI figures – can now be addressed, by locating cameras along a route, ensuring compliance over tens of kilometers. "One particularly exciting area is the further development of average speed control for Managed Motorways, integrating variable speed limit capability," Collins says. "This could allow considerable cost savings by a much wider spacing of gantries and infrastructure, while maintaining the flow benefits of a variable speed limit."

Used appropriately, average speed solutions offer a rapid, cost-effective solution, as Collins concludes. "They are safer, as KSIs typically drop by 60% or more. They are smoother, which improves journey time reliability and reduces congestion. They are greener as less fuel is burned. And at the same time, they are fairer – typically only one in 10,000 journeys results in a fine."

Cambridgeshire, A14 casualties 22km

Annual Average	Killed	Serious Injury	KSI Total	% Change
Before*	1.3	13	14.3	-68.6%
After**	0	4.5	4.5	

*Annual average three years prior to installation

**Annual average two years post installation

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WHEN YOU NEED TO BE SURE

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Everything you wanted to know about ALPR… and more

Just as ALPR forms the foundation of many ITS applications, its use in law enforcement is also on the rise. Mike O'Brien from CitySync USA details some of the considerations

License plate recognition (LPR) is one of the most sought-after technologies on the market for law enforcement. Many organizations are using or investigating the use of license plate readers and should thus be aware of those selling inadequate or sparsely supported LPR readers.

LPR systems offer a multitude of surveillance abilities and when considering a system, you should always consider how the product will be used and what you expect to get out of it. Most vendors offer a mobile application as well as fixed or static systems. More advanced companies offer a wide range of products, such as journey time monitoring, access control, handheld solutions, and vehicle recognition software.

What you first need to consider is, do I need this as a mobile or fixed solution? A mobile system will consist of cameras mounted either in or out of the vehicle, which allows the officer to perform his daily routine while capturing and querying each and every plate viewed by the cameras. You can consider this as another set of eyes in the vehicle for the officer, which in turn creates enhanced officer safety as well as a force multiplier for the department. A mobile system is deployed to hit on stolen vehicles, stolen license plates, wanted-on-warrant individuals at both a local and federal level, BOLO (Be On (the) Look Out), and AMBER alerts. However, your LPR system should be capable of handling numerous databases, each capable of handling a million or more records. It is greatly encouraged for law enforcement officials to create their own additional databases to further hit on scofflaw debt, gang crime activity, drug traffickers, local warrant issues, predators, homicides, robberies, or quite simply for any vehicles of interest.

Typically, there are two types of cameras offered in mobile applications – color or infrared (IR). Color cameras can be

JellyBean is CitySync's ALPR camera for both mobile and fixed police use

unobtrusively installed in a police vehicle, allowing the officer to check plates covertly while the IR cameras must be installed on the exterior of the vehicle. You will therefore need to understand the limitations of the cameras offered and figure out where an acceptable installation location might be on your vehicle. Most vendors only offer a proprietary IR solution that will require exterior-mounted cameras and a PC to be installed in the vehicle trunk. IR cameras and computers tend to be expensive and can be eliminated with certain vendors.

In this regard, there is something to consider – there are some companies able to mix and match the color/IR cameras and install non-resource-intensive LPR software onto your existing mobile data terminal (MDT) to create something affordable.

When looking for a mobile system you should ask yourself a few questions. Is a true covert solution important? How many hotlist files can be imported into my system and triggered at once? Can the system populate a multiple hit return on the same plate? Is the GUI interface self-explanatory and easy to use with large, clearly identifiable buttons? How will the hotlist data be imported, and are there options for this? What report features are important to me?

A simple touchscreen interface gives full control of all vehicle cameras to a police driver with easy-to-interpret clear displays showing tracked vehicles and instant alarms with user-defined priority levels

A fixed LPR solution is mounted to a street pole, gantry, or any permanent or semi-permanent location, providing data for interdiction and investigative use. These cameras are typically analog IR, allowing plates to be captured in a narrow field of view, say 10ft wide or a single lane of traffic. More advanced vendors are always looking ahead with their technology and have found ways to make their products perform better while keeping the consumer in mind. They have created an affordable solution with high-definition (HD) cameras. An HD LPR camera can be installed in a manner to capture two lanes of high-speed traffic and some offer it with a single software license. This creates further coverage with fewer cameras, less software, and importantly, less infrastructure/installation costs.

A fixed LPR system is similar to a mobile one with regard to the data it hits against, but generally transmits data to a centralized location via WiFi, 3G, etc. Many reporting tools should be available to the officer to study the data. When considering a fixed system, you must be aware of the local ordinances and use a qualified professional for the engineering and installation.

With whatever system you select, you must be aware of the variances in LPR vendor characteristics. You must verify the vendor's claims with a live demonstration and contact other departments using the product. Ask them about the recognition achieved in their area and how the customer support has been, if needed at all. You will find that some products work as advertised while others are under constant repair.

There are also some terms to consider when speaking with vendors. Accuracy, unfortunately, is not measured the same by each supplier and can be skewed. Some claim upwards of 95% accuracy but leave out how they came to that result; they can be saying they read 95% of the plates that came into the field of view, but not say how many of those were wrong. Another way that claims can be skewed is if there are seven characters on a typical plate and one of them was read wrong and six characters read correctly, equating to something like 86%. This should be regarded as 0% accurate and a complete failure! True accuracy must be determined by reading every character correctly from every vehicle that crosses the camera's path.

Read rate is determined by the number of plates that the system sees and then how many it really reads at various speeds. When asking this, you should make sure the read rate is given with each vendor reporting at the same speed. To give you an idea of a true accuracy, if you were to read 95% of every vehicle in its path with a 95% overall accuracy – every character read correctly – your overall accuracy/read rate would be

something like 91.8%, which is the standard used in the UK.

Both fixed and mobile applications can be connected to a back office and should be considered. The back office stores the data from all the mobile/fixed camera deployments and defines how you will deal with the license plate data. There are some things you should bear in mind in regard to back offices. What kinds of reports are available to me? Can I create customizable reports? How big a server will I need? Can hotlist databases be pushed to the cars from here? Can it send electronic notifications via email, SMS, etc? How long can I save my data? Does it employ administrator rights for security purposes?

License plate recognition is growing and eventually every vehicle or department in the USA will have some sort of LPR deployed. As a result, some of the bigger vendors have been working closely with the National Institute of Justice (NIJ) and the International Association of Chiefs of

> "You must be aware of the variances in license plate recognition vendor characteristics"

Police (IACP) to develop a standard that could facilitate LPR data sharing among departments nationally. The NIJ's Information Led Policing section funded an effort to work with a vendor consortium in developing a data schema capable of compliance with Global Justice XML Data Model (GJXDM) standards.[1] This endeavor included working with different vendors with the expectation that all would be encouraged to write to the standard.

Vendor participation and cooperation were a key component to making this a success. The initial results of this data-sharing effort were demonstrated at the 2009 IACP LEIM conference and progress has definitely been made. Although not yet ready for distribution to the field, the software developed appears to have great potential, and plans are to take it next to a proof of concept stage.

Ultimately, the right vendor of choice is one that has been in business for 10 or more years as a LPR manufacturer of both software and hardware, and not someone new to the game – a company that is sure to survive the current economic state and always looking to improve its technology.

[1] *www.lawofficer.com*

Upholding the law with radar and LIDAR

Jim Shaw from Stalker Radar – one of the pioneers in speed detection for police officers – reveals some of the technological highlights in its range

Employed by more than half of the law enforcement agencies in the USA – and deployed in 158 countries worldwide – Stalker Radars and LIDARs offer law enforcement professionals accuracy, durability, and dependability in traffic speed measurement.

"The first Stalker Radar, the Stalker ATR (Advanced Technology Radar), was introduced by Applied Concepts in 1990," says Stalker's Jim Shaw. "The entire police radar sector has been transformed from a complacent 'me-too' industry to a very dynamic state-of-the-art industry as a result of our DSP (Digital Signal Processing) and microwave technology, introduced throughout the Stalker line."

The company's DSR (Direction Sensing Radar) 2X is another notable advance. "This features DSP, digital antenna design, direction-sensing technology, VSS mode operation, as well as many other proprietary Stalker innovations," Shaw explains. It also reportedly takes officer safety to a new level with a built-in Rear Traffic Alert. "This activates when a patrol car pulls into traffic and one or more fast-approaching vehicles in the same lane are detected," Shaw adds. "If the vehicle is closing at over a preset speed, an alert tone sounds a visual alert is shown on the display screen, notifying the officer of a dangerous situation."

The Stalker II handheld radar is designed for dash-mounted performance in a versatile, compact package – and is especially suited to officers on PTWs. "Powered by a long-life battery handle, it is not dependent on vehicle power to operate and is easily transferrable into a patrol car and dash-mounted. It can also automatically distinguish between faster or slower same-lane targets in moving mode without a 'slower' key and can simultaneously track targets closing and going away." Directional arrow icons on the display tell the operator whether the target is in front or behind the patrol vehicle as well as its direction of travel relative to the patrol vehicle. Plus, a full-function remote control provides direct access to the operator settings in its operator menu.

"In dense, urban traffic settings, the Stalker LIDAR excels," Shaw continues. "Being laser-based, it uses light rather than radio signals to measure vehicle speed, while its Doppler-type tone gives the officer a familiar indication of vehicle speed for easy transition by radar operators." It also features a head-up display (HUD) and provides the operator with target vehicle speed and range while allowing visual tracking and eliminating the need to refer to the LCD display.

"Our PC LidarCam is a logical extension of LIDAR," Shaw continues. "This automatically captures high-resolution digital pictures of speeding vehicles – it's ideal for selective enforcement assignments. It also ensures dependable photographic capture of the violator's speed, date, and license plate number. This solution – combining a modern high-speed camera with LIDAR speed-measurement equipment – provides an accurate and responsive portable system. The clarity of the license plate number leaves no room for doubt," Shaw confirms. The main components include a CE-certified Stalker Lidar, a 3fps Nikon DSLR camera with 300mm auto-focus lens, and an Intel Core2 Duo tablet computer with an indoor/outdoor touch-sensitive screen. The components are mounted onto a rigid chassis, which sits on a heavy-duty tripod. It is controlled by a custom-written, proprietary software application running on Windows XP or Vista.

Once set up, the LIDAR and camera are aligned and focused on a distant target point. When the LIDAR measures a target in its field moving faster than the violation speed, the PC triggers the camera to take from one to six sequential photos. The tablet computer screen then displays each, as taken, with overlaid text showing the officer's name, location, speed, distance, date, and time in bright contrasting yellow letters. JPEGs are then saved on the hard drive for later processing. Optional features include Infrared Night Photo function, external-battery power supply, and GPS interface.

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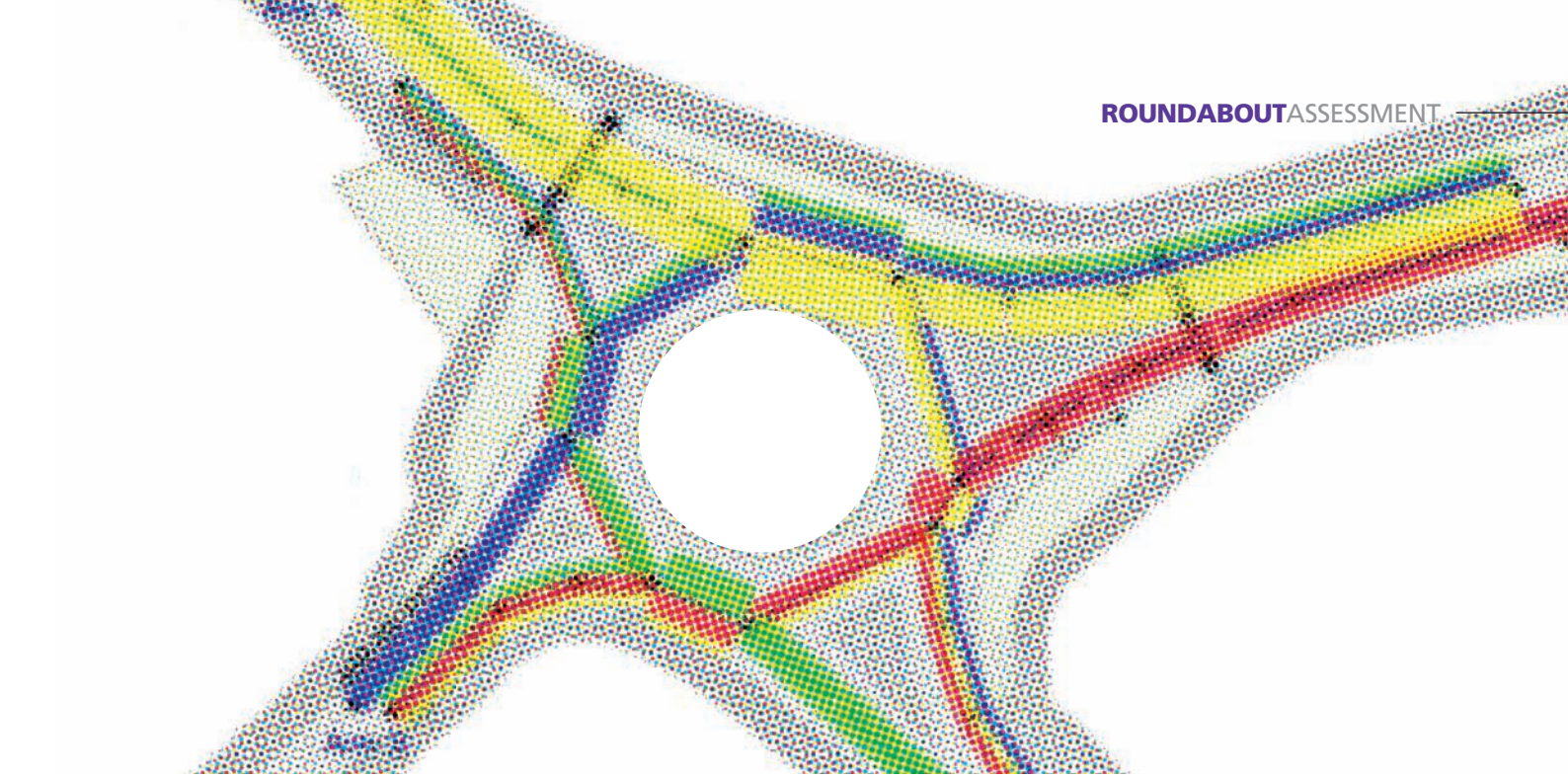


SEVEN UP

An invaluable tool for roundabout design and analysis, the latest version of ARCADY offers a host of new features and a brand-new user interface to aid the busy traffic engineer. **Louise Smyth** speaks with its developers

Images courtesy of TRL Software

Being very much a future-focused publication, nostalgia is not something we at *Traffic Technology International* tend to dwell on. Yet it's hard to suppress a little wave of it when discussing a product that originally ran on MS-DOS. The product is TRL's ARCADY (Assessment of Roundabout Capacity And DelaY – not perhaps the most natural of acronyms), and although its days of using 'old-school' operating systems are long gone, the story of how it came to be – and remains today – a valuable instrument in the traffic engineer's toolbox, is worth mentioning.

"The history behind ARCADY goes all the way back to 1980, which was when TRL did the initial research that the core of the product is based on," explains Graham Burtenshaw, a product manager at TRL. "TRL was a public company then, part of the government, so the focus was on producing reports about how to analyze roundabouts – it was a while before somebody said 'we could turn that into software'. In the mid-1980s a primitive DOS version was created and it grew to become a viable commercial product, with the first Windows version appearing in the late 1990s."

Today, ARCADY is in its seventh incarnation (Version 7 was launched in July 2009) and has had a variety of features added over the past few years – including the ability to model mini-roundabouts and small networks of linked roundabouts, more types of accident prediction, and pedestrian crossing models. From version 6 on, visualization techniques were added. In ARCADY 7 productivity is further boosted by the ability to quickly model different times of day, different years and alternative layouts all within the same file. This version also represents the most radical overhaul as the entire user interface has been redesigned.

Part of the motivation for making such changes comes, as expected, from user feedback – TRL has held regular user groups for many years. But the company also seeks inspiration from inside its offices in Crowthorne, Berkshire: "As we've grown our staff in the traffic group, experienced engineers and practitioners have joined us, bringing their 'on-street' use of ARCADY and other tools, and they've provided invaluable feedback," Burtenshaw says.

GLOBAL PRESENCE

There is also another reason behind the development of the most recent version, as Gavin Jackman, head of software, explains: "We wanted to dramatically grow the international business with all of our software, but specifically in territories where there was a focus on roundabouts. Our installed base has already grown from 10% to 25% in the past two years. In the UK, ARCADY is the tool of choice for modeling non-signalized roundabouts, but if you look to the USA, for instance – where there's a 'roundabout revolution' occurring – there are very few tools that have actually got the research and evidence-based background that actually goes into the product.

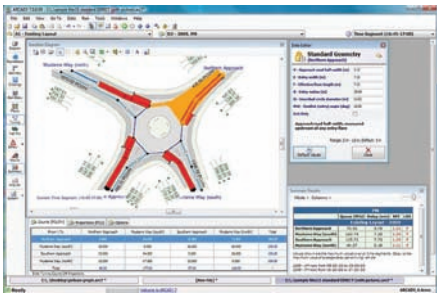
"Some people in North America are currently using microsimulation tools, but where ARCADY differs is that it's at the junction level, therefore the level of detail data input that goes in and the detail that you get out is of a higher degree," Jackman says. "Microsimulation will look at individual roads and vehicles but it won't give you the accident prediction or the overall flow geometry and capacity of roundabouts and so on."

This is not to suggest that ARCADY is a direct competitor to microsimulation. Junction design products (such as ARCADY and TRL's TRANSYT) can co-exist with microsimulation and Jackman cites Australia and New Zealand as two examples of regions where people happily use both. His only caution to those less familiar with the

As roundabouts become more complex, sophisticated design software is needed

options available is that "microsimulation is not necessarily one tool that fits all sizes".

Burtenshaw recalls a recent conversation that aptly illustrates why a specialized tool for roundabouts is so valuable: "I was talking to one of our international resellers about microsimulation and roundabouts," he says. "He mentioned that in ARCADY, if you make the road wider at the roundabout, it will give you an increase in capacity. But in microsimulation, no matter how big you make that value, it won't make any difference; it'll just stay the same because the microsimulation doesn't know what to do



In Version 7, the entire graphical user interface has been overhauled

ARCADY allows engineers to experiment with a range of 'what if?' scenarios

"Anybody could install a roundabout, but without proper analysis, it would be liable to bottlenecks and accidents – and nobody today has the budget to re-do a roundabout once it has gone in"

Gavin Jackman, *head of software, TRL, UK*

with it. It may look as if it's doing something – and you'll see the cars going round on the screen – but it's not actually much of a faithful reproduction of real life."

Achieving that real-world accuracy will be key in determining ARCADY's growth in markets other than the UK. As such, ARCADY 7 is equipped to work for countries that drive on the left or the right and has metric or imperial modes. Interestingly, it can even be calibrated according to driver behavior. If results from the UK nature are not completely satisfactory, some parameters can be adjusted to improve those results – a useful element when considering driver behavior in countries where roundabouts are so alien they might as well be crop circles.

TRL is teaming up with resellers in dozens of countries around the world, a few of the latest being Poland, Ghana, Italy and Brazil. But it's North America where the company is taking its most proactive role. ARCADY already supports the TRB's *Highways Capacity Manual* guidelines for roundabout analysis, so the main focus for TRL has been on spreading the word about the benefits of the tool. "In the USA and Canada we partner with Ourston Roundabouts, one of the leading and pioneering roundabout consultancy companies," Jackman explains. "They are spearheading the use of roundabouts rather than signalized traffic control in that region."

Ourston Roundabouts provided input on how to tailor Version 7 to the North American market and the company now runs training sessions on ARCADY. "In the past three months, Ourston has run four training sessions and several of the large consultancies in Canada have now purchased the product," Jackman adds. Among the authorities in North America that have purchased the tool are Michigan DOT, the City of San Diego and the Municipality of Waterloo. All of these names are new customers to TRL, which highlights just how well received Version 7 has been. Further proof is that some of these clients have already bought repeat licenses to increase their use of the tool – demonstrating that even those people new to the software are finding it both easy and valuable to use.

Smart and thorough design allows traffic engineers to iron out any potential problems before a roundabout is installed

FIRST IMPRESSIONS

So what is it that both new and existing customers are particularly impressed with? "Where ARCADY differs from other software packages relates to the accident prediction," Burtenshaw says, explaining the USP. "Being able to assess accident rates and explore the safety aspect means that authorities can design roundabouts from a safe driver perspective. Preventing just one accident pays for the software many times over."

Jackman agrees that the financial impact of using such a tool is a major draw for potential customers: "ARCADY combined with an experienced traffic engineer will design out problems before they occur. Anybody could install a roundabout, but without proper analysis, it would be liable to bottlenecks and accidents. No local authority in the world these days has the budget to re-do a roundabout once it has gone in. ARCADY also offers a robustness of performance in that it allows users to look at future patterns of traffic growth – allowing them to anticipate scenarios in advance."

The new code used in Version 7 has enabled TRL to extend the product's capabilities even further by incorporating a link to Savoy Computing's Autotrack software. "This is about bringing the CAD design of a roundabout together with the analysis of the actual traffic flow around that geometrical drawing. We are trying to harmonize the traffic engineer and the civil engineer's design process."

Jackman refers to BIM (Building Information Modeling) engineering principles, whereby the focus is on creating a model of whatever is being developed and re-using that model for a variety of purposes – therefore avoiding the need to recreate data in many different software tools. "Linking ARCADY with Autotrack means that we're aligning ourselves with a recognized process development within the architectural and civil industry and bringing traffic engineers in as well. That's a big shift – with huge potential." ■

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HAVING SPEARHEADED FEDERAL SIGNAL'S RECENT ACQUISITIONS SPREE, **BILL OSBORNE** IS ADAMANT HE'S GOT THE BEST TOLLING TOOLS IN THE BOX TO COMPETE AT THE HIGHEST LEVEL

Interview by Louise Smyth/Photography courtesy of Lex Kembery

When Bill Osborne appears in his LinkedIn profile photograph shaking hands with President Barack Obama, it's a little disconcerting but pretty damned impressive at the same time. Thankfully this online discovery occurred following our interview at Intertraffic Amsterdam in March, therefore avoiding the chance to get stagefright in the presence of someone so seemingly well connected, as well as embarrassing questions such as 'So, you actually got to touch him?'

Osborne may well have friends in high places – and indeed is kind of a big deal himself – but he couldn't be more down to earth. He has a friendly and engaging manner, a no-nonsense attitude and – unusually for the CEO of a US corporation – is not flanked at all times by over-eager PRs poised to intercept any questions on a 'classified' list. Perhaps his time in the male-dominated, plain-speaking automotive industry has helped shape this ego-free, direct demeanor – Osborne was a Blue Oval boy for many years, heading up truck engineering for Ford North America, then becoming president and CEO of Ford Canada before assuming the same role at Ford Australia, a country he regards with great fondness. Although his job title hasn't changed, the role he assumed at Federal Signal in September 2008 has meant getting to grips with a very different set of tasks, priorities and people – and quickly.

THE FAMILY GUY

The ITS industry often moves frustratingly slowly for some, yet Federal Signal has been undergoing an extraordinary period of growth that has set the traffic management sector talking. Acquisition after acquisition has been announced and Osborne's feet have barely touched the ground over the past 18 months. So what has this buying frenzy been all about? "When I came to Federal Signal it was clear that one of the things the company needed was a platform for growth," says the man who formulated the plan. "We have some very good cash-generating businesses, but in many ways we lacked the vehicle for growth. When we looked at our business portfolio, the fastest growth was with PIPS Technology [the ALPR technology specialist, acquired by Federal Signal in 2007], so that's where we decided to focus. PIPS serves two markets: it has a public safety customer base as well as an ITS customer base, and when we looked at the two markets, we felt that the bigger of the two opportunities was ITS. We also felt that in the long-run a standalone ALPR company wouldn't be enough, and that we needed to participate in other elements of the value chain."

ALPR alone not being "enough" alludes to the company's ultimate goal – to become a seriously big player in road-user charging. "We felt a complete road-user charging solution would be something that we could use eventually around the world," Osborne explains. "So that was the acquisitions strategy – to be able to build a complete solution and effectively become a one-stop shop for road-user charging."

The original plan was to snap up a large integrated company that already had most of the necessary components for RUC, rather than buy several smaller organizations, but

as Osborne says laughing, "Nothing ever goes to plan!" The revised version – plan B, if you like – saw the company acquire Sirit, Diamond Consulting Services and VESystems in short succession, and has actually allowed Federal Signal to have more freedom with regard to who it works with and how. Osborne emphasizes how important it is to work with people of a similar mindset in terms of goals and working practices. The 'pick-and-mix' strategy also enabled Federal Signal to go after the technology it truly wanted to get on board. "We were looking for companies that we thought had the best-in-breed technology in their particular segments – and we feel pretty confident that's what we have got," Osborne explains with a smile.

Commenting on each of the companies individually, it's clear how that confidence came about. "We believe Sirit has the world's best high-performance RFID readers. The 510 Infinity series is an industry standard. We also felt Sirit had a great lead in passive tag technology and we feel passive tags are going to be very important in the future.

"What we liked about VESystems is the high level of customer satisfaction. It has a great track record in terms of the flexibility of their solutions and the level of customer service that they provide – those were the elements that made them very attractive to us. Plus the processing and accuracy in their back-office system was second to none. The roots of VESystems go back to Lockheed Martin's payment systems, so this very small company in California that had world-class leading technology was a great find."

Perhaps the most unexpected acquisition to outsiders was that of Diamond Consulting Services – to the uninitiated eye, a little company on the opposite side of the Atlantic to Federal Signal, based in rural England. But technology conquered geography when it came to Idris – the jewel in Diamond's crown. "Idris vehicle classification software is almost a de facto standard in the USA, with about 85% market share on smart loop detectors. We worked with Idris on the E470 cashless tolling application in Denver, and that relationship proved we could have a seamless link between Idris and PIPS. It is strategically important to have this integration, which we can now replicate around the country for cashless tolling."

> "We know that DSRC is far more prevalent in Europe and we would love to be able to partner with a strong player that brought those technologies to the table"

A NEW DAWN

Following the acquisitions, a new business unit called FSTech has been formed, which is effectively an umbrella division for all ITS activities and is headed up by former VESystems founder and CEO, Manfred Rietsch. Although the plan is to go to market with an all-in-one solution, Osborne is keen to allay any fears that these well known brands will disappear: "ITS is an industry that relies very heavily on partnerships, so our goal is certainly not to hold any of these brands hostage! If a customer wants just one component, a PIPS camera for example, then we will certainly offer that. But the brands will operate as one business unit and we will offer integrated solutions."

If the past six months are anything by which to judge, by the time that this article lands on your desk these initial acquisitions could be old news, and Osborne hints that the spending spree may not yet be over. "All of us regard this as a global industry, so while UHF is predominant in the USA we know that DSRC is far more prevalent in Europe and we would love to be able to partner with a strong player that brought those technologies to the table," he admits.

"Then there's traffic data management, which we think is also going to be important. Ultimately, what we'd like to be able to do is build a technology infrastructure that can support all of those different uses, so not just road-user charging but traffic management, safety and security, capacity, utilization, and so on. We really believe that the long-term potential is to have one common technology platform that serves a variety of uses."

It's an ambitious aim to go for such an all-encompassing strategy (our discussion also touches on the role that Federal Signal could play in IntelliDrive, video analytics and security), made all the more challenging by having such a fragmented domestic marketplace to start from. On this issue, Osborne looks to Europe for inspiration: "The European market is far more integrated, with a great deal more technology, whereas the USA appears to be lagging a bit in comparison. I attribute that to the lack of technical standards. What's clear in Europe is that the European Union has created some very important standards that have allowed companies to be able to operate at a larger scale. To get big investments in technology and R&D means being able to have a scale to recoup those investments. I think what's missing in the USA are common standards, but I do believe we're on the right road and we'd like to play a part in that. Federal Signal would like to see more open architectures and more transparent standards, which will obviously create more competition but will also grow the entire market space. We believe that the broader the dissemination of these technologies, the quicker you'll get adoption. And specifically for road-user charging, it will help people get to grips with paying for their use of the roads."

Increasing competition is something that Federal Signal is already used to dealing with in the US market – for every Sirit there's a Mark IV or a Transcore and Osborne lists "a whole plethora" of companies competing with PIPS. But it's the European market – so crucial to Federal Signal's long-term goals – that's more of a concern. "One of the trends we've noted in Europe is that many of our customers are now getting into the ALPR business," Osborne says. "Where we used to pretty much sell exclusively to Siemens, the company has announced its own speed product using ALPR. Q-Free, another big customer of ours, recently bought ALPR software supplier Dacolian. It's a shifting landscape. Some people who are customers today could be competitors tomorrow." That of course, is assuming Federal Signal doesn't buy them first... ■

NEW TECHNOLOGIES ARE OPENING UP OPPORTUNITIES FOR INNOVATIVE SERVICES TO INFRASTRUCTURE OPERATORS, CONCESSIONAIRES AND ROAD USERS, AS **RIK JOOSTEN** EXPLAINS FURTHER

Interviewed by Lloyd Fuller/Photography courtesy of Jason Clark

Following the collapse of the Dutch government in February, all 'controversial' policies were put on the back burner ahead of elections in June. Politicians being politicians, they prefer to distance themselves from controversy – especially around election time – so regardless of the support that the Dutch road pricing scheme, Anders Betalen voor Mobilitiet (ABvM), seemingly had within parliament, the risk of alienating the voting public was deemed too much of a gamble. "Somebody has to be extremely motivated and bold to push these policies through," says Rik Joosten, CEO of Egis Projects, which has its fingers in many ETC and road operations projects worldwide. "In London you had someone who was very determined; if you don't have a Livingstone it's always going to be difficult."

Overall, Joosten is fairly pragmatic about the news from his home country, admitting that it's a case of déjà vu for him. "It's stalled a number of times before, but it will come," he predicts. "They need it in the Netherlands. You can't build more roads and you can't fit any more cars onto the motorways, so you need to stimulate better use of the system. As has been proved in London, Stockholm and Singapore, pricing forces people to think more about when and how they use the network."

A CHANGE OF FOCUS

In 2005, when Joosten became CEO of Egis Projects, he viewed ETC developments in the Netherlands and elsewhere as an opportunity for his organization to veer from ETC operations to being a straight service provider. "I could see there were some big changes on the horizon," he says. "In time, I believe most tolling in the classical sense will disappear but that toll services – the actual managing of the client database – will become a business sector in its own right. I've been pushing the whole development of this activity at Egis Projects for a while now, quite carefully though because conceptually it's quite far from our core business."

The background of Egis Projects is in road operations and PPPs, so in the main a fixed price is received over a long-term contract – for instance, in Hungary with the newly opened M6 Phase III motorway, the government will pay the concessionaire to operate that 65km stretch for the next 30 years. "With ETC services you have to earn from each client, to fight for fees – i.e. fight for a percentage of each transaction, fight for customer account fees, and so on. But with a database of clients to whom you can offer added-value services, such as LBS, it's quite attractive – a completely different business model but attractive nonetheless."

Easytrip was the result of this renewed focus. Although the first launch of these services was in Ireland in 2007, in April 2008 a second self-developed project kicked off in the Philippines in collaboration with the North Luzon Expressway. "With the Philippine Easytrip tag, you receive an account card that you can use at motorway service stations and fast-food outlets to pay for petrol, meals, etc." In Ireland, the focus is more on interoperability, stimulated by the NRA via its 'information exchange agent'. This system developed and operated by Egis Projects on behalf of the NRA provides users with a simple way to pay for tolls on all of Ireland's existing and future toll roads. "Whether you're on the M1, M4, N8, M50

– or even crossing the East Link Bridge or using the Dublin Port Tunnel – our 185,000 in-service tags work everywhere, regardless of the operator. The tags also provide access to more than 9,000 parking spaces (mostly operated by Q-Park) in Dublin, Limerick, Cork and Belfast. Despite not being the operator of the M50 free-flow toll road, we still collect 40% of the revenues on behalf of the NRA."

THE GOLDEN TOUCH

Strangely for a very French company – Egis Projects is a 100%-owned subsidiary of Groupe Egis, which is owned by the French financial institution Caisse des Dépôts et Consignations (CDC) – hardly any of its business is on French soil. One recent and high-profile overseas project was the free-flow toll operation on the Golden Ears Bridge in Vancouver, British Columbia. "It's the only project that we have in North America," Joosten reveals. "It opened in July 2009 and at the moment we have about 35,000 tags in circulation and 30,000 video accounts." Admitting that the penetration rate could be better, Joosten hopes that once the Port Mann Bridge is rebuilt, take-up will accelerate. "The problem is always the fee – fees stimulate penetration," he says. "If the video tolling rates are high, then people automatically switch to tags. Clearly video tolling is more expensive, but the difficulty lies in how you market both options." Through Egis Projects' subsidiary, Transroute International Canada Services Inc, responsibilities include registration and management of subscriber accounts, management of ETC transactions (transponder and video), invoicing of the users and collection of fares, and reconciliation of transactions and payments.

"The US market is very interesting and attractive for us, but it's a difficult one," Joosten continues. "Ideally you need a local presence. Groupe Egis is a long-term member of IBTTA and we do share information and participate in IBTTA activities, and we're always monitoring for opportunities that could fit our business model." The Dutchman – who joined Egis Projects in 1997, initially to restructure the motorway concession in Hungary (which he unfortunately had to close down) and later had project director roles on the Berlin Airport project and Portugal's SCUT road pricing scheme – says the Golden Ears Bridge scheme was the ideal size for Egis Projects and wouldn't extend its capacity in any way. Rather modestly, he refers to Egis Projects as a "relatively small" company and as a consequence many of the projects that materialize in the USA – PPPs and tolling tenders – require far too much investment, and thus could present a risk. "We want to secure more business in the USA, but we'll take it on an opportunity-by-opportunity basis," he says. "Fortunately we have a lot of business in Europe and elsewhere."

CLOSER TO HOME

Europe is in the vanguard of developing national tolling schemes and Joosten and his colleagues have tendered for many of the proposed and currently operating projects, from the UK lorry-charging scheme to Slovakia's HGV system. At home in France, Egis Projects is currently participating in the tender for the ecotaxe project, which consists of charging tolls on about 15,000km of state national roads (trunk roads), expressways and motorways. This project is top of the agenda for Groupe Egis and CDC. In relation to Poland, a joint prequalification has been submitted alongside its French competitor and partner, Sanef. "We have similar ethics and approach to the business," Joosten says of his rival. "We have even exchanged staff over the years – people from Sanef sometimes end up working for Egis Projects and vice-versa!

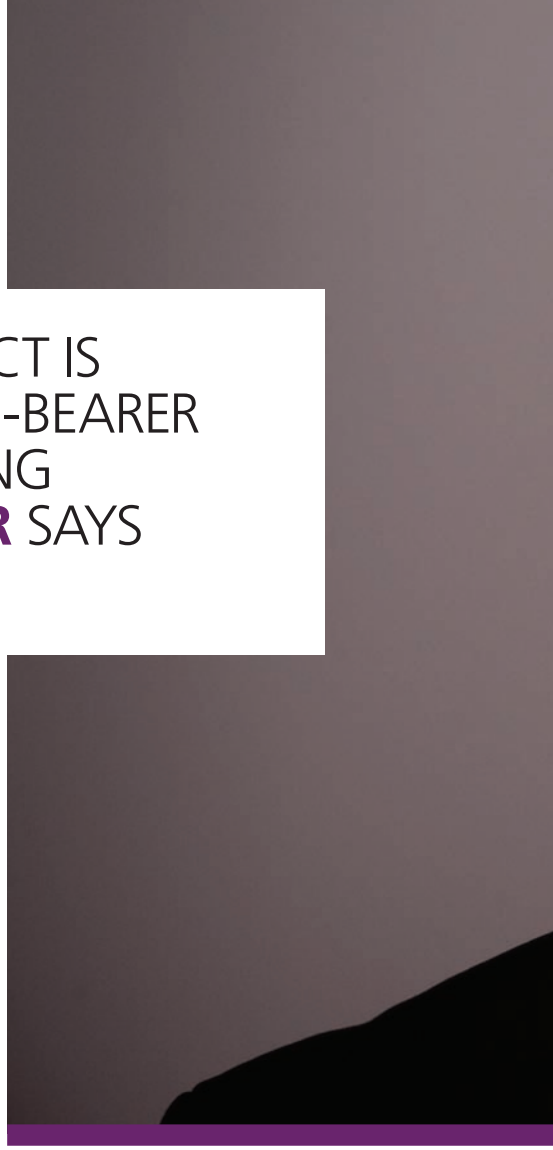
> "I believe that all tolling in the classical sense will disappear but that toll services – the actual managing of the client database – will become a business sector in its own right"

"Poland is especially important for us as we are already a part-operator on the 154km segment of the A2 motorway (Nowy Tomysl to Konin) in the middle of Poland, as well as on the 62km segment of the A4 motorway (Wroclaw to Katowice) in the south. For us, the Polish truck-tolling contract would tie all of the operations together. We've been in Poland for around 12 years, so we feel that we have a vested interest." In addition to operating these two sections, the contractor, A2 Strada, awarded Egis Projects a deal for the next 105km segment of the A2 motorway (Swiecko to Nowy Tomysl), comprising the tolling, telecommunications and traffic management equipment and systems as well as the weather stations, emergency phone boxes, toll booths and traffic counting equipment. In 2009, it also secured from the Polish Roads Authority (GDDKiA) the tolling, telecommunications and traffic equipment contract for the 162km segment of the A4 motorway (Wroclaw to Katowice).

Further afield, there are interests in several Australian projects, most notably Melbourne's CityLink – the first AET-only toll road in the country. In addition, it boasts tunnel operations in Sydney and Melbourne, which according to Joosten is an area of the business in which Egis Projects excels. "We run the Dublin Port Tunnel for the NRA, which has been designed to reduce the number of HGVs using surface streets in the center of Dublin. We also operate a number of urban and interurban tunnels in Croatia, Greece and Portugal, as well as tunnels on the recently opened A5 motorway between Vienna and the Czech Republic – the first PPP in Austria. In fact, we supplied all of the tunnel equipment for the A5, such as safety systems, ventilation, lighting, SCADA, etc, but we did it all as an integrator – as a company we do not actually manufacture anything ourselves." The Euro 1.3 billion project for ASFINAG has been fully privately financed and is being operated for 30 years through a special-purpose operating company, Bonaventura Strasserhaltungs, of which Egis Projects has a 50% share.

Joosten says governments are increasingly looking at PPPs as a way of financing their roads infrastructure, particularly in light of the current economic climate and the tendency for public projects to overrun. In relation to the latter, he refers to a report commissioned by Infrastructure Partnerships Australia, which revealed that on average cost overruns for PPPs amounted to approximately 1.2% of the total, whereas traditional contracts cost overruns were closer to 15%. Meanwhile, the majority of PPPs are completed on time, which cannot be said of many public sector projects. "PPPs are a bit more costly at the beginning, but in the end, the price is the price and that's what sticks – everybody has to stay with it."

Among Joosten's aims for Egis Projects in the near future, he hopes to increase the road operations business from its current 1,450km to around 2,000km, as well as reinforce its leading presence in tunnels. "On the ETC side, we want to become one of the five leading services companies in Europe for HGV and passenger car tolling. We also want to extend our global tag/OBU penetration from the current level of 800,000 under contract both as operator and service provider to the 1.5 million mark. Winning new toll road projects, toll charger projects and developing our Easytrip service provider concept will be vital to achieve these ambitions. In fact, we are cautiously optimistic that our current investments in both the ecotaxe project in France and the Polish national ETC project will bear fruit and that we could potentially win one or both of them by the end of the year." ■



THE SLOVAKIAN TRUCK-TOLLING PROJECT IS ARGUABLY ROAD PRICING'S STANDARD-BEARER GLOBALLY. FOR COUNTRIES CONSIDERING SOMETHING SIMILAR, **KARL STRASSER** SAYS GNSS WILL DELIVER ON ALL FRONTS

Interviewed by Nick Bradley/Photography courtesy of Alexis Kembery

Despite the controversy that has shrouded the Slovakian truck-tolling scheme – from the hard-fought tendering process with appeals, counter-appeals and an ongoing EU investigation, to the blockades set up by angry hauliers once the system went live – the technology has run like clockwork. Karl Strasser is head of tolling at Siemens, technology supplier to operator SkyToll, and prefers not to be drawn too much on the politics at play. As far as the 43-year-old Austrian is concerned, as technology provider, he and his company have delivered beyond expectations, demonstrating once more the merits of GNSS tolling in open-road scenarios. Moreover, he believes that Slovakia and Germany are just the start.

"Of course, I wouldn't recommend GNSS for every situation – you have to look at it on a case-by-case basis, analyzing the requirements of each accordingly. GNSS is obviously not suitable for cities such as London where you are just trying to enforce a cordon, or on single lanes or tunnels where microwave-based solutions might be preferred. But for Slovakia, I think the business case was there for GNSS."

The tender for the Slovakia scheme was 'technology neutral', although the fact that NDS wanted to toll all first- and second-class roads – as well as major motorways – dictated a flexible solution not so dependant on fixed infrastructure. "A microwave concept is simply not cost-effective for such a widescale operation," Strasser feels.

TECHNICAL TALK

Technologically, the Slovakia scheme for Narodna dialnicna spolocnost (NDS) is actually rather a big deal, since after TollCollect it is only the second satellite-based system for wide-area multilane free-flow tolling worldwide. Siemens was responsible for the satellite-based toll recognition software and on this occasion the supply of approximately 200,000 OBUs to operator SkyToll. Although the TollCollect and NDS schemes are for the tolling of heavy trucks – and both utilize GNSS/GSM – that's where the similarities end. "It's hard to compare the two," Strasser admits, when quizzed whether or not the Slovakia scheme might be more advanced as a result of the two systems being implemented five years apart. "In Slovakia the system is mandatory, whereas in Germany – where we supplied 500,000 OBUs – it's not obligatory to have an OBU, as there is an alternative booking system in place. Also, the Slovakia system is plug-and-play; the OBU simply slots into the cigarette lighter (although it can quite easily be fed into the main power supply). In Germany, the OBU is also connected to the tachograph. And for occasional users or those just passing through Slovakia, an OBU can be leased at the entry border for a small deposit, which is refunded when you reach the exit border."

Toll data is continuously collected through the OBU using satellite technology and transferred to the back-office through GSM/GNSS. "Special algorithms ensure that the data cannot get lost, and are able to monitor and track any tampering," Strasser reveals. At the back-office, the calculations are achieved in a similar way to those in the cell phone industry.

And what of the thorny issue of privacy? "Well, it's a tolling application and therefore the data reflects exactly where the vehicle is heading," Strasser acknowledges. "But we do not transfer the complete stream of tracking data – the OBU takes the GPS data, the GPS position fixes and calculates a tolling recognition, and subsequently only aggregated data is transferred to the back-office. Certainly, privacy is an issue if the position data is then matched to user data, but this is not the case in Slovakia."

So if privacy is assured, what exactly upset the hauliers who set up blockades when the scheme went live? "I think the protests reflected the specific implemented toll scheme based on the toll law, which maybe wasn't optimal at the start," Strasser says. "As far as I am aware, though, these problems have now been ironed out."

There was also some frustration at the launch from truckers queuing at the border, which NDS has since indicated was unavoidable as the borders were naturally the best locations from which to distribute OBUs to those truckers who needed them.

FOR WHOM THE SYSTEM TOLLS

The SkyToll system is made up of three major functional blocks. In the first instance, there is the trip-collection system, which includes the usage of the public satellite positioning data received from the GPS, the OBUs, the GSM/GNSS communication link, and a back-office component called Electronic Tolling Back-Office (ETBO), which manages all of the OBU activities.

The Central Information System (CIS) comprises the rating, billing, invoicing, money clearance, web portal, logistics, and customer relation management subsystems (including the call center). Attached to this are management information, archiving, and enterprise resource management systems. Interfaces link to NDS, the banking/card providers, the OBU vendor(s), the national vehicle registry, and the printers for paper-based user communication.

Similar to the TollCollect system, enforcement is conducted via roadside equipment, mobile enforcement units and an enforcement back-office component. In the enforcement back-office, events are analyzed for further prosecution, while the data about the user and OBU status is maintained through lists. The enforcement part of the system was provided by Norway's Q-Free, which deployed DSRC and video technology in this instance. Trucks pay per zone transited, with the information being reported by GNSS to the back-office. The

tag itself uses CEN-standard DSRC, which ensures international interoperability and therefore future expansion to cover all vehicles on a common platform.

Toll data collection is based on segments with predefined lengths using GPS positions for reference. The logic of segment detection is implemented in the OBU using simple geo-reference objects (entry point, control point, and direction of travel). This recognition logic is based on two consecutive control points, which are detected using GPS-based position referencing, assisted by direction of movement. These principles even allow the handling of very close parallel roads and crossings of tolled and non-tolled roads.

The accuracy of GNSS-based tolling has in the past been questioned, although the statistics gleaned from the SkyToll project would suggest this should no longer be a concern. A functional test of SkyToll's concept was carried out by NDS at the back-end of January 2009. Nine 3.5-ton trucks and a bus were used, and altogether more than 13,200km was traveled. Each vehicle transported two active OBUs from Siemens, as well as an independent GPS device for verification purposes. "The aim was to corroborate that the system would fulfil the required operating criteria," Strasser recalls, "the first being the functionality of the toll system itself and the second achieving the required efficiency and accuracy of toll collection. SkyToll passed all 10 tests, as well as tests relating to installation, registration, correct operation of the OBU, and the correctness of the billing of the toll transactions." According to one of Strasser's colleagues, Vladimír Slezák, the achieved toll segment recognition rate was 99.85%, which Strasser feels sets new standards for the whole ETC sector. "Not only has the system proved flexible and functional, it's proved to be a highly reliable solution for this type of national toll system. We are perfectly happy. It's performing over one million toll transactions a day on a road network of 2,400km. The technology, project management, and stringent testing are all reasons for this success."

> "Paying for road usage based on how much you use the roads is fair. The stumbling block will always be convincing the general public of that – and I am glad that's not my job!"

WHATEVER NEXT...?

Siemens certainly has its foot well and truly in the door of these types of schemes and with more projects being proposed – such as in France, Poland, Hungary, and Slovenia – he and his colleagues in Siemens' newly formed tolling business unit find themselves in a great position, particularly with the only two GNSS projects in existence appearing at the top of its resume. "GNSS will play a big role in the future of European tolling," Strasser concludes. "It's set up for interoperabilty already, and when Galileo arrives, I think we will be able to add some exciting new applications to the mix."

One contract Siemens will have to put on ice, however, is the Dutch ABvM nationwide tolling project. "Our technology is set up for passenger car tolling," Strasser notes. "The OBU for Slovakia has obviously been designed for trucks, but we are already working on a next-generation design that is smaller and more suited to automobiles – and more importantly cheaper.

"They have made good steps in the Netherlands," Strasser concludes. "The reason it's been suspended is political. But I believe they will introduce the system, and indeed they are quite a long way down the road already. Paying for road usage based on how much you use the roads is a fair way of taxation. The stumbling block will always be convincing the general public of that – and I am glad that's not my job!" ■

Above and beyond

The communications technology being deployed as part of the IntelliDrive initiative has huge potential not only for the safety issues it was designed to address, but also with regard to improved traffic flow, more efficient transit and even RUC schemes

by Amy Larsen, Siemens, USA

Modern vehicles already use an array of computers to control everything from engine dynamics and automatic braking to driver navigation screens. Likewise, modern signalized intersections are being equipped with advanced transportation controllers (ATC) with the computing power necessary to perform many additional transportation tasks simultaneously with signal control. Cooperative connectivity between vehicle computers and intersection computers is being successfully applied to reduce emissions, reduce travel times and to improve the safety of the driving public.

IntelliDrive is the USDOT initiative to enable safe, interoperable networked wireless communications among vehicles, the infrastructure, and passengers' personal communications devices. Uniform standards for worldwide interoperability have been published by standards development organizations, including the Institute of Electrical and Electronic Engineers (IEEE) and the Society of Automotive Engineers (SAE). IntelliDrive's goal is to make surface transportation safer, smarter and greener.

SAFER SYSTEMS

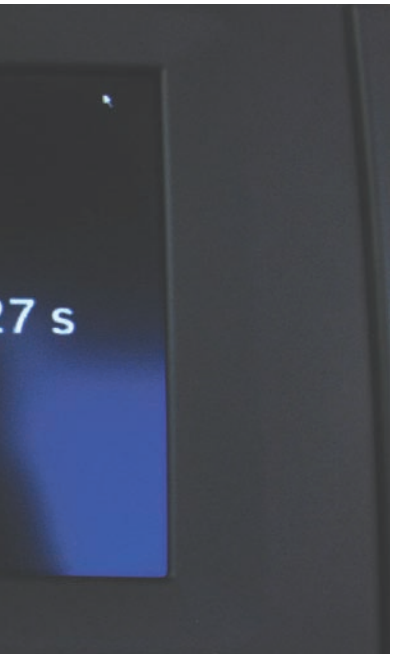
Cooperative Intersection Collision Avoidance System for Violations, or CICAS-V, is an ITS program with collaboration from the USDOT, automobile manufacturers and state and local DOTs. The CICAS-V system uses two-way DSRC to disseminate information about upcoming traffic signal changes and GPS to warn the driver that a stop sign or traffic signal violation is about to occur. The CICAS-V in-vehicle equipment has a variety of applications. It provides the ability for the vehicle to match lane location with current and upcoming signal changes for the signal controlling that lane, offering traffic signal time to phase change determination with better than 50ms accuracy.

There is continuously updated distance-from-vehicle-to-signal information, as well as the ability of the vehicle to provide haptic warnings by pulse from the vehicle Automatic Braking System during potential intersection violations.

In a potential intersection violation scenario, the vehicle can provide a haptic warning via its automatic braking system, whereas during potential traffic signal violations the vehicle can transmit wireless messages to enable the traffic signal controller to extend the red phase in the other directions. In addition, there is an 'all-red' extension designed to protect drivers from red-light runners.

The equipment also has benefits with regard to traffic flow and vehicle priority. A pre-yellow alert from the signal controller, for instance, enables the driver to prepare for the yellow phase before it is actually visible, and the priority of the vehicle can be transmitted to the intersection to allow emergency vehicles and transit a smooth path through the intersection. Arrival time can be transmitted from vehicle to intersection, which has great potential in terms of replacing loop detector zones.

A BMW 7 Series uses signal phase and timing data transmitted wirelessly from Siemens' traffic signal controllers



The image shows regenerative braking in the BMW 7 Series

Screenshots courtesy of CAMP

Video frames showing actual signal compared to in-vehicle signage

SMARTER: BEYOND CICAS-V

The USDOT has recently expanded the IntelliDrive architecture beyond DSRC to include existing widely deployed wireless technologies, such as 3G/4G cellular service. Both DSRC and cellular technologies have certain advantages, depending upon the IntelliDrive application.

DSRC is a mature wireless technology with a proven track record in safety-first industrial automation applications, including pipeline, power grid and petrochemical process control. The performance of DSRC is immune to extreme weather conditions, such as rain, fog, snow, etc. Meanwhile, DSRC has connection times and latencies small enough to be seamlessly included in the software control loop among in-vehicle computers and signal control computers. For example, tests using a vehicle-mounted high-speed video camera verified that the actual traffic signal and the signal displayed on the navigation panel changed within the same video frame at rates faster than 20 frames per second, or less than 50ms latency. This quick response time is being used in applications such as collision avoidance, autonomous vehicles, automatic braking and adaptive cruise control where the data must be tightly coupled among vehicle and roadside controllers.

CELLULAR AND MESH NETWORKS

Although DSRC has great advantages for high-speed control systems, it is limited to distances of about 2,000m and also limited by the fact that it's not yet widely deployed in transportation applications. IntelliDrive has historically focused mainly on safety applications, but its scope has been expanded to include mobility applications to shorten travel times, to reduce greenhouse gas emissions and to increase fuel efficiency. For these applications, quick response time is of lesser importance than dissemination of vehicle and roadside information over a wireless infrastructure that is already widely deployed. For these applications, cellular and mesh networks are being used to realize additional IntelliDrive applications that require wide coverage but do not need the quick response offered by DSRC. Once the requirement for the fast DSRC response is removed, IntelliDrive applications shouldn't really care how the data is transported from roadside to vehicle. And the best news is that existing wireless services embedded in vehicles can implement many IntelliDrive applications immediately, including cockpit display of in-vehicle signage for traffic signals covered by snow and speed zone alerts. The advent of 4G service will provide quick responses that rival DSRC for IntelliDrive applications outside of the realm of DSRC active safety applications.

INTELLIDRIVE FOR SUSTAINABILITY

With the increase in the Corporate Average Fuel Economy (CAFE), climate change and limited oil supply, car-makers are going green to reduce travel times, reduce emissions and reduce fuel consumption. In addition to automobiles, IntelliDrive and the SAE J2735 message set supports transit applications such as light rail transit and bus rapid transit. Moving beyond the simple display of information, IntelliDrive technology has already been adapted for engine efficiency, eco-driving and transit applications. For example, Caltrans, BMW and Siemens demonstrated fully functional IntelliDrive DSRC technology for advanced vehicle detection and fuel savings at the October 2009 AASHTO meeting in Palm Desert, California. In this live demonstration, a production 2011 BMW 7 Series used signal phase and timing information transmitted from the Siemens traffic signal controller to constantly compare the approach distance to the traffic signal countdown remaining in green. When the signal was predicted to be red at arrival, the engine was shut off and regenerative braking used to slow the vehicle. After stopping at red, the same signal information was used to control the vehicle's cabin temperature and restart the engine just prior to green. As part of the BMW EfficientDynamics initiative, this IntelliDrive technology has significant fuel savings.

By augmenting this demonstration with cellular technology, vehicles are platooned into green waves with travel times and exhaust pipe emissions precisely known. Further integrating IntelliDrive transit messages will subsequently coordinate vehicle platoons with bus and light rail schedules for accurate arrival times and driver information for best route and recommended speed. Cellular technology is also used to anonymously track and transmit vehicle miles traveled within a tax district to decouple road use payment from fuel tax for the next generation of electric cars, as well as rebating road funds directly to local districts. ■

To find out further information, please contact Siemens by telephoning +1 512 834 4811, emailing amy.larsen@siemens.com, or alternatively log on to www.siemens.com

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The holy trinity

When it comes to detecting vehicle speed, three technologies dominate: loops, radar and laser. Each solution has specific advantages and disadvantages, depending on the end user's priorities. Expert advice can explain these differences and assist in decision-making

by M.G. Kim, Keon-A, Korea

Detecting, targeting and identifying high-speed vehicles requires advanced technology since the window of opportunity to capture the precise moment of positive identification can be counted in just milliseconds. To measure accurate speeds, capture images of vehicles from the most appropriate vantage point, as well as recognize numbers and letters on license plates, requires a combination of technology, planning and positioning. At a speed of 100km/h (62mph) vehicles move approximately 2.8m in only 10ms, which requires the detection response time to be a maximum of 25ms.

The majority of detection devices on the market can be classified into three technologies – inductive loop coils, radar and laser. Inductive loop coils are the most effective sensor devices as they have the most accurate speed measurement capability and a response time within 10ms. However, their use can be expensive and disruptive to traffic flow as installation requires the road to be cut open and the loop coil to be buried beneath the surface.

Radar technology applies a Doppler effect that sends out electric waves in a wide area and measures the returned waves to detect the speed of all vehicles. Advantages include ease of installation combined with a relatively cheaper price as a result of the fact there is no need to cut open the road, as in the case of inductive loops. However, due to wave dispersion, the waves are influenced by moving objects in the surrounding area, while the response time is approximately 35ms. It is difficult to find an appropriate position as it is necessary to use high-resolution cameras and take images in wide angles to be able to detect multiple lanes in a wide area. It also becomes increasingly more difficult to detect, positively target and identify a vehicle in violation as the number of vehicles within the vantage point rises during busy traffic scenarios. Therefore it's not appropriate to use radar technology in a multilane heavy traffic urban environment.

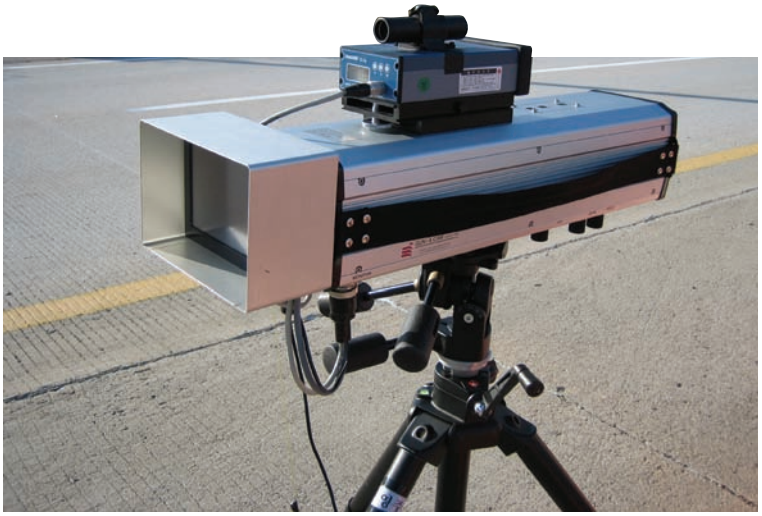
UPON REFLECTION

Laser technology is able to overcome the installation disadvantages of inductive loops while also achieving a similar detection speed and overcoming the disadvantages of radar technology. Some of the most innovative companies use 900nm wave laser, which is harmless to humans and is able to detect and target vehicle by vehicle. A 900nm laser detects a vehicle's speed by measuring a reflected beam of light.

Laser technology does, however, experience difficulties in obtaining regular reflections, as the amounts of reflection from uneven surfaces of vehicles and black-colored vehicles are too small to detect those vehicles properly. Scattered reflection from wet road surfaces is also a challenge to laser detection.

Many companies have devised solutions to increase reflections to the sensor device, making the sensor capable of differentiating between regular reflections and diffracted reflections. An example of an innovation designed to overcome laser's disadvantages can be seen in Keon-A Information Technology's use of Wide and Dual Laser Beam (WDLB) technology to detect vehicles. The WDLB system sends more waves and therefore receives more reflected waves, while its dual-laser beam concept plays a role similar to that of inductive loops. ■

Please contact Keon-A Information Technology by telephoning +82 2 2041 5557, emailing info@keona.co.kr, or alternatively please visit the company's website at www.keona.co.kr



This system enforces speed limits by using a laser sensor to measure vehicle speed

Speed enforcement systems styled with an aesthetically designed exterior

Great expectations

Considering the needs and desires of the end-user (the driver on the road) could be the defining factor in the future deployment of cooperative traffic management solutions. One European scheme demonstrates the positive results achieved by such an approach

by Alexander Frötscher, AustriaTech, Austria

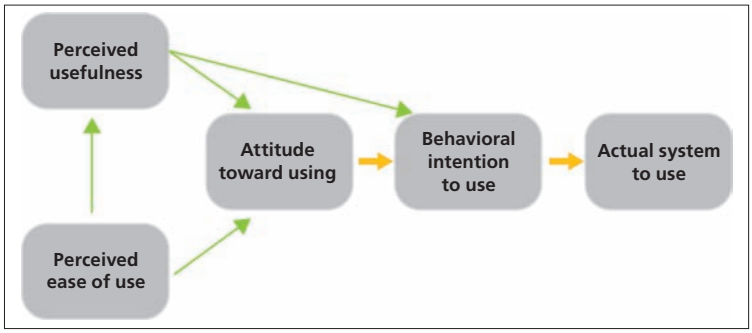
Cooperative services on high-level road networks could revolutionize traffic management in the future. But expectations of road operators and drivers differ in a variety of ways. On the one hand, road operators have to consider the costs and quality of safety-related information, while travelers want timely, location-specific information to plan their trip. And both want safety and traffic flow to be enhanced.

Over the past few years, various efforts have been made to support projects relating to cooperative systems and to develop reliable and practicable solutions. COOPERS – an integrated project in the EU's Sixth Framework Programme – connects vehicles via continuous wireless communications with road infrastructure on motorways for data exchange relevant to a specific road segment or ensemble of vehicles to enhance road safety and enable cooperative traffic management. The COOPERS system collects, prepares and monitors traffic flows in the traffic control center and provides vehicles and drivers with real-time, situation-based safety-related data and infrastructure status information, all of which is distributed via a dedicated infrastructure-to-vehicle (I2V) communication link. The driver is therefore warned of any dangerous situations ahead and informed actively and accurately in the vehicle from the respective infrastructure operator or public authority, so that he can adapt his driving behavior to avoid the critical scenarios.

Over the course of the past three years, the system has been developed and tested at four European test sites, each with different requirements in terms of installation of intelligent infrastructure, density of traffic, and geographical aspects.

The collection of traffic information via distributed sensor networks and the smart combination of input data channels with data fusion algorithms in the traffic control center is the most important part, with direct (and high) impact on the quality and reliability of the available information for drivers. To enhance the quality of the distributed traffic information in the setup of the demonstration areas, two independent data sources were applied, meaning that any advice to the driver was only distributed if the respective information was confirmed by these two independent data sources.

This approach extends the concepts of in-vehicle autonomous systems and vehicle-to-vehicle (V2V) communication with tactical and strategic traffic information, which can only be provided by the infrastructure operator in real-time. Direct I2V communication to the travelers extends the responsibility and liability of the infrastructure operator in comparison to today in terms of reliability and accuracy of information to advise drivers/vehicles.



The diagram shows the Technology Acceptance Model (TAM)

EXTENSIVE TESTING PHASE

To utilize the experiences for proposed further process models of cooperative traffic management, the installation and setup of communication networks operated not only for a short demonstration time but for

COOPERS extends the concepts of in-vehicle autonomous systems and V2V communication with tactical and strategic traffic information provided in real-time by the operator

a period of up to six months. This enabled the infrastructure operators to evaluate the day-to-day performance of the equipment and the overall reliability, from message generation to transmission into the vehicles. The installed systems were operated for regular periods of 10 hours a day, six days a week, with the generation and transmission of over 1,000 traffic messages during that time. The infrastructure operators provided services such as international seamless service handover with data exchange between operators, enhanced cooperative traffic management based on floating car data, and road safety-related traffic management information for drivers within the vehicle.

The reason for COOPERS to concentrate on a limited set of traffic information services and focus on the quality of the available information was based on the partners' past experience that traffic information was not reliable or accurate enough to meet travelers' demands.

The OBU within the vehicle will be connected to the roadside via a wireless link

As a European project, the main focus was to develop a cross-border solution, so a standard protocol for decoding and encoding of traffic information services, TPEG RTM, was selected as a result. Additionally, the need for an independent communications technology approach saw the setup of 'combined' demonstrators with validation of several types of communication technologies, from broadcast, DAB and cell-based to GPRS/UMTS, WiMAX and short- and medium-range communication technologies such as CALM IR. Services for drivers included accident/incident warnings, roadwork information and lane-specific advice, traffic jam warning and guidance, and in-vehicle variable speed limit information.

User acceptance is one key factor for the future deployment of cooperative systems such as COOPERS, but it's not often considered as a main part within a telematics and network performance assessment. Knowing the importance of this factor, the information services have been tested extensively from the user perspective, with the involvement of more than 200 test drivers in the demonstration sites. A mixed method field design is used in COOPERS, with investigations performed with both quantitative and qualitative approaches to account for the special conditions with COOPERS test sites across Europe. A validated and pretested questionnaire is used to test standard items in the technology acceptance model (TAM), which tries to explain acceptance and the use of technology. In addition, qualitative interviews serve as the basis for further understanding sources of information.

The other part of the testing procedure – with test drivers of all ages – allowed for driving with and without the system. Several parameters were collected, starting from the usual vehicle performance measures such as speed and headway to drivers' physiological measures. In addition, driver behavior and user-acceptance models were used to move a step beyond the exploratory level.

SCALING UP EXPECTATIONS

By the end of the testing phase the feedback obtained from COOPERS was exceedingly positive. Based on the scientific evaluation methodology and cross comparisons between demonstration sites, communication technologies used and user feedback for cooperative systems, some key results were obtained. First, it was noted that several combinations of communication technologies fulfilled the requirements for in-vehicle cooperative traffic management information. Second, road infrastructure operators were able to extend their existing systems with cooperative systems functionality. The user acceptance of the system, meanwhile – integrated with a navigation-related HMI – was constantly high. Also, a surprising result of the demonstration drives was that data privacy was not deemed a matter of concern for the test drivers, and there was no evidence that these results differed between the various user groups. Currently, the system meets travelers' expectations for in-vehicle traffic management information on single corridors of a transport network, although large investments and efforts with more users involved will be necessary to extend cooperative mobility to the next step for widescale deployment. ■

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A model approach

The story behind the deployment of a multipurpose traffic simulation framework for the 400-Series freeways and major arterial roads in the Greater Toronto Area is interesting reading for those tasked with implementing similar projects

by Yannis Stogios, Delcan Corporation and Robert Pringle, McCormick Rankin Corporation, Canada

The Ontario Ministry of Transportation (MTO), one of North America's most preeminent transportation agencies, has often turned to innovative methods to handle traffic growth and congestion issues in the Greater Toronto Area (GTA). Over the past 12 years, MTO has grown more reliant on microsimulation as the analysis tool of choice for the majority of its traffic planning and operational review projects. This accumulated experience has now led MTO to a new approach for its analytical needs – namely the development of a multipurpose, multilayer traffic simulation framework for the freeway and major arterial road network in the GTA.

Macroscopic modeling has proved its worth over many years for the forecasting of future travel demand in support of MTO's highway planning and programming. In recent years, microsimulation has also become a valuable element of the traffic engineer's toolbox. For example, in 2004, MTO was faced with 75 overnight closures of the eastbound Highway 401 express lanes to rehabilitate an 8km-long section between Kipling Avenue and the Basketweave (a stretch of Highway 401 whose name derives from the criss-crossing design of the road). A microsimulation analysis demonstrated that the work could instead be conducted through two weekends of full closures without causing operational breakdown of the highway, saving around CA$1.9 million (US$1.76 million). Comparison of the microsimulation results with performance data collected during the closures proved the efficacy of the model as a decision-support tool, and has actually led to awards and wide recognition throughout the industry.

3D visualizations provide context for understanding modeling outputs. Here, the CN Tower as seen from a highway approach

Highway 401, included in the framework, is the longest of the 400-Series highways covering over 500 miles and (one of) the busiest in North America

A THREE-TIER FRAMEWORK

Today, many MTO projects include microsimulation analysis as a key requirement. It is used to evaluate the benefit of proposed highway or interchange improvements, provide travel-time estimates in the forecasting of high-occupancy vehicle (HOV) use, and evaluate the impact of lane closures in workzones. It is also used for analyzing the operation of toll facilities, HOV lanes, roundabouts, and other features not easily evaluated via macroscopic models.

The experience accumulated through such projects has now led to the idea of consolidating all relevant modeling in a comprehensive traffic simulation framework. The aim of this framework is threefold. First, it ensures consistent modeling results across studies (which is currently an issue due to variability in the software packages used and the quality of the models produced). Secondly, it minimizes overlap and duplication in model development and testing, thus making efficient use of MTO's modeling budget. Finally, it facilitates timely decision support by MTO management. The framework was conceived so as to enable the most appropriate model (in terms of level of detail and efficiencies of scale) to be used.

LEVELS OF MODELING

Most transportation modeling to date has focused on macroscopic or microscopic models. The simulation framework being adopted by the MTO, however, involves three levels (macro, meso, and micro). This third 'middle' layer provides more detail than macro models for network-wide analysis of traffic operations/management strategies, HOV forecasting, intersection-level traffic estimates, etc. It also improves efficiency where analysis does not require the full detail of micro models, or where a very large area is being modeled. Delcan and MRC's task was to develop requirements and evaluate software tools for a three-level framework.

A macroscopic level incorporating the broader region's Emme-based travel demand forecasting model is already available through MTO's previous initiatives. It is large-scale (extends beyond the GTA) and

is suitable for area-wide strategic planning analysis. It also provides useful input for the other layers of modeling in this project.

A microscopic level is being developed under the current project. This has a high level of detail and is suitable for analysis of traffic and transit operations in highway corridors or sub-areas.

Mesoscopic modeling is a relatively recent development and had seen somewhat limited use on behalf of MTO until this project was started. It fills a void between the other two layers, enabling evaluations that might require more detail than a macroscopic model can provide, and yielding improved efficiency over a microscopic model. For example, an HOV forecasting study completed just before this project began required a cumbersome, manually driven interaction between the available macroscopic and microscopic models. The need to interact arose as neither model was on its own sufficient or suitable for the problem at hand. Using a macroscopic model alone would not provide the required discrimination in travel-time estimates, while a microscopic model of the GTA system would have been onerous to develop and time-consuming to run. This project could have been completed with improved reliability of results and at a much lower cost if a mesoscopic model had been available.

RIGHT TOOL FOR THE JOB

After evaluating the various software platforms (or combinations thereof) available, Aimsun (from TSS – Transport Simulation Systems) was selected for proof-of-concept (POC) testing as the mesoscopic/microscopic software platform. It was chosen because it was found to be compliant with the framework's functional specifications, has a single common network and database that supports all levels of modeling, and has a good interface with the existing Emme travel demand model. For MTO, it was also important to choose a product that had proven consistency in results from micro and meso layers, plus powerful, efficient windowing-in on sub-areas for detailed analysis. In short, the outcome of the evaluation was a pleasant surprise: virtually all of the functional specifications developed for the framework could be met by a single package, and those that could not were already a firm part of the product roadmap.

The area covered by the proof of concept color-coded by modeling attributes

FINDINGS AND BENEFITS

Delcan and MCR developed a POC model to validate the three-level approach and to confirm that Aimsun indeed meets the detailed functional requirements of the MTO. The POC is currently undergoing approval by MTO. The evaluation included several key aspects. One of the first requirements was to ensure interfacing with the Emme-based demand forecasting model. At the functional level, a number of test scenarios were modeled to confirm that the framework can satisfactorily tackle the variety of situations of immediate concern to MTO. These include modeling tollways and HOV lanes, as well as both freeway and arterial traffic control systems. In addition, the project team worked to verify that it was possible to make efficient reuse of models produced in the past using alternative software. Finally, of paramount importance was validation work to demonstrate consistency of results with field measurements and other models in use.

Evaluation of HOV lanes is a key use case for the framework

With the approval of the Ministry being imminent, the geographic expansion of the framework eastwards has already started. Eventually, the framework will include the entire highway system in the GTA.

"Our consultants have proved to me that efficiencies can be gained by consolidating our traffic modeling in a multipurpose, multilayer simulation framework and by adopting a fast, efficient mesoscopic modeling engine as the 'heart' of our simulation software platform," explains Goran Nikolic, MTO's head of Traffic Planning & Modeling. He views the framework as MTO's preeminent analytical tool for future traffic planning, operational reviews and strategic decision-making – potentially, MTO's implementation of the integrated corridor management concept.

Studies that have been recently completed or are now under way include consideration of HOV lane implementation first as a use for new highway lanes. Microsimulation has been used to confirm HOV lane access zone and terminus locations, forecast HOV lane use, and evaluate measures to improve operations, such as speed change lanes between the HOV and general-purpose lanes. Prior to the multilayer Aimsun framework, these tasks involved cumbersome manual interfacing between macroscopic and microscopic models and extensive updating and revisions to two separate models with independent networks and databases. With the new framework, such operations can be conducted seamlessly and more efficiently, making extensive use of the fast mesoscopic level within a prebuilt framework. In the case of HOV forecasting, network-wide shifts to HOV use – dealt with at the macroscopic level – had to be considered separately from conversion to HOV within the corridor, addressed at the microscopic level. With the Aimsun framework, these can be properly considered at the same time using the mesoscopic level. The same also applies to studies that included evaluation of HOV and HOT lanes, and general-purpose lanes as alternative uses of new highway lanes. ■

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AET? Yes we can...

With the technology to make all-electronic tolling a reality, what's stopping us from eliminating stop-and-go lines at the toll booths, lowering our operating costs, and reducing congestion? The answer is 'not much' for several trendsetting US agencies

by Victor Poteat, PBS&J, USA

The origins of AET lie in electronic toll collection (ETC), which was first introduced in Norway in 1986 with the addition of ETC booths along with cash tolling booths. Early-generation systems required drivers to slow to speeds of around 5mph at automatic tolling gates so their payments could be recorded electronically. The technology has advanced – and so has the toll booth infrastructure – such that cars can now pass through ETC-only lanes at around 25mph. ETC-only lanes are typically mixed in with cash lanes. This is an improvement in congestion that rewards transponder holders with faster lanes and less congestion. But bumper-to-bumper conditions still clog the cash lanes, though.

AET represents an advanced adaptation to increasing highway congestion by completely removing cash tolling from the picture. With open-road tolling (ORT), for example, the automatic gates are removed, and tolls are recorded via overhead gantries while vehicles continue at highway speeds.

Florida's prepaid toll program, SunPass, incorporates the latest AET technology

A WINNING COMBINATION

The developments in AET have inspired advances in highway lane designations – and vice versa. Innovative ideas for new forms of traffic management and land designations have driven AET technology. Together, AET and managed lanes are designed to help keep traffic moving.

High-occupancy vehicle (HOV) lanes are typically reserved for the use of vehicles carrying at least one or two passengers, along with the driver. In some places, they are being transformed into high occupancy toll (HOT) lanes to allow single-passenger vehicles to join the fast lane for the fee.

All over the USA, transportation agencies are converting lanes – whether they be toll lanes, shoulders, or dedicated roadways – to mixed-use managed lanes dedicated to mass transit, HOVs, emergency, and single-occupancy drivers willing to pay tolls. Toll rates are typically based on time of day, vehicle occupancy, and the number of axles.

Drivers can opt for predictable travel times in managed lanes. If they choose to use general-purpose lanes, they may still experience less congestion, because the managed lanes offer additional systemwide capacity. AET, however, maximizes the benefits of managed lanes by providing a non-stop travel option.

The Brooklyn–Battery Tunnel is a toll road in New York City which crosses under the East River at its mouth, connecting the Borough of Brooklyn on Long Island with the Borough of Manhattan

BIG PLANS IN TEXAS

Many agencies in the state of Texas have embraced tolling as their mantra for reducing congestion, enhancing safety, improving air quality, and expanding economic opportunity. The Texas Tollways program, for instance, is a statewide system of toll roads equipped with ORT being implemented by TxDOT. Hundreds of miles of tollways are already completed and many more miles planned. Texas drivers holding TxTag, EZ Tag, and Toll Tag can travel the Dallas, Houston, Austin, Tyler, and Laredo area without ever having to stop to pay.

The Harris County Toll Road Authority (HCTRA) in Texas implemented the first AET in the USA. Early this year, HCTRA converted an under-utilized HOV lane of Houston's Katy Freeway (I-10) into four managed lanes, freeing up space in the general-use lanes and making travel faster for everyone. The managed lanes are available to single-occupancy vehicle drivers who pay tolls, while HOVs may use them for free during peak hours.

In 2008, the Texas Turnpike Division of TxDOT completed the largest and most expensive toll road project ever undertaken in the state. The 62-mile Central Texas Turnpike System links three Austin area toll highways – Highway 45N, the extension of

The President George Bush Turnpike – a vital east-west route to the northern half of the Dallas Metroplex

Loop 1, and State Highway 130 – offering a combination of ORT and cash tolling.

The North Texas Tollway Authority (NTTA) has a comprehensive plan to improve mobility and enhance customer service by expanding and upgrading its toll facilities by converting to AET systemwide. As the NTTA is expanding, all of its new facilities are being constructed for AET. NTTA is also converting its existing network of 65 miles of toll roads, bridges and tunnels to an AET system. When NTTA's President George Bush Turnpike (PGBT) was converted to AET on July 1, 2009, it became the first major toll corridor in the USA to be converted from cash toll collection to AET. The Dallas North Tollway and the remaining NTTA facilities that currently accept in-lane cash payments are scheduled to be converted to AET in 2011. New projects – including the Sam Rayburn Tollway, the Lewisville Lake Toll Bridge, Southwest Parkway, and the Eastern Extension of the PGBT – will also be constructed as AET.

OTHER EXAMPLES

By converting Highway 167's HOV lanes to HOT lanes, the Washington Department of Transportation (WSDOT) was able to improve mobility in both the general-purpose and the HOT lanes. Drivers who use WSDOT's Good to Go! AET system cruise through HOT lane tolling stations at highway speeds.

Tolls for the HOT lanes go up when traffic is heavy and down when it's light, enabling drivers to maintain average speeds of at least 45mph at least 90% of the time. The success of this project is spurring other tolling operations in the region to do the same, and WSDOT has adopted a policy to consider a managed lanes approach to all new highways that are added to the state's roadway system.

Florida's Turnpike Enterprise's (FTE) statewide, prepaid electronic tolling system, SunPass, can be used on the state's FTE toll roads, its bridges and for parking at some airports. With an eye on safety and further easing congestion, the Turnpike Enterprise initiated the conversion of 266 SunPass ETC lanes to SunPass-only (AET) lanes in 2003. SunPass-only lanes allow customers to drive through tolling locations at speeds up to 25mph. Currently, 36 of the SunPass-only lanes are equipped with overhead radio frequency readers that automatically deduct tolls, allowing customers to travel at highway speeds through open-road (gate-free), express tolling (ORT) locations. Just one of these express lanes can accommodate more than 2,200 vehicles an hour – or five times that of a cash collection lane with a manned toll booth.

In 2008, the Florida Department of Transportation (FDOT) began the first phase of construction of the state's first managed lanes. By reducing existing lane widths of the I-95 corridor in south Florida from 12ft to 11ft, and reducing the inside shoulder width, FDOT was able to convert a five-lane freeway into two managed lanes and four general purpose lanes, providing drivers a choice.

The first 6.2 miles of the project were completed in 2009, with the entire project, extending from I-395 in Miami-Dade County to I-595 in Broward County, slated for completion this year. Similar to Washington's Highway 167, Florida's managed lanes have variable congestion pricing, designed to keep vehicles moving at a speed of 45mph at all times. HOVs and vehicles carrying at least three riders may use the managed lanes for free. FDOT estimates the project can save as much as 38 minutes during peak times.

Completely cashless tolling may soon come to one of the largest toll authorities in the world, New York's Metropolitan Transit Authority Bridges and Tunnels (MTA), which collects approximately US$1 billion in toll revenue annually. PBS&J will conduct a year-long study for implementation of cashless tolling at the seven bridges and two tunnels managed by MTA, including the Robert F. Kennedy Bridge, Verrazano-Narrows Bridge, and the Brooklyn-Battery Tunnel. The study will explore the technical, policy, and financial issues of converting to a cashless system, which would allow vehicles to pass through tolling points without the need to stop. The cashless system would make life a little easier for more than a million drivers daily and would supplement the authority's current E-Z Pass system.

STREAMLINED MAINTENANCE

To minimize the occurrence of undetected system malfunctions in AET lanes, Florida's Turnpike Enterprise implemented a software system that allows the maintenance and engineering departments to monitor the lanes remotely. The Toll Operations Team staffs the operations center around the clock to manage the electronic and mechanical components of the toll lane network, assessing incoming incident reports and responding to service and repair requests. When field equipment repairs are necessary, AET gantries such as those on I-95 express lanes in Miami-Dade County have retracting equipment arms to allow maintenance without interrupting traffic flow.

It's clear that the technology is available to convert our transportation system into a model for eliminating stop-and-go toll collection, provide mobility and enhance safety. As states continue to develop strategies for improving mobility, user-fee roads will be a part of the solution. ■

Vic Poteat is a senior vice president for PBS&J, located in the firm's Orlando office. He can be reached at VPoteat@pbsj.com or +1 407 647 7275. Watch PBS&J's related video, Driving Mobility, *at http://www.pbsjbuzz.tv and learn more about the advances in ETC, AET and ORT at PBSJ.com/tolls*

Detection tools

501 During Intertraffic Amsterdam, Xtralis Traffic Solutions launched four new series of traffic detectors within its ASIM range. The new lines are designed to be a new generation of traffic control and monitoring products, which are reliable, accurate and designed for long life in challenging road traffic environments. The new ranges include the IR 30x, a series of passive infrared detectors used to detect vehicles at larger distances or pedestrians within a 10m range, and the MW 334, which is a compact Doppler radar detector used for mobile traffic-light control. The different thresholds are adjustable to meet the requirements of any specific installation. The DT 372 is a combined infrared and ultrasonic detector that can count and detect the presence of stationary vehicles, while the DT 35x is a detector that combines radar with passive and dynamic infrared. It can be switched in a low-power mode to work with solar panels and can detect speed, vehicle length, gap time, traffic jams and can signal a wrong-way driver alarm. It can also be mounted sideways.

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Visionary approach

502 Basler Vision Technologies has begun production of the first four models in its ace series of compact area-scan cameras. ace is claimed to be the smallest GigE camera in its class with Power over Ethernet (PoE) technology. These models include both mono and color versions of the high-quality Sony ICX618 VGA and ICX445 1.3 megapixel CCD sensors, running at 100fps and 30fps respectively. Basler ace cameras are just 29 x 29 x 42mm in size and offer a wide variety of features, such as optoisolated digital input and output channels, a 60MB onboard image buffer and user sets for storing parameters.

The ace series was designed to make the GigE series available to new markets. The company believes that the combination of a small footprint and PoE technology makes this range unique. "Basler ace cameras are ideal for intelligent traffic systems and for robotics, electronics, semiconductor and medical applications," said Henning Tiarks, team leader of product management.

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"How do you communicate between independent truck drivers, a contractor and workers on foot to orchestrate traffic patterns inside the workzone?"

see page 40

Law and order

503 For traffic police to be able to perform their duties efficiently, they require equipment that won't let them down. The Hong Kong-based organization C4 Development offers a range of tools to assist the law enforcement officer. A popular line is the traffic police PDA, which incorporates a mobile terminal to record any illegal events that occur when the police officer is on duty. As officers do not want to be encumbered by many pieces of kit, C4 has integrated the PDA with its breath alcohol analyzer. There is also a magnetic card reader to enable offenders receiving an on-the-spot fine to settle immediately by credit card. An IC card reader connects with the police system, as well as GPS and GPRS to locate the position of the officer on duty and enable more efficient deployments of his time.

As frontline police officers are the first to reach crime sites, it is important for them to record what has happened. C4 manufactures a portable digital video recorder (PVDR) that it combines with a walkie talkie: the product is named TalkieCam. C4 is an experienced breathalyzer manufacturer and is the first company to offer a thermal printer and a keypad built into its breathalyzer product. All data can be recorded with detailed information such as license plate, driver name and license number. In 2010, C4 has launched two new breathalyzers with built-in printer, touchscreen and GPS. One is with touchscreen-only and the other has a backlit keypad, which is more convenient for police officers who are wearing gloves.

One challenge C4 has looked at is how to monitor drink-drivers and offenders under court orders for previous drink-related offenses. A wall-mounted breathalyzer is offered to assist in such cases. The device has a camera and facial recognition system, which can also be connected to the internet. If an offender is under a court order for surveillance, it can be installed in their home to conduct regular testing. It also has benefits for companies or fleet managers who have strict policies for ensuring workers do not conduct their duties after drinking.

CONTACT

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An eye on the scene

504 Camera expert VideoIQ has announced three new ranges of video surveillance cameras – the iCVR dome camera line, the iCVR-MP megapixel dome cameras and the iCST range of streaming cameras and encoders. All three lines are suitable for traffic, tunnel, bridge, car park or other infrastructure surveillance applications, and can be integrated with video management systems, command and control integration platforms, and access control systems.

The iCVR-MP delivers full 1,080p resolution and frame rate, zero-bandwidth recording, full megapixel analytics and support for VideoIQ IQTrack automatic digital PTZ and track system. They feature up to 0.5TB of intelligent, onboard Network Video Recorder (NVR) storage within each camera, which eliminates the need for centralized storage and reduces deployment costs, complexity, infrastructure, time and resources.

The iCVR dome camera also stores video up to 0.5TB of onboard storage for several months of recording, eliminating the streaming of images across a network to a central NVR, so reducing network traffic and bandwidth consumption by over 90%, compared to conventional IP video surveillance systems.

The iCST line of streaming cameras and encoders are designed for use with central storage and third-party video management systems. The line includes the iCST-MP, which delivers 1,080p video at up to 30fps. With almost seven times the resolution of a standard VGA camera, operators can digitally zoom in for superior detail, or cover nearly three times the horizontal area with a single camera, allowing the same area to be covered with fewer cameras.

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Q Conducting maintenance work on our roads should not be a dangerously high-risk career. How can we improve safety at workzones?

A "I believe that the immediate answer lies within risk communication. People will generally do the right thing if they appreciate the risk, understand the consequences, and are provided with a solution. Motorists, equipment operators, and workers simply need to understand the dangers they face in workzones and the best course of action to keep them safe. In many cases, taking the best course of action will require information tools, such as ITS-based communications and proximity warning/viewing devices."

Bradley M. Sant
vice president for safety and education, ARTBA, USA

A "I recently heard Gene Kranz talk about President Kennedy's mission to put a man on the moon. Kranz talked about Apollo 13 – the teamwork, dedication, communication, and persistent search for solutions under stressful conditions that brought the crew safely to Earth. What does that have to do with workzone safety? Kranz authored a book entitled *Failure Is Not An Option*. On both sides of the barrels, we must commit that failure to make workzones safe (not safer!) is not an option. We must exhibit teamwork, dedication, communication, and the persistent search for solutions. Each day we fail, more workers and road users die. Working together we can optimize the workzone system to the constraint that injuries and deaths equals zero."

David E. Fosbroke
statistician, division of safety research, NIOSH, USA

A "Development of workzone traffic control needs to move from reactive strategies to proactive strategies, and also to move from method-based to performance-based strategies. We know how a workzone will work from road to road, based on years of application, which should create the opportunity to design traffic control plans that meet the needs of the motorist, and how the motorist will react to the traffic control."

Brian Zimmerman
workzone administrator, Michigan DOT, USA

A "In today's information age, communication is king. Along the roadway, the ability to provide motorists with real-time data is essential. ASTI's mission is to provide both the motoring public as well as Departments of Transportation with as much customizable, relevant, up-to-date information as possible. The ability for both groups to be able to make informed traffic decisions based on accurate information is essential to reducing accidents while maintaining fluidity in a highly volatile area such as a workzone."

Noah Jenkin
director of sales,
ASTI, USA

A "If 90% of all accidents are caused by human error, then only so much improvement can be engineered into the system. Ultimately, it's the responsibility of drivers to adjust to conditions. We need to remind even good drivers that it only takes a fraction of a distracted second to be involved in an accident that could change their lives. Developing a driving culture that places a priority on responsible habits through education and enforcement would make workzones safer for both the traveling public and the workers."

Doug Steele
senior engineer,
Applied Research Associates, USA

A "Taking for granted that appropriate safety training can reduce workers' exposure to risk, I think there are two issues that increase the risk of workzone accidents. The first is speed, but driver distraction is also a worry. Speed can be controlled by introducing speed enforcement before the workzone, but an appropriate visual identification of the workzone should also reduce the risk. A combination of the three (training, speed enforcement, and visual identification of the site) could lead to a marked reduction of accidents. Obviously, each site is different and requires a specific solution: roadworks in a city street may benefit more from a visual alert than from speed control, whereas a highway workzone will benefit from well-positioned speed enforcement. There is not a single solution – but if there were, this would not be a 'Burning Question'."

Cosimo Cecchi
export sales manager, Sodi Scientifica, Italy

***TTi* READERS ARE INVITED TO ANSWER THE BURNING QUESTION FOR THE JUNE/JULY 2010 ISSUE:**

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

email answers to traffic@ukintpress.com

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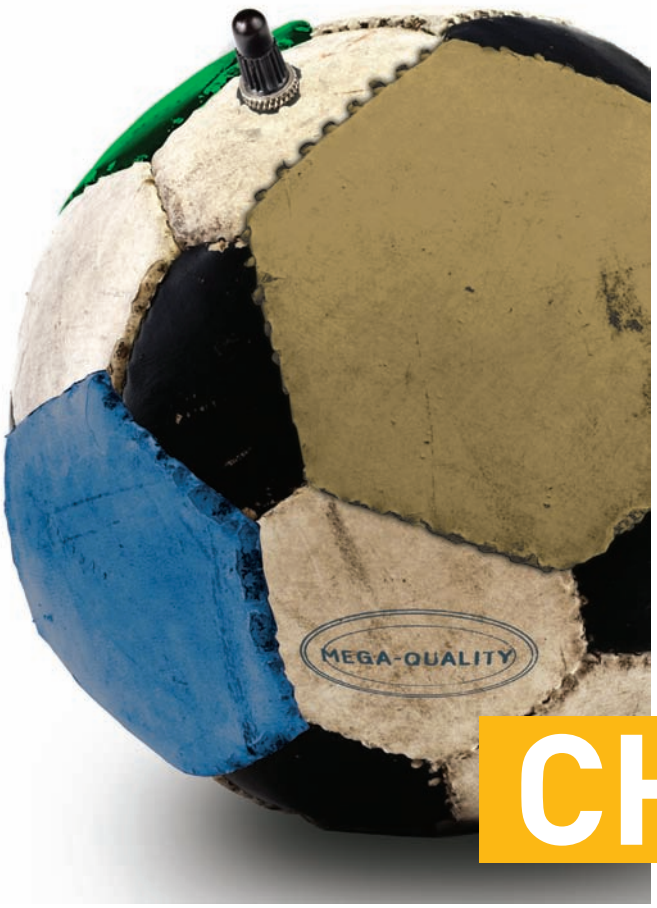
A The parts of this ball are produced by different manufacturers. The integrator is then forced to combine parts, test them, and put them together.

B The parts of this ball are produced by the manufacturer which is also the integrator.



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Q: Which ball is more balanced?

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