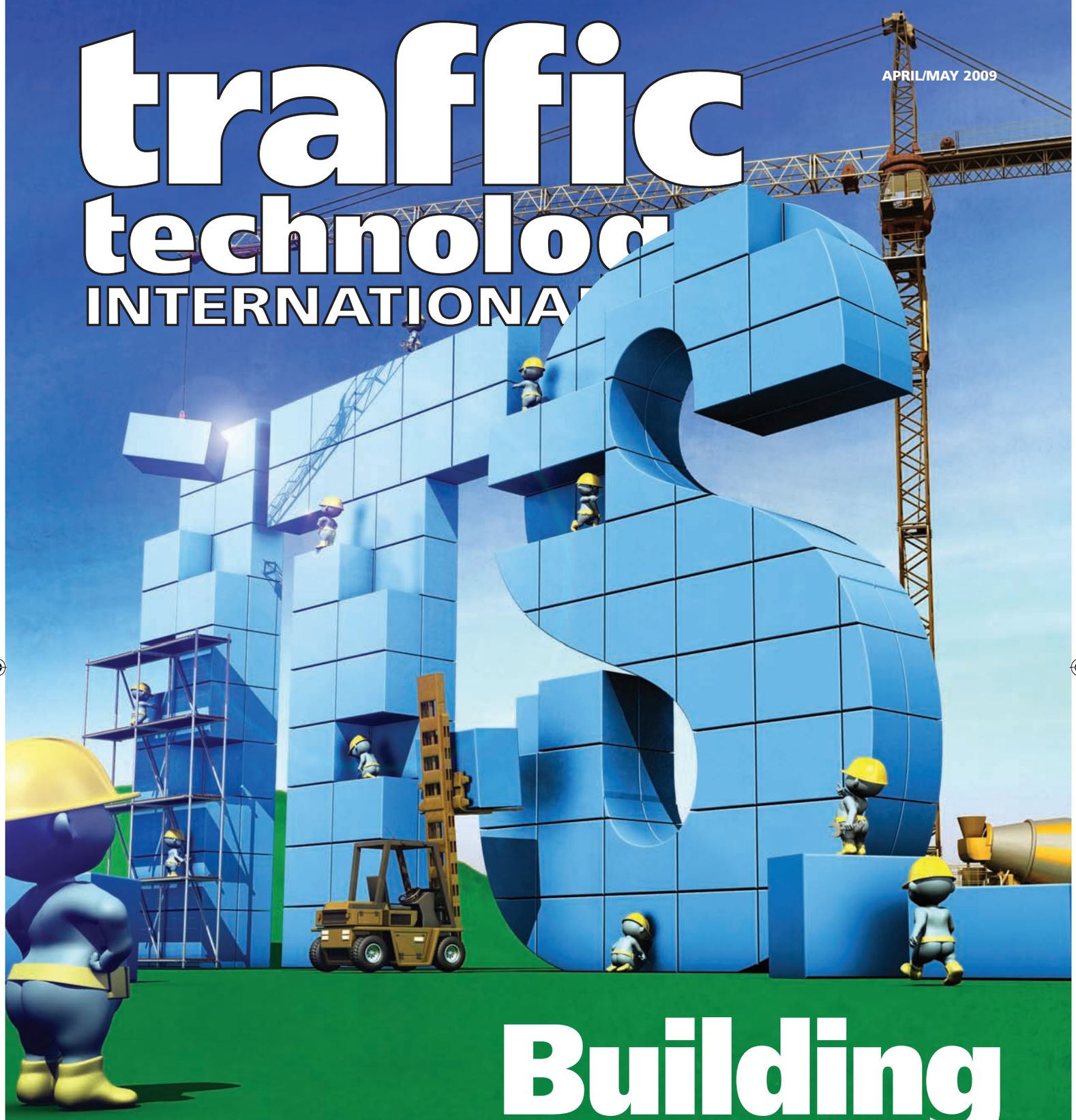
traffic technology INTERNATIONAL

APRIL/MAY 2009



Building blocks

Ethernet: the foundation of a flexible and cost-effective ITS network

Say 'no' to the jams

David Roper: Providing congestion relief in the real world of commuter traffic

Enemy of the state

Why Homeland Security *should* be part of the traffic manager's remit

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44 BUILDING BLOCKS
FOUNDATIONS OF SUCCESSFUL ITS

The rise of industrial communications networks and the crucial role they play today (and moving forward) in fostering the development of truly intelligent transportation strategies

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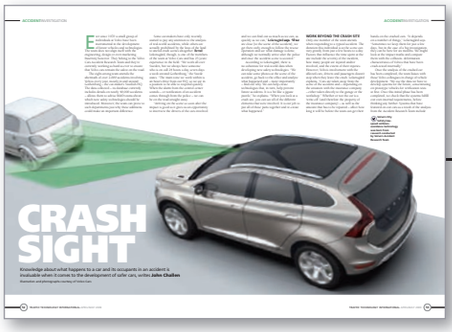

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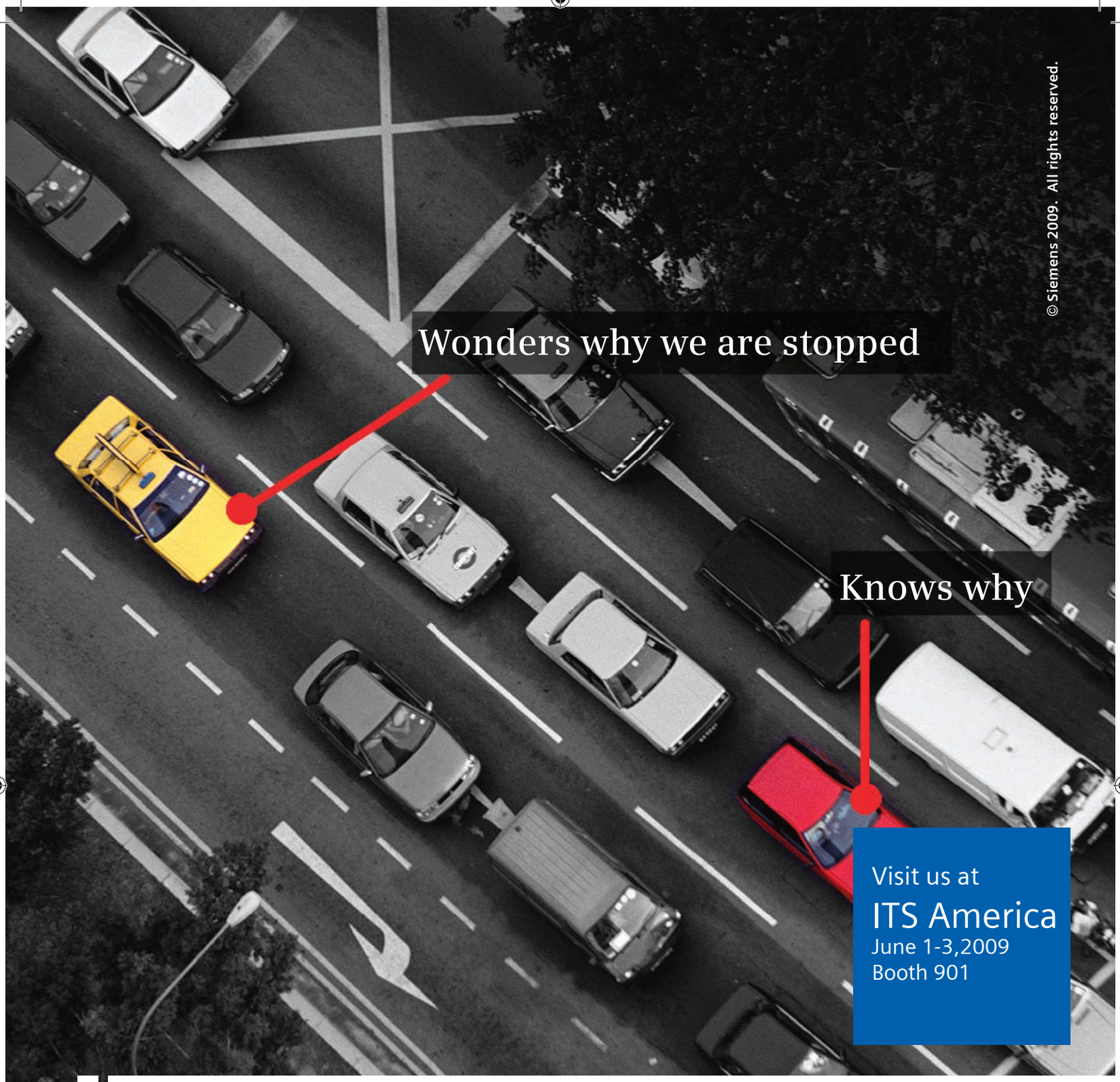

It's all about to change

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Spending spree

Christmas has come very early for states across the USA, as Secretary LaHood comes calling armed with a sack full of Stimulus cash

Main: President Obama, flanked by Transportation Secretary Ray LaHood and Vice President Joe Biden at the USDOT Below: A road-widening project kicks off in Missouri

LLOYD FULLER

Washington, USA Transportation stimulus dollars are being put to work all over the USA, as states kickstart their construction projects and, in turn, hopefully the economy. "As a path to restoring economic prosperity, the Stimulus investment in transportation infrastructure makes a great deal of sense," suggests Phineas Baxandall, senior analyst for Tax and Budget Policy, US Public Interest Research Group. "But it is critically important how the money gets spent. It is not enough to simply spend. Poorly thought-out transportation policies of the past have contributed to many of America's most pressing problems."

As companies clamor to grab a piece of the US$48 billion pot, reports of cut-price deals and price slashing are widespread. "The bids are coming in lower than we would have imagined," Secretary Ray LaHood admitted in an interview recently, adding that low bids should provide good value to taxpayers. If the low bids continue to come in, it could means that DOTs will get more for their Stimulus money.

"In a very short time, cities will be humming with construction workers, engineers, maintenance crews and many others," LaHood said. "You'll see roads repaved, interchanges improved, bus and rail systems repaired, upgraded and expanded."

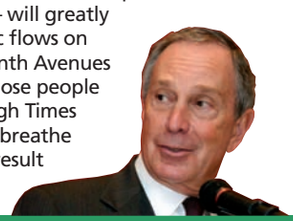
UK left fuming

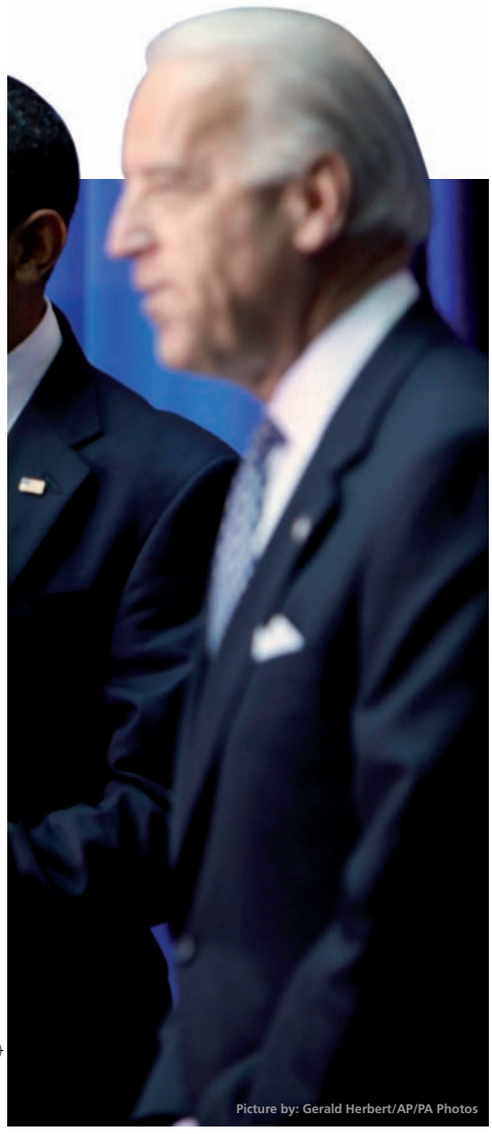
London, UK The UK has the most widespread levels of dangerous traffic fumes in Europe, according to a recent UK government report, with hundreds of Local Authorities breaching EU limits for NOx. The fumes on certain stretches of road exceed levels in 95% of cities and regions in the UK compared with 82% in Austria, 52% in Germany and 21% in France. The report says Britain will break EU air pollution laws and face fines unless it takes measures, such as subsidies for electric cars, or even a national road pricing scheme.

6 …billion pounds (US$8.8 billion) will be invested in England's road network, according to the recently published Highways Agency (HA) annual *Business Plan* for 2009-10. "We now have a defined major roads program for 2009-10 and beyond," says Graham Dalton, chief executive, "which includes rolling out Hard Shoulder Running and Active Traffic Management schemes on key sections of our motorway network… This will deliver greater benefits for managing and operating the road network, making journeys more reliable and safer."

Walk this way

New York, USA New York City mayor Michael Bloomberg and NYC Department of Transportation Commissioner Janette Sadik-Khan are hoping to combat traffic congestion in the center of New York by pedestrianizing sections of Broadway at Times Square and Herald Square. They claim that the pilot project – which will be opened later this year – will greatly improve traffic flows on Sixth and Seventh Avenues in Midtown. Those people who pass through Times Square will also breathe cleaner air as a result of the scheme.





Picture by: Gerald Herbert/AP/PA Photos

What's good for ITS is that the Stimulus is not just about large construction projects. In California, for instance, San Jose will convert 100 streetlights to LED technology in the coming months, and has requested up to US$20 million in Stimulus funding for an extra 25,000 more. As well as cutting the annual electricity bill of US$4 million, the LEDs feature transmitters that alert engineers when maintenance is needed.

The world according to Intertraffic…

Amsterdam, The Netherlands *Traffic Technology International*'s publisher, UKIP Media & Events, has joined forces with the organizers of Intertraffic to create a brand-new publication to be known as *Intertraffic World*.

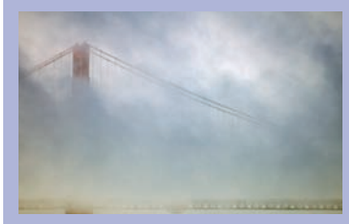
This +200-page journal will be launched later in the year and will focus on the major service and technology disciplines found within the vast halls of Intertraffic. *Intertraffic World* will be distributed to almost 20,000 engineers, specifiers and key decision-makers worldwide.

Graham Johnson, managing director, UKIP Media & Events, says, "*Intertraffic World* will build on the technologies and concepts that appear within these pages, adding to the mix highly focused articles and technical papers on the very latest road and vehicle safety systems, parking technologies, and road infrastructure products. It will unquestionably become the must-read annual showcase for any traffic engineer, city planner, vehicle engineer, or DOT key decision-maker."

Erik Dijkshoorn, domain manager Intertraffic Worldwide Events, Amsterdam RAI, adds, "*Intertraffic World* is an additional offering to the Intertraffic community and another step in developing Intertraffic's multimedia ambitions."

To pre-register for your free copy of *Intertraffic World*, please visit www.ukipme.com/intertrafficworld

Caltrans trial for Fog Pilot technology



Sacramento, USA Caltrans and the California Highway Patrol are working on a project called 'Fog Pilot', which uses technology to cut the frequency and severity of car crashes caused by fog and extreme weather. It is being tested on a 19km (12-mile) stretch of freeway along SR 99 in California's Central Valley. This particular stretch of freeway is notorious for dangerous fog conditions, and was the site of a deadly 86-car collision in November 2007.

As fog conditions increase in severity, traffic speeds tend to decrease rapidly. When you combine the rapid decrease in traffic speeds with decreased visibility, it makes it easy for faster traffic coming into heavy fog zones to collide with the slower traffic ahead. The Fog Pilot system keeps drivers updated on upcoming speeds and visibility in advance, so they can slow down and adjust their driving as necessary.

FOREWORD

Although our *Traffic Technology International* offices are 3,000 miles away from US shores, the sound of construction has been deafening over recent weeks as states across the USA spend the funds from President Obama's Economic Stimulus Plan. No sooner had the ink dried on his recovery strategy than the 'shovel-ready' projects to which he referred leapt into action. One of the first was in Missouri, where crews began work to widen a highway and build a new bridge, replacing one that was built more than 70 years ago. In Colorado, state officials say they have 127 structurally deficient bridges, 115 of which are 75 years old (an era in which today's traffic would have been unimaginable). These and many other projects are being financed, in part, by the US$48 billion injection into transportation's coffers, most of which is heading in the direction of highways – making it the largest single donation since President Eisenhower signed the Federal-Aid Highway Act.

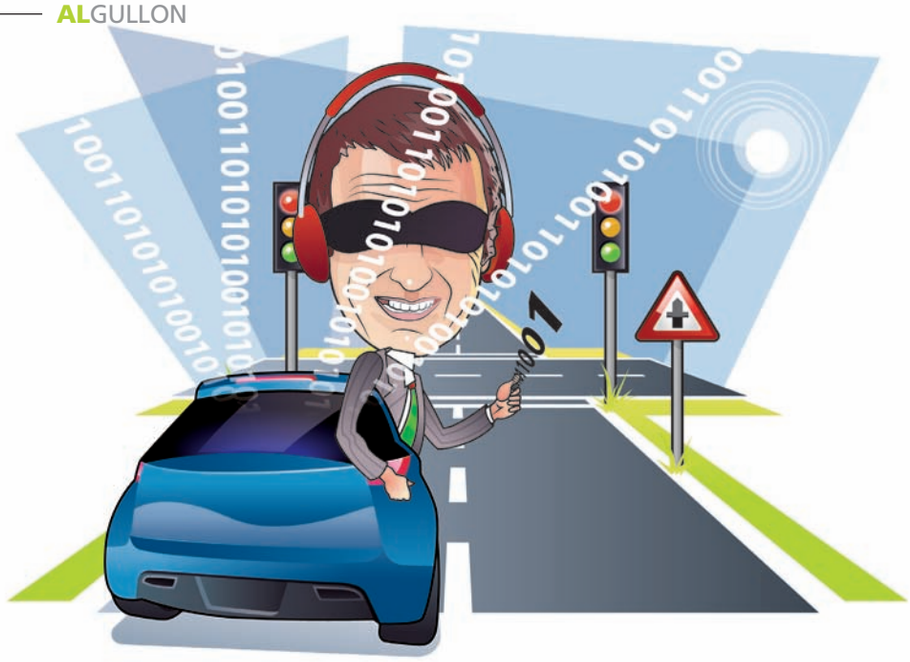
We've all heard and read – and in my case written – about the USA's 'crumbling and ailing infrastructure' so many times that it's become a cliché. But if the decibels emanating from the off-highway machinery pounding away at the asphalt in the USA are anything to go by, these funds are a welcome respite – even if they are a country mile short of bringing the whole network back to a respectable state of repair.

Whether or not this will have the desired effect of stimulating the economy is a debate for another day. But we should rejoice that projects are being fast-tracked. I am crossing my fingers that funds will be spent wisely – on HOV projects, ATM and Managed Lanes schemes, and, dare I say it, mileage/vehicle-based road user charges. The Obama Administration is encouraging innovative, outside-the-box ideas, and this sector could bore him with them. Is he prepared to listen – truly listen? Road repairs are one thing; ensuring that what moves on top of them moves efficiently is another matter entirely.

History is a wonderful asset and shows that in times of economic crises, those who invest and innovate come out the other side stronger. If President Obama and those beneath him really want to make the most out of the transportation asset – the lifeblood of the US economy – a sensible chunk of that US$48 billion must surely be spent on ITS.

Nick Bradley
Editor
Traffic Technology International

ALGULLON



THE APPROPRIATENESS (OR NOT) OF ACRONYMS...

Our controversial columnist takes issue with some (not all!) red light programs. Having something of a penchant for acronyms, he explains why they make him 'LOL'

by Al Gullon, Automobiles+Concepts+Environments, Canada

Without me noticing the moral imperative, two of my recent columns focusing on red-light cameras recommended strobe lights to alert AMPS-blinded drivers they were about to run through a junction in 'mid-red'. The 'moral imperative' arose during research for my 13th World Congress on ITS (London) paper, which advocated mandating black boxes c/w three video channels and concluded that "Even in the absence of… a legal obligation, consideration of the moral imperative alone suggests that a government cannot observe/record inattention on the part of the driver without also including a system to warn the driver when such misconduct becomes critical to… safety..."

Photo-radar and, for 50 years, the roadside radar trap are never put in places where '10 or 20 over' would be "critical to road safety" and thus the moral imperative has never arisen before. With that mindset of collecting fines for 'speeding' in non-safety-critical situations, it is not surprising that 'authorities' never noticed that red-light cameras, ostensibly installed to discourage drivers from 'misconduct critical to safety' but often installed/operated surreptitiously, were *ipso facto* being put in 'safety-critical' situations. They then collected the money without considering the moral imperative.

VII (and related acronyms) – while being necessary to save us from AMPS – is not aimed at collecting revenue but providing timely A&A (Advice & Assistance) when the traffic situation moves from 'normal' to SNAFU. [VII has made a move out of the obscurity of acronyms with 'IntelliDrive' – see *p*26]. But I have always been concerned that the 'Vs' in those acronyms meant vehicle and that researchers were assuming that passing information to the vehicle meant it had reached the driver's conscious mind. Not so. The AMPS-blind driver is also AMPS-deaf! And the time required to get through the AMPS 'earplugs' may not be available in 'safety-critical' situations.

I would recommend an important change to that acronym from V2V to Vio2Vic – Violator2Victim. And, in addition to my recommended white strobe light to warn all approaching drivers of a change from green to red, traffic managers should install a speed-distance photo-radar, capable of detecting a vehicle approaching at a speed too great to make a normal stop for the red, whether imminent or extant.

Upon making that detection, the device would fulfill the 'moral imperative' by activating both a red, fast-strobe light in the direction of the Vio and an orange, fast-strobe light for the potential Vic(s) in the cross traffic. Whether or not a crash ensued I would have no objection to the violator – having not reacted properly to the white strobe – being ticketed for dangerous driving based on the speed/distance measurement. ■

Please email feedback to al@alsaces.ca

Caught on camera

Reading, UK A new family of cameras has been unveiled by Vista, VNPRCe, which allows for the accurate and reliable capture of license plates for a range of applications. The cameras can be used as standalone units or in conjunction with the company's VNPR software, providing what it believes is an impressive "98% image capture rate for legal retroreflective plates". These new cameras have been designed to make installation as simple and quick as possible. Each comes completely preconfigured so that there are no complicated installation settings – installers simply need to ensure that the camera is pointing in the right direction.

All-round package

Richmond, Canada New traffic circle design software called TORUS has been published by Transoft. The company says that designing modern roundabouts is an iterative process in which small changes in the design can result in large safety and performance issues later on in the design process. The application was developed around dynamic editing tools, which give users the ability to considerably reduce the number of iterations needed while receiving immediate feedback on fastest drive paths and critical sight lines as the result of design changes.

The new software tool allows users to visualize the effect that minor changes have on traffic safety, as well as the operational performance of a trafic circle's design. It also gives designers the ability to manage multiple iterations within a single CAD drawing, allowing them to save, recall, and compare iterations easily without the need to create layers.

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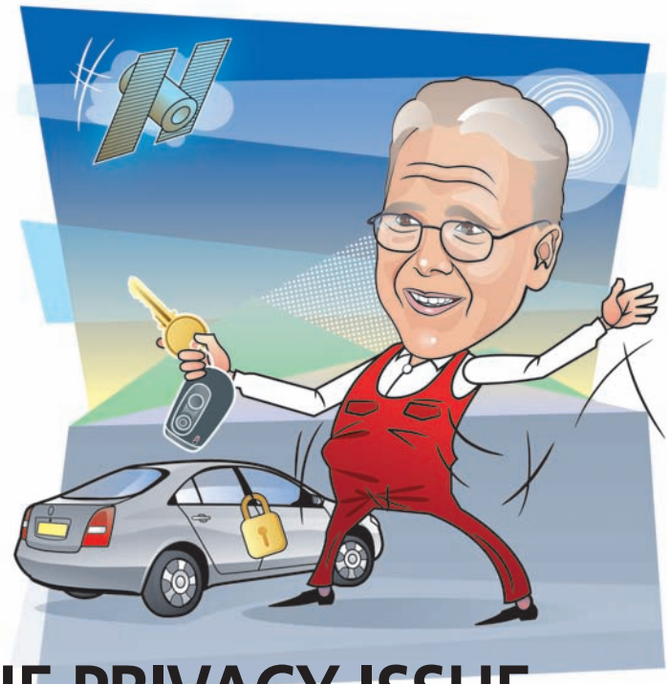


THE PRIVACY ISSUE

Although our road pricing expert is convinced the 'Big Brother' argument can be resolutely quashed by secure technology, he argues that political will is more of a worry

by Bern Grush, www.grushhour.com

The US Congressional National Surface Transport Infrastructure Financing (NSTIF) Commission in the USA recommended in its February report the transition from fuel taxes to a vehicle miles traveled (VMT) charge.

The commission pointed out that this could be done privately, even while using GPS (which can easily be done, and has been done). Nonetheless, the most common and consistent objection to the use of GPS for road charging is that privacy will be compromised. For some, this fear is real and arguably even justified. In the EU, legislative steps are being taken to ensure location data doesn't leave private vehicles when GPS is used. Bills are calculated with onboard equipment (OBE) that sends out billing data without any time or location information, or even by payment on board with a smart card. There are related ways to ensure that the OBE is working correctly and that payment is being made also without privacy invasion. Specifically, there is no technical requirement that any person know – or any machine outside of the OBE record – the location data from a trip for a road use charging system.

Indeed it is possible to provide anonymous onboard units that are prepaid (e-cash can be loaded anonymously). These devices can debit a trip and immediately erase all location data within three to eight minutes of stopping a vehicle, for extreme anonymity. In this case, to invade privacy, an onboard unit would have to be forcibly seized, decoded and uploaded within a couple of minutes of stopping a vehicle. That is immeasurably more private than the current RFID-type systems that we use for E-ZPass or SunPass in the USA.

The question is not whether privacy can be protected. It can be. The question is: what kind of legislation will the USA (and each state) enact? The EU is designing legislation that will not permit road-use meters to send location data out of the car to be provided to private vehicles. We must decide and enact the legislation we want here, in the USA, as well. We cannot tell motorists not to worry without pointing to such measures. It is not enough to say 'we won't' – we need to say 'we can't'. We need to provide metering systems that cannot permit privacy to be compromised.

Although privacy is not the only objection to VMT, it is the one we are wisest not to dismiss. The USA has a longstanding social contract that we may go anywhere we wish and do anything we wish with whomever we wish – as long as it is legal. Whether they like VMT or not, Americans will expect to be able to continue doing this. Not addressing this clearly and unequivocally is to reduce the likelihood of acceptance of VMT charging. The sooner we do this and begin educating motorists, the sooner we begin rescuing our surface transportation network. ■

Any comments to bgrush@skymetercorp.com

Obama pushed on speed limiters

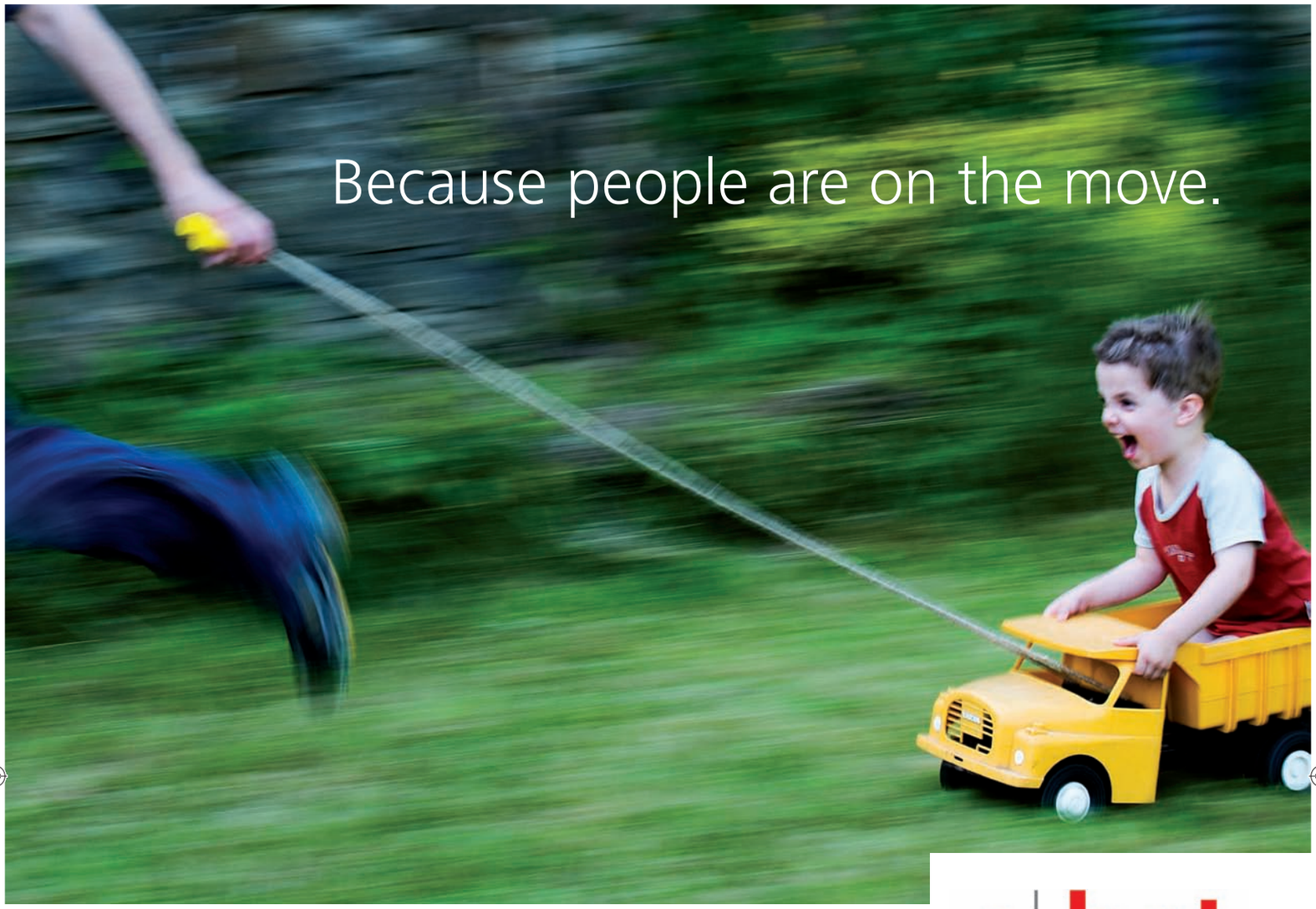
Atlanta, Georgia The pressure group, Road Safe America, has been lobbying the new Obama Administration to mandate the use of speed governors on US trucks.

All trucks of 13 tons or more built since 1992 are fitted with speed governors, although drivers are not required to use them. Road Safe America, however, says it would be a simple task to activate the governors and initiate a "common sense, inexpensive regulation" that would save the lives of many of the around 4,000 motorists and 1,000 truckers killed each year in crashes involving big trucks. The Bush Administration opposed the regulation requiring governors.

Route master

St Paul, Minnesota The Hong Kong Transport Department has opted for Image Sensing Systems' Autoscope video vehicle-detection technology for expansion of the island's Journey Time Indication System. The Hong Kong system displays estimated travel times in real-time at key diversion points in the roadway, allowing drivers to select the optimal cross-harbor routes to and from Kowloon peninsula and Hong Kong Island. The travel-time data is calculated through a sophisticated algorithm using traffic data detected by the Autoscope system. Overhead roadway signs clearly display the estimated times, in doing so making it convenient and safe for route selection. The new expansion includes 20 units of Autoscope Solo Terra, increasing the total deployment of Autoscope in this application to 41 units.

Traffex 2009, 21-23 April, Hall 5, Stand E10



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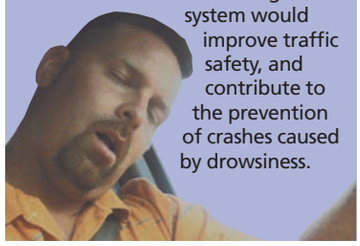
Sleep declaration

Linköping, Sweden VTI has been studying warning alerts to combat driver drowsiness. Sound was reported as most disturbing and effective, while belt vibration was seen as least disturbing – but also least effective. Results were related to volume of the sound and amplitude of the vibrations.

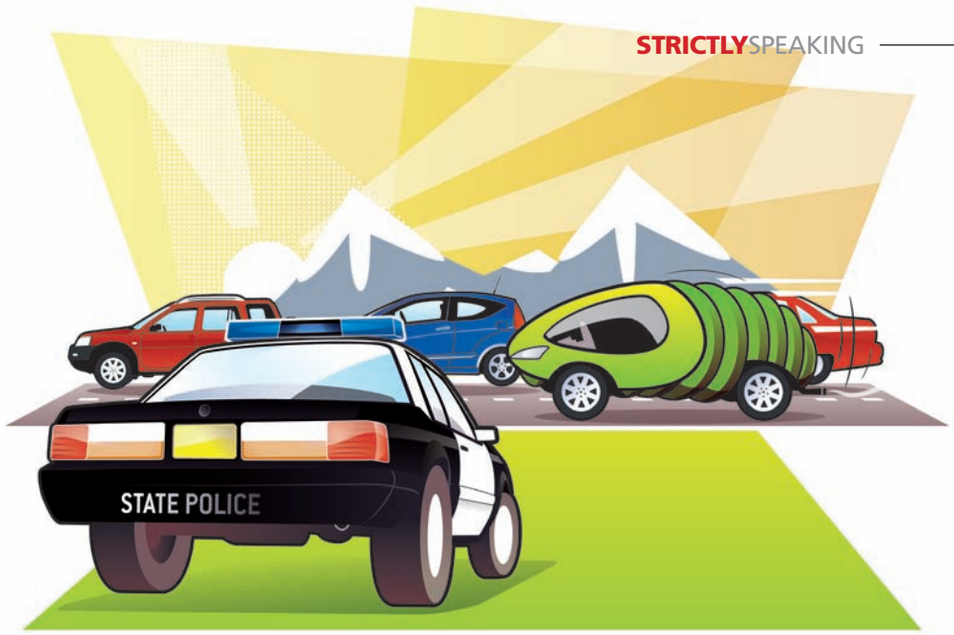
More than 70% of drivers said the warning had influenced their driving and 85% thought it made them more alert, while 55% said they had helped them to stay awake. The warning was easy to understand, and the drivers felt it was clear what was expected from them. Almost all thought the system would improve traffic safety, and contribute to the prevention of crashes caused by drowsiness.



Support for average speed enforcement

Perth, Australia More than 3,000km of Western Australia's roads would be covered by average speed cameras under a plan that has won the support of assistant commissioner, Steve Brown. The state's 'top cop' describes the cameras as the "ultimate model" for enforcement, while police minister, Rob Johnson, says they are a "great initiative for ensuring that people travel within the limit".

The proposal to use average speed cameras with a mixture of handheld radars, fixed cameras and Multanovas (Doppler radar-based speed cameras), was detailed in a government-commissioned report released in 2008 by Monash University's Professor Max Cameron, who estimated the model could save dozens of lives a year on Western Australian roads. He says it would probably cost more than US$14 million (AUS$21 million) to install the cameras to monitor 74km of metropolitan freeway, 248km of Perth roads, and 2,990km of regional roads.



DRIVEN TO DISTRACTION

Police authorities face a continual battle with driver stupidity and recklessness. Could in-car CCTV be the deciding factor in encouraging drivers to modify their dangerous behavior?

by Julian Cooke, Traffic Safety Systems, UK

As a supplier of in-vehicle CCTV roads policing solutions, I shake my head in disbelief at the dangerous and foolhardy behavior exhibited by drivers, on an all-too-frequent basis, which has been caught on camera.

When it comes to road safety, it is not just the disruption that accidents cause to the smooth flow of traffic – which can be problematic enough on main arterial routes – that gives real cause for concern. More worryingly, it is the fact that incidents involving automobiles have become a real public health issue to the extent that for some regions the rate of fatalities surpasses that of many serious illnesses. In fact, a report from the World Health Organisation (WHO), on the back of soaring car ownership, suggests that road traffic accidents could outstrip stroke and HIV as one of the main causes of preventable deaths worldwide by 2020.

The reality is that for some drivers, cocooned inside their cars, it is all-too-easy to become detached from the world outside and forget the potential for serious injury or worse which can result from an out-of-control vehicle. We are seeing, as traffic volumes grow, and time pressures on drivers increase, a greater willingness to take risks and drive without due care and attention, putting their lives and those of others in jeopardy. Sadly, behavior such as tailgating, rapid lane changing, road rage, undertaking, using mobile phones while driving or even eating and putting on make-up is all too common.

Working with police forces in regions such as the Middle East, I am reminded time and again of the potential for things to go badly wrong and the need for the right technology to be in place to clamp down on the culprits. One particular area of concern is emergency lanes and hard shoulders, where vehicles are traveling illegally at speed to avoid queues; the danger here is that cars using the lanes for breakdowns are liable to be hit from behind. There have been a number of fatalities in the Middle East related to high-speed impacts where lawbreakers have crashed into the back of static vehicles.

Thankfully, there is a growing consensus among authorities in both the developed and developing world regarding the need to take action. Many are turning to in-car CCTV as, unlike fixed cameras, they are better placed to capture specific patterns of driver behavior and be rapidly deployed to hotspots across the network so drivers know, wherever they are, that there is the potential for a suitably equipped police vehicle to catch their transgressions.

The hope has to be that with advances in technology, greater education of drivers regarding the dangers while on the move, and a more aggressive approach by authorities, that the worst predictions for accident fatality rates in the years ahead will not come to fruition. ■

TO 'V' OR NOT TO 'V'?

Misener calls upon his Shakespearean wit to address the often perplexing issue of V2V communications, and finds himself asking the question, 'What would William do?'

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

Some believe that V2V communications enabled by DSRC – at near 5.8GHz in Japan and 5.9GHz in the USA and Europe – is the Smart Car breakthrough. They feel the 'I' or infrastructure is no longer the issue, as infrastructure operators are not motivated to apply futuristic wireless technologies for safety and mobility, rending impractical vehicle-to-infrastructure (V2I) or infrastructure-to-vehicle (I2V) communications.

This is a retrenchment of the idea that the road authority is an integral element of the safety and mobility equation. In this brave new world, vehicles and not road operators would shoulder these responsibilities. Moreover, we should dispel the notion that DSRC along the roadside would be the gateway to landside operations. Let's now forget about relaying local safety information such as traffic signal phase and timing. Let's forget about safety information from DSRC-enabled probes, such as location of potholes or slippery roads. Oh, and let us 'uninvent' DSRC-enabled services as obtaining traffic state information from vehicles, electronic transactions to include commercial services and maybe tools such as dynamic tolling.

I submit that if I was a 'V' listening for another 'V', it may take many years until I heard even a peep. Consider that the very definition of V2V dictates that its utility is expressed as a function of (percentage of market penetration).

Let's pretend that V2V is offered by 10% of new cars, or perhaps one million new cars a year. On a base of perhaps 250 million vehicles on US roads, that's a penetration of 0.4%, rendering the probability of V2V interaction at, what, 0.16%? Okay, let's mandate DSRC on all new cars, upping the probability of V2V interaction to a whopping 1.6%. Clearly, someone needs to subsidize the purchase of my very quiet DSRC radio until my 'V' finally begins to hear other 'Vs'…

Consider that my colleagues and I have installed 12 DSRC roadside transceivers near my San Francisco home, which we serve through a backhaul network to our lab. In such a scenario with but a modest investment in V2I, the very first DSRC-equipped vehicle realizes some potential benefit as it hears another DSRC unit during its daily travel, and therefore is subject to safety or mobility services. This enables potential value proposition upon the first use and could obviate that pejorative verb, 'subsidize'. Yes, I submit that the Bard was right:

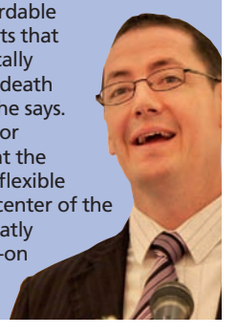
To V or not to V, that is the question;
Whether 'tis nobler in the mind to suffer
The crashes and fatalities of outrageous fortune,
Or to take DSRC against a sea of traffic,
And by opposing, end it. To die, to sleep;
No more; and by a sleep to say we end
The heart-ache and the thousand natural shockwaves… ■

80

…million dollars is the value of the contract that AECOM has been awarded for design and construction management services for the modified Central-Wan Chai Bypass and Island Eastern Corridor Link plan in Hong Kong. When completed, traffic will bypass the heavily congested existing roads along parts of the island's north shore via a 3.7km tunnel. "This will relieve congestion, improve the environment and create jobs in Hong Kong," says John M Dionisio, AECOM president and CEO.

iRAP assessment targets Vietnam

Basingstoke, UK The International Road Assessment Programme (iRAP) is currently inspecting over 3,000km of Vietnam's highways. The project is expected to be completed in April, with analysis of inspection data and production of the Targeted Road Safety Plan occurring in the second half of the year. iRAP Asia Pacific CEO, Rob McInerney (pictured), says the iRAP Vietnam project will use the latest digital-imaging technology to inspect 3,000km of the nation's high-risk roads, including 2,000km of National Highway 1, which connects Hanoi in the north with Can Tho in the south. "The inspections will help us to identify affordable improvements that can dramatically reduce road death and injury," he says. "We know, for example, that the provision of flexible posts in the center of the road can greatly reduce head-on crashes."



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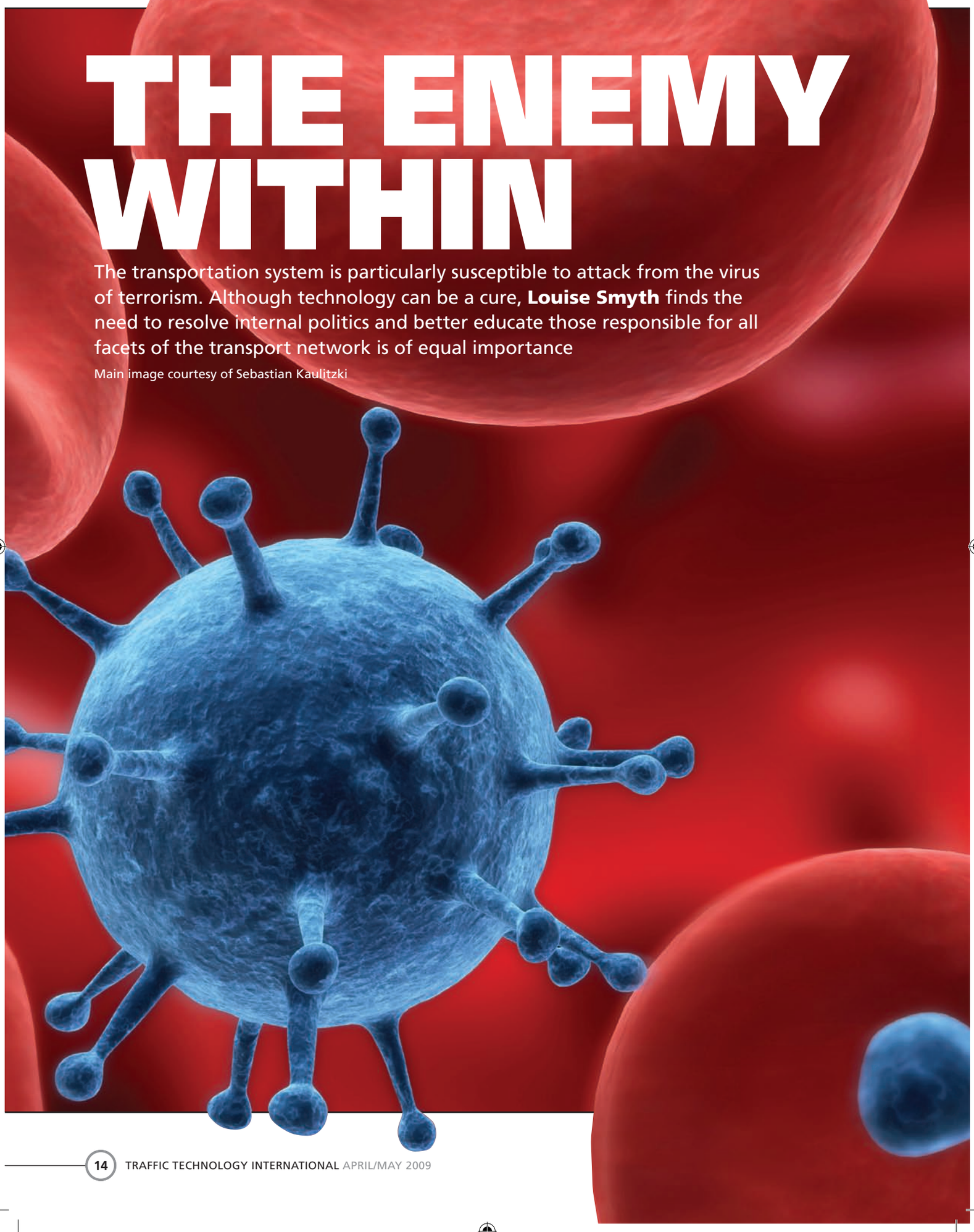
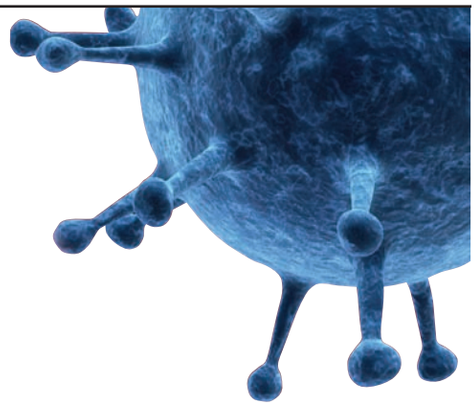
THE ENEMY WITHIN

The transportation system is particularly susceptible to attack from the virus of terrorism. Although technology can be a cure, **Louise Smyth** finds the need to resolve internal politics and better educate those responsible for all facets of the transport network is of equal importance

Main image courtesy of Sebastian Kaulitzki





If the hit TV series *24* is to be believed, terrorist threats to the transportation network can be dealt with swiftly via real-time communication between agencies responsible for different modes of transport, with full cooperation from various governmental departments, and with absolutely no infringement of civil liberties. But given that Jack Bauer is able to drive from any part of Los Angeles to any other within 15 minutes, some doubts arise as to the authenticity of the transport-related storylines in the show...

In an ideal world, reality would match the scenario outlined above. But we are not even close – yet. The transportation network (particularly roads) is an inherently vulnerable infrastructure. Certain elements such as bridges and tunnels are flawed by design, which isn't surprising given that they were constructed before many of today's modern explosives and chemical warfare agents were conceived. In others, such as land borders, safety and security have always been carefully considered – so, too, have various ways to defeat the strategies put in place. These are the natural hazards of a system that is open and accessible to all.

THE WEAKEST LINK?

US agencies such as the Transportation Security Administration (TSA) are making progress in this field. The TSA's Office of Transportation Sector Network Management 'leads the unified national effort to protect and secure the nation's intermodal transportation systems'. The key word here is 'intermodal'. When considering the issue of Homeland Security, all transport modes must be regarded as a whole. Weak links in any sector must be strengthened – and this is something that the TSA, the FHWA, and others are working toward.

With an impressive resume behind him, Dr Clifford Bragdon is currently leading the efforts to establish a Global Center for Preparedness (GCP), to be headquartered at the Florida Institute of Technology. It is being supported by a consortium of the military, businesses (including Lockheed Martin and Raytheon), government agencies, non-profit organizations, and academia.

Construction begins shortly and Bragdon is eagerly awaiting the opening in the third quarter of 2010. "It will be a 10,000ft² facility, inside of which will be the 'Fusion Theater' – the 'Spielberg' of global preparedness, dealing with sound, aroma, vibration, and vision. We're also building a DREAM (Dimensional REality And Multisensory) simulation so we can conduct strategic analysis and 'what if? scenarios', whether they be traffic, traffic security, or logistics. Bragdon is keen to stress that simulation is just as practical as it is academic, and that this is not just theory but affects reality. "We've conducted simulation for the world's largest commercial port for cruise ships, Port Everglades," he says. "In a virtual world, we blew up one of the biggest ships in the world while it was in the harbor, then went underwater, into the air, and so on, to show what the impact was. My kick is prevention rather than response. We were spending too much money on response, rather than creative approaches to get these things under control at the start."

THREAT ANALYSIS

This is a lot easier to say than to do and Bragdon freely admits that threats to the road network in particular (whether natural disasters or terrorism) are a worrying priority: "I've rated the threat analysis of all modes," he explains. "Intermodal is at the top, followed by rail and transit. Aviation is pretty far down the list. The problem is that road systems are pretty free of diagnostics. We don't spend any time on that; we assume that a road is a safe system."

To be more proactive on US roads involves working within the confines of a well-established infrastructure, pinpointing weaknesses and finding ways to overcome them. Bragdon refers to a current project in New York, where some bridges are being equipped with preventive measures, such as encasing spans so they can't be penetrated by explosives or high-speed saws or torches.

Looking ahead, Bragdon takes issue with the way 'sustainable' is perceived by those in transportation: "Whether we rebuild a bridge, as in Minneapolis, or start from scratch, long-term survival is about more than the potential for age; it's about potential threat." If a threat becomes a strike, VII-type systems could come to the fore: "Vehicles are becoming warning systems due to the passive information technologies that they integrate: if there is a threat – a natural accident or anything else – these are now being put into almost real-time situations that can be interfaced with the public."

The move toward intelligent surveillance, simulation, and communications is certainly a step in the right direction but again there is an inherent flaw in the design: "Even our smart systems for monitoring behaviors have been set up by modes of transport, and are not intermodal," Bragdon explains. "So you have good roadway networks, but do they interface with highways and ports? No, that just doesn't happen. An airport controller knows nothing about what a harbor master does and a harbor master knows nothing about what a traffic engineer does.

"In the USA we have more than 47,000 miles of Interstate, 600 bridges over 20ft in length, 54 tunnels, over 50 freeway traffic operations centers, and 300 municipal centers. They cannot operate independently of each other, so intermodal connection systems are going to play an important role."

Bragdon is not alone in this approach and the USA is seeing the growing development of joint-use systems – whether for underground utilities, cabling networks, or other purposes. And there are companies working on ways to make those systems better protected. "The next thing we're doing is preventive design of communications systems," Bragdon reveals. "We're working on a project called Garret Place, which is a secure building that can be protected against any threats (including cyber terrorism) and can sustain itself. There's great interest to start building these 'citadels' – not complete cities but economic city networks that are based on safety and security in their design."

MILITARY MANEUVERS

One man familiar with such citadels is Drew McBryde, director of Command Management Capabilities for Raytheon's

"We were spending too much money on response, rather than creative approaches to get these things under control at the start"

Dr Clifford Bragdon, *Associate Provost, Dean of the University Colleage, Florida Institute of Technology, USA*

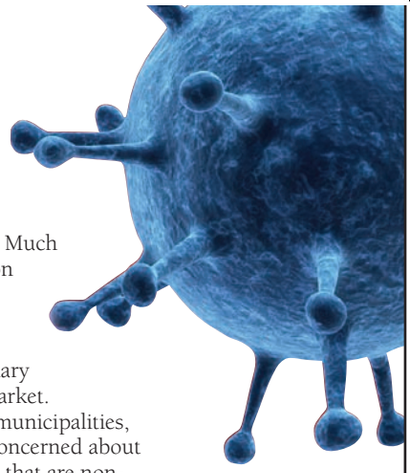
The honey trap

One organization is taking a more natural approach to security screening, by using specially trained bees to sniff out anything untoward. David Grant is a development scientist with the UK company Inscentinel.

"Inscentinel is now finalizing the development of a prototype handheld detector – the VASOR (Volatile Analysis by Specific Odour Recognition)," Grant explains. "This is a multiple-substance detector that can be used for many applications, including the prevention of terrorist atrocities. The fully working prototype will be tested by the UK Home Office later in the year to assess its capabilities in real-world situations. This is an exciting step for Inscentinel – from previously demonstrating the technology in the laboratory to proving that it actually works."

Grant continues, "As the bees are held within a small detection 'box', the end-user and members of the public need not know they are involved at all. The output is a simple 'Substance Detected' or 'Clear'. The technology is therefore unique in combining the biological sensitivity similar to a sniffer dog with the ease of use of an electronic system.

"It is envisaged that the system will be used at airport security (or on other modes of transport) in place of current electronic trace detectors to screen passengers and their luggage, and the trials with the Home Office will be geared toward this kind of scenario. Inscentinel's bees can be trained to detect virtually anything that smells. They could be used to screen for explosives, narcotics, or even counterfeit goods. As the technology is handheld, it can be used almost anywhere."



Network Centric Systems. Much of his career has focused on military defense, but in recent years he's been tasked with bringing the expertise garnered in military applications to the civil market. "More and more entities (municipalities, states, governments) are concerned about terrorism and civil aspects that are non-defense related. We are currently bidding on the safety and security for the King Abdullah Economic City in Saudi Arabia. The Kingdom of Saudi Arabia has decided to build some economic cities and this is the first one, occupying 162km^2 of land. There will be a gated community of 1.5 million residences, it will have a sea port through which 20 million containers a year will pass, an industrial zone, a financial district, as well as resort and residential zones. All of the traffic management, safety and security is open for bidding, and we want Raytheon to be the technical provider. Just one agency will be responsible for the police, fire, traffic and access control. Ultimately, 70,000 video cameras will all be tied into one command and control center."

McBryde relishes the opportunity to work on a project that is safe by design. "It's a blank slate where they can start from scratch and put in place not only the infrastructure but the concept of operations and the information exchange," he says.

The Advanced Spectroscopic Portal (ASP) is a nuclear screening portal system designed to identify and interdict the illegal entry of nuclear devices and materials into the USA

NYPD cordons off roads near Grand Central Station during an investigation

"In Saudi Arabia, the Ministry of Interior is responsible for a lot of that, so they don't have the challenges that we have in the USA in terms of working with many disparate agencies that are already in place."

Raytheon is also heavily involved in road traffic. Jon Ramirez is vice president of Highway Transportation Management Systems at the company, and he's noticed various security issues coming under the traffic manager's remit: "The interesting aspect is the capture of a vehicle's license plate and then determining as a public body what you're going to do with that. In our case, we pass them along to the authorities so, for example, they can charge that vehicle for coming into a particular area, but the application is obviously very well suited to security." Ramirez explains that Raytheon has already conducted some pilot projects for defense arms of the US government to test this type of technology, although he says the key to bringing traffic technology to the security market is better coordination on the part of the relevant authorities: "It's a whole different application from an enforcement situation. We have to deal with the civil liberties aspect, so we're dealing with different agencies – either state or local. They are usually run by publicly elected boards, and can be skittish when it comes to doing anything that may have an impact on civil liberties."

Expert opinion

Currently Associate Provost, Dean of the University College at the Florida Institute of Technology, Dr Bragdon is an authority on intermodal transport security. His most recent book, *Transportation Security*, was published in 2008 and he has been invited to the Office of the President twice in the past year as a result of his international reputation in intermodal transport safety and security. Bragdon holds a US Government Patent for inventing the Intermodal Transportation Simulation System (ITSS). This is capable of simulating all transportation modes (by air, land, and sea) in both 3D and 4D, and was recognized by *Newsday* as one of the 21 most-important new inventions for the 21st century. He also established and directed the Center for Intermodal Transportation Safety & Security – a US$10 million federally funded facility involving 12 public universities and coordinated by USDOT.

Picture courtesy of Mohammed Javed/AP/PA Photos

Pakistani police officers check vehicles after a security alert in Islamabad last June. Authorities arrested three suspected suicide bombers and seized more than 1 ton of explosives; a prime example of the transport network being used for terrorist activities

"The key with CCTV-based systems is not just what is detected, but also in knowing what to ignore"

Ivy Li, *co-founder and managing director, iOmniscient Corporation*

Raytheon is known for its security technologies. As well as license plate recognition systems, in its armory it also boasts radiation detection, x-ray scanning of vehicles for potentially hazardous materials, vehicle tracking technology, and so on. But the usefulness of such solutions has to be questioned if their potential is diluted by people's wariness of using the information they gather. What use is tracking a potential terrorist on the road network if nobody will act on the data? Ramirez has a rather worrying anecdote to illustrate this problem: "I recently had a meeting with the head of a large DOT, and I mentioned to him that his DOT monitors vehicles that carry dangerous loads, meaning people have to register to carry these loads on the road. Once they register their trip, the DOT has no idea where they are – they know they're going from point A to point B in a particular timeframe, but that's all. So we pointed out this public safety hazard and explained that we could track those vehicles and let the DOT know exactly where they were. He was absolutely not interested."

SEE THROUGH THE CROWD

Mercifully, this attitude is not preventing companies from working on ways to deal with potential threats to the transport network. iOmniscient is one such company that is heavily involved in technology for border security. Ivy Li, co-founder and managing director of iOmniscient, explains her organization's approach: "The entry point for most countries consists of airports, ports, and railway stations. These tend to be very crowded areas. Traditional motion detection-based video analysis is useless in such places as it operates on the basis of comparing two images and seeing if there is a difference [the difference being classified as someone moving]. In an airport there could be hundreds or even thousands of people moving around. To be of any use, a system has to be able to detect abnormal behavior in such a crowded scene." iOmniscient has internationally patented software that copes with crowded scenes, which is able to detect suspicious bags that may have been abandoned.

"A really useful feature is the Nuisance Alarm Minimization System (NAMS), which is based on artificial intelligence," Li says. "The key with any CCTV-based system is not just in what is detected, but knowing what to ignore so that you don't get thousands of false alarms each day."

The recent introduction of iOmniscient's IQ Hawk system enables detection and identification to be conducted at the same time on the same camera using a facial-recognition capability to identify people who may be on a 'wanted list'. This is a highly useful tool for any border checkpoint. iOmniscient's CEO, Rustom Kanga, makes an interesting point about why IQ Hawk goes beyond traditional surveillance systems: "We have found that PTZ cameras can easily be defeated by anyone who understands them. If a camera is watching a scene and someone jumps over the fence on the right-hand side, the camera will zoom in on him. However, if he is a decoy then another five people could jump over the fence on the left and they will be missed. We developed IQ Hawk to overcome this."

Technological innovations such as this are good news. But until enough people in the transport sector start making Homeland Security an integral part of their remit, and start communicating more effectively with other modes of transport, our road networks will not be as well protected as they could or indeed should be.

EXTRAS ONLINE

In a web-exclusive article – *Protecting the unprotectable* – AECOM's David Faust and William Sewell look at securing where the rubber meets the road **www.traffictechnologytoday.com**

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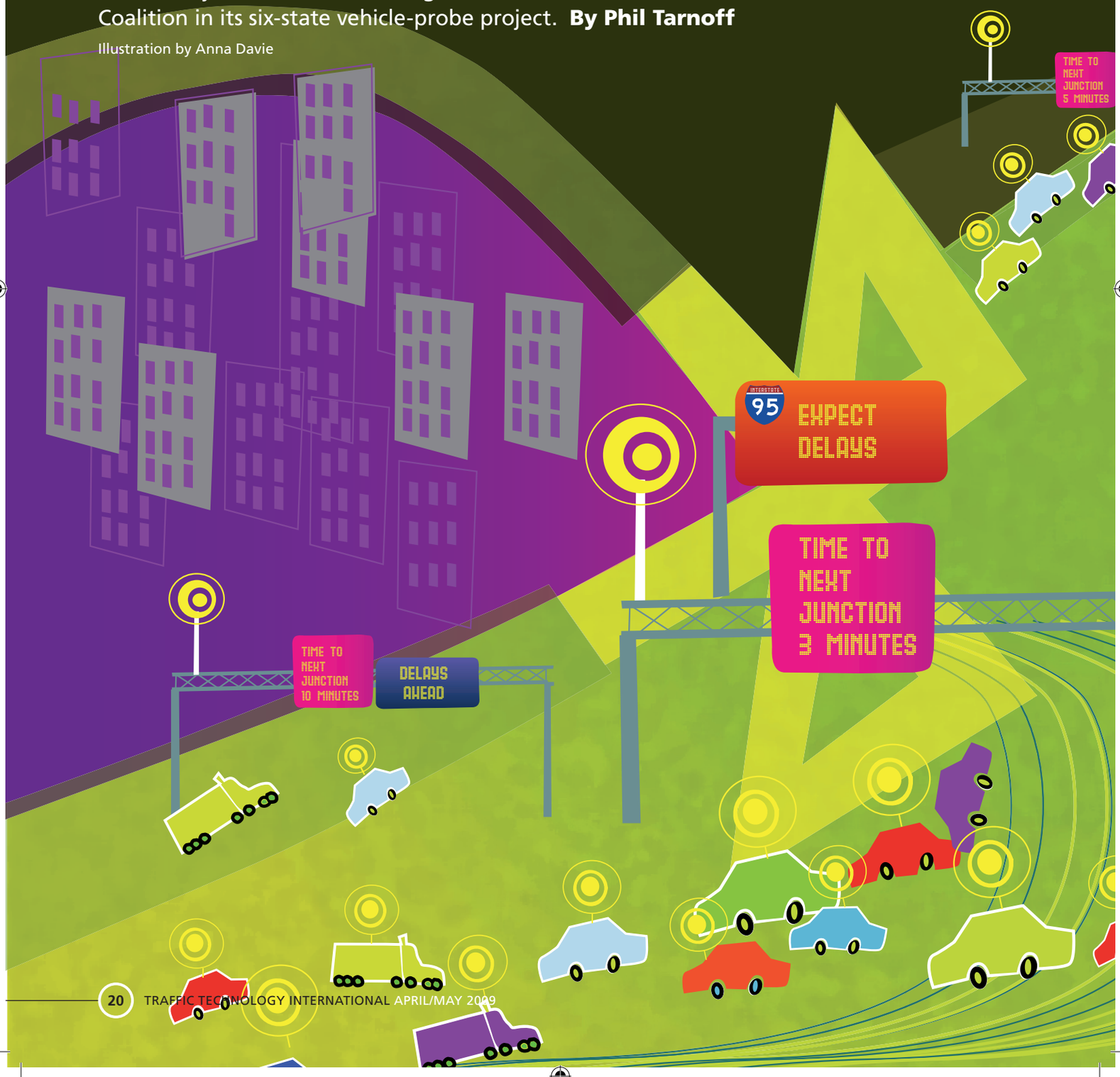
MADE TO MEASURE

Bluetooth revolutionized communications when it was launched in 1998. Today, its accuracy is such that it is being used to validate GPS data for the I-95 Corridor Coalition in its six-state vehicle-probe project. **By Phil Tarnoff**

Illustration by Anna Davie



Arising out of a remarkable coincidence of parallel research activities at the University of Maryland and Purdue University, a new technology has been developed to provide accurate measurement of travel times on both freeways and arterials, offering the possibility of great improvements in traffic management and traveler information. Utilizing Bluetooth communications, the innovation has been extensively tested by both universities with results that far exceed the accuracies of other technologies.[1]

In fact, the demonstrated accuracy of the data produced by the technology has been shown to exceed that of floating cars and other manual techniques, to such a degree that it is being used to validate the GPS data being purchased from Inrix by the I-95 Corridor Coalition in its six-state vehicle-probe project.[2] The capabilities have been validated through the collection and analysis of more than 10,000 hours of traffic data.

With the encouragement of the University of Maryland, a new company has been formed to produce the Bluetooth equipment. The new organization, Traffax Inc,[3] has raised the capital needed to market, produce and support the Bluetooth equipment and sell it throughout the world.

BLUETOOTH CAPABILITIES

Bluetooth is a telecommunications industry specification that defines the manner in which cell phones, computers, PDAs, car radios, and other digital devices can be easily interconnected using short-range wireless communications. One example of the use of this technology is the interconnection of a cell phone with a wireless earpiece to permit hands-free operation.[4] The technology received its unusual name in honor of Harald Bluetooth, King of Denmark – who united Norway and Denmark during the mid-10th century.

The Bluetooth capability is implemented using a low-cost transceiver chip, which exchanges information with other Bluetooth devices within a globally available frequency band of 2.45GHz. Each device has a unique 48-bit address. Bluetooth transmission ranges include 10m for Class 2 radios and 100m for Class 1 radios. However, the Bluetooth traffic detection technology described here has been able to increase these ranges through appropriate adjustments to receiver sensitivity and device placement. As a result of its relatively low transmission power and narrow bandwidth, Bluetooth offers the advantages of low power requirements that permit the use of relatively small batteries and/or solar cells for field operation. The challenge of the technology is the implementation of roadside monitoring equipment with the sensitivity and rapid acquisition time necessary to receive Bluetooth signals from high-speed traffic.

Bluetooth transceivers continuously transmit their 48-bit ID for the purpose of identifying a device with which to communicate. This 'inquiry mode' is used to establish a link with the 'responding devices'. Inquiries are made by a Bluetooth transceiver, even when it is already engaged in communication with another device. The continuous nature of this process facilitates the identification of passing vehicles or pedestrians containing Bluetooth devices, as all equipped and activated devices will be

"The Bluetooth technology calculates travel times by matching public Bluetooth wireless network IDs at successive detection stations"

transmitting inquiries as long as they have their discovery mode enabled.

The 100m detection range can be considered the radius of a circle with the Bluetooth receiving antenna at its center. Any Bluetooth transmitter entering this circle will be detected. This is a potential source of error for recording vehicle passage times, as the vehicle could be detected at any point of the circle that impinges on the roadway. The worst-case error is 100m corresponding to a Bluetooth receiver placed at the edge of the roadway. So, for two successive receivers, the worst case error would be 200m. As receivers are typically placed at approximately two-mile intervals, this would correspond to a maximum error of 200m per 3,200m, or 6%. However, this is an unbiased random error as vehicles could be detected at any point within the circumference of the circle, and furthermore, it would be a rare installation for which the receiver is so close to the edge of the roadway that the detection zone is as large as 100m. The maximum error of 6% is considerably less than the accuracy with which travel times can be estimated using conventional detectors, for which error rates as high as 30% have been found.

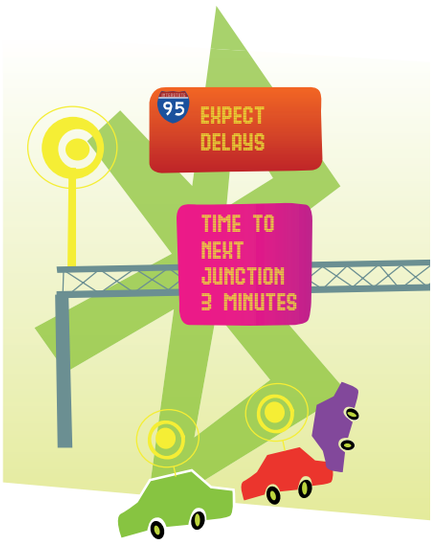
BLUETOOTH IN TRAFFIC

In its most basic form, the Bluetooth technology calculates travel times by matching public Bluetooth wireless network IDs at successive detection stations. The time difference of the ID matches provides an accurate measure of travel time and space mean speeds based on the distance between the successive stations. Accurate measurement of distance between successive Bluetooth data collection sites is accomplished using GPS equipment installed in the Bluetooth devices that record location as a header record for the collected data. An equally significant application of the Bluetooth technology is its ability to collect Origin-Destination (O-D) information, which is derived by tracing a Bluetooth transceiver's path through a series of Bluetooth units with known locations. In the past, it has been necessary to acquire O-D data using either expensive license plate-matching equipment or unreliable postcard surveys.

The use of Bluetooth offers a number of advantages over existing methods. This approach directly measures travel time and space mean speed, a leapfrog advance over existing point detection technology such as the inductive loops, radar detectors, and image processors commonly used by most transportation agencies. The greater accuracy of the Bluetooth units is because travel times and space mean speeds are measured directly by the equipment, while these variables must be inferred from the point detection technology using speed measurements at discrete locations.

Bluetooth also measures travel times and O-Ds for a variety of modes (highway vehicles, rail, and pedestrian) as the Bluetooth devices are associated with people rather than vehicles, and it can be applied globally due to the proliferation of the Bluetooth standard protocol. Similar techniques are available that detect the passage of toll tags, such as the E-ZPass. However, adequate samples of toll tags are only available in the vicinity of toll facilities.

Bluetooth also simplifies field installation procedures as a result of the low-power and omnidirectional antenna patterns. It offers a greater degree of privacy than toll tag tracking, license plate surveys or cellular telephone geolocation as there are no databases of Bluetooth addresses that can be used to associate those addresses with individual vehicle owners.



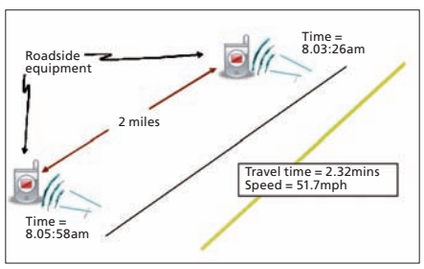


Figure 1: System configuration of the BluFax technology

PACKAGING BLUETOOTH

The portable version of the Bluetooth equipment produced by Traffax takes advantage of the small size and lower power drain of the Bluetooth and GPS chips to offer a device with adequate memory capacity and battery life for more than four days of unattended operation. The electronics include a small single-board PC, a GPS unit, and the Bluetooth transceiver. The large components are the battery and power converter (shown opposite), with the Bluetooth electronics mounted along the right side of the case. This portable design does not require communications or external power sources, as the removable memory eliminates the need for downloading, and the battery life is more than adequate for temporary data collection.

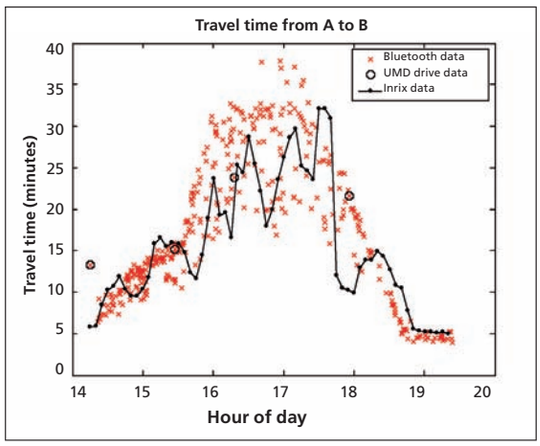
These characteristics proved to be ideal for validation of the vehicle-based GPS data being acquired by the I-95 Corridor Coalition project. In fact, the data collected during a single day's observations provided sample sizes of 5-7% of the total traffic stream – more than adequate to provide a good sample of the travel times of passing vehicles as long as volumes are in excess of 600 vehicles per hour. This sample size is significantly greater than could be achieved using floating car surveys.

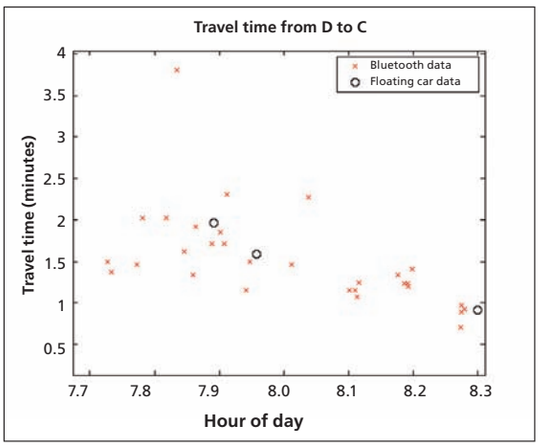
A Bluetooth installation has been deployed in Indianapolis, Indiana, where it was being used to measure travel times and collect O-D data during the Brickyard 400 NASCAR Winston Cup event at the Indianapolis Motor Speedway on July 27, 2008. The yellow case shown opposite is a watertight marine container, which contains the battery and supporting electronics. The permanent installation includes solar power and inexpensive data communication.

FREEWAY TEST RESULTS

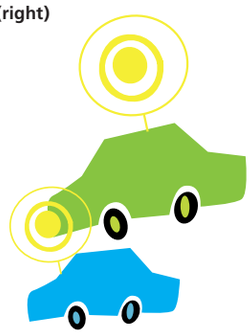
To date, the equipment has been tested at many different freeway and arterial sites at many locations throughout the USA and in Brisbane, Australia. As already mentioned, the most extensive deployment was made for the purpose of validating GPS-based vehicle probe data procured by the I-95 Corridor Coalition from Inrix in connection with its six-state vehicle-probe project. In all cases, the equipment performed flawlessly and provided reliable travel time measures. The data presented here represents a very small sample of the overall results.

The initial testing for the I-95 Coalition project was on a heavily traveled 15-mile section of the Capital Beltway (I-495) near Washington, DC. The 20 units deployed in connection with this data collection activity





The graphs show comparisons with GPS data added (left) and arterial validation results (right)



were relocated to different sites as the data collection proceeded.

Three data sets were developed in connection with these tests. The Bluetooth data was intended to represent 'ground truth' due to its anticipated accuracy and large sample sizes. Floating car data was collected due to its historical use for collection of travel time data as a representation of ground truth, and to provide a check for the Bluetooth data. Finally, GPS data acquired from Inrix is being purchased on an area-wide basis by the I-95 Corridor Coalition.

The results of these tests are shown above in the graph on the left, which provides a comparison of the Bluetooth and floating car data, as well as the GPS data acquired from Inrix. The data shown in this case is the eastbound travel time between I-270 and Connecticut Avenue (MD 185) between 14.30hrs and 19.30hrs.

The comparison between the Bluetooth and floating car data shows good agreement between the two data sources, except for the single floating car data point at the beginning of the Bluetooth data set. This single data point shows higher travel times than the Bluetooth data because the car making the floating car runs had stopped to install the Bluetooth equipment on the I-495 median. The mismatch between the floating car and Bluetooth data quantifies the time required for 'field installation' of the Bluetooth equipment at approximately eight minutes (the excess travel time for this particular run). The differing number of data points on these two curves demonstrates the potential of the Bluetooth technique to deliver statistically reliable data due to its large sample sizes, as opposed to floating car runs for which only three data points could be acquired during the same time period. The comparisons in the graph also show good agreement between the GPS and Bluetooth data. The GPS data does not suffer from the limited sample size of the floating car data, although here, again, the Bluetooth sample size appears to be significantly greater. The GPS data exhibits a tendency to oscillate at times when there is a large variance in the travel times of the Bluetooth data, possibly as a result of inadequate sample sizes in the GPS data. Clearly, the large Bluetooth sample size facilitates the ability to analyze other data sources and to better understand traffic flow characteristics.

ARTERIAL TEST RESULTS

A sample arterial data set comparing Bluetooth and floating car data is shown above in the graph on the right. Here, again, good agreement is shown between the two data sets, with the Bluetooth data providing a significantly higher sample size.

The arterial data differs from the freeway data in a number of respects. It shows greater variability, undoubtedly caused by the presence of traffic signals and mid-block facilities. It has smaller sample sizes, characteristic of relatively lower volume arterials, and has an increased presence of outliers due to vehicles making brief diversions along the arterial, which has significant strip development. All these arterial characteristics are typical, and demonstrate the importance of using Bluetooth technology, with its higher sample sizes, if reliable data is to be collected.

The Traffax unit was used to validate GPS data in the I-95 Corridor Coalition project

Many additional applications exist for the Bluetooth technology that can leverage its O-D capabilities while ensuring a relatively high level of privacy to owners of Bluetooth-equipped devices.

Potential applications include the use of O-D data to support traditional planning activities associated with the development of new facilities. It can also be used to evaluate impacts of dynamic message sign (DMS) messages on traffic diversion percentages and support the operation of toll facilities with variable pricing features. This data can be used to support the evaluation and levels of service provided by these facilities to ensure that 'paying' customers are receiving the improved services for which they are being charged, such as comparing the travel times of tolled versus facilities without tolling. Finally, pedestrian flows can also be measured, for instance at major events.

Bluetooth equipment offers the benefit that it is an open system, not based on proprietary communications protocols. Development of the Bluetooth equipment has taken advantage of the large consumer marketplace that supports the production of the Bluetooth chips. This marketplace has ensured the availability of inexpensive, low-power products adaptable to inevitable future advances in the state-of-the-art of short-range communications devices. As Bluetooth technology evolves in the future, or is replaced, the chips can be replaced with the newer technologies. ■

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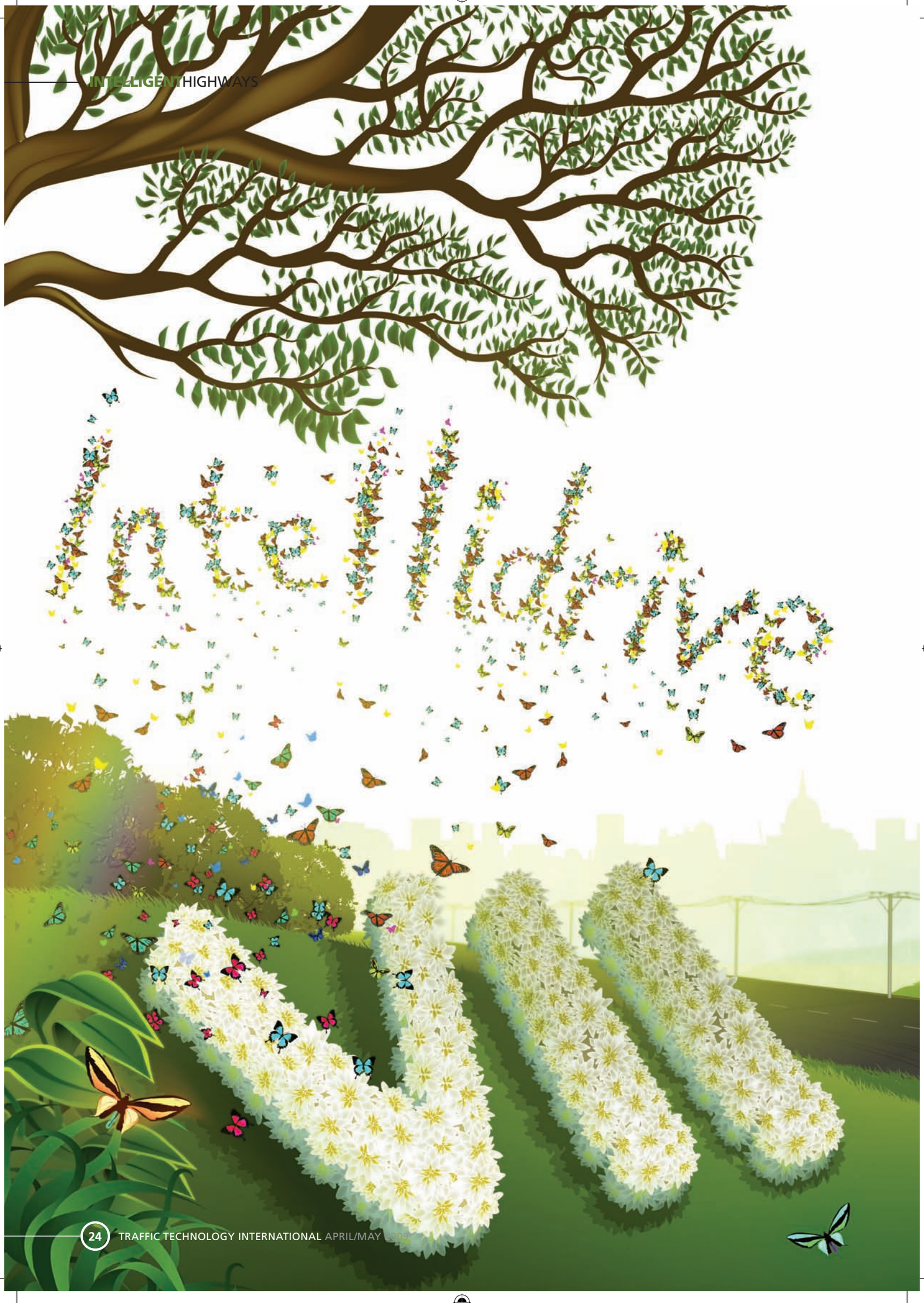

intelidrive

END OF THE ROAD?

Following the USDOT's announcement in January that the VII program will be rebranded, rather than listen to rumor, **Max Glaskin** went straight to RITA for an exclusive update. Far from being the demise of VII, he discovers that this is merely the end of the beginning

Illustration courtesy of Magictorch

VII is dead; long live IntelliDrive. That was the cry that rang out on January 9, 2009 when the USDOT's ITS Joint Program Office at RITA issued a 91-word statement. The new name and logo for its Vehicle Infrastructure Integration (VII) program "better represents the full potential of the initiative", the release read, while encompassing "a broader suite of potential technologies and capabilities than the original notion of VII."

For a while after, there was an eerie silence. Enquiries in the industry received uncharacteristically guarded responses. One insider emphasized the new IntelliDrive logo was registered and protected. Another wouldn't talk on record. Organizations normally keen to discuss ITS didn't reply at all. It seemed everyone was waiting to find out more before making up their minds.

Fortunately, 10 days after the IntelliDrive website was officially unveiled, Shelley Row, director of the USDOT's ITS JPO and Mike Schagrin, the program leader, pulled over and gave *Traffic Technology International* an exclusive interview, explaining the reasons that prompted the change and their hopes for what it will achieve.

MOVING ON…

The key messages that emerged were safety, a broadening of communication technologies, better ways of working with partners, and a focus on aftermarket devices.

The interview kicked off by demolishing the idea that IntelliDrive is merely a new set of clothes for the VII emperor. "For a long time the community told us that VII was not a very user-friendly term. People thought it was 'seven' in Roman numerals," Row explains. "At the same time, it's a research program and research programs – by their very nature – have to change and respond to what's going on in the environment."

A lot of the VII research had been based on the premise that DSRC was the communication technology of choice for all applications, from safety and mobility right through to tolling. "That was fine for the first phase of a research program and we've learned a lot," Row says. "But many more options have become available to us, allowing us to look at things in a broader framework. It became an opportune time to change what we called the program and the way we talked about it. We followed a stakeholder involvement process and interviewed folks. We had a marketing firm who worked with us. That's how we came up with 'IntelliDrive'. I feel it's the next evolution of the research program."

Schagrin points out that there had been overlaps in ITS programs. "We had a number of programs that were addressing more or less the same kinds of things. There was VII, the V2V safety project, and the cooperative intersection collision-avoidance project. This was an opportunity to consolidate and bring these three

programs into better alignment under a common umbrella. Under IntelliDrive there's probably more safety emphasis."

"At the very highest level, I view IntelliDrive as the information that's going in and out of the vehicle," Row explains. "There are some very important mobility applications in there but most of it is for safety applications."

CHANGING FOCUS?

So the transition from VII to IntelliDrive apparently follows the natural course of R&D programs – when some progress has been made, it becomes necessary to change the focus. But does that mean that all of the previous investment in 5.9GHz DSRC is going to be thrown out with the bath water? "No, not at all. We want to be very clear on that point," Row asserts. "There's a range of applications that are part of IntelliDrive. If you look at the active safety applications such as V2V and V2I for safety, they require very fast, high-security communications and DSRC is the only thing out right now that will do that job, so we're 100% behind DSRC for those applications.

"The thing out there that confuses people is that if you look purely at mobility services there are many technologies that can provide those applications and we want to be open to those. We are still behind DSRC 5.9, particularly for those applications for which it is so uniquely suited."

So 5.9 will play its part in safety, while other communication technologies will be considered for other roles. But what of the VII testbeds in California and Michigan, which Row acknowledges have enabled a lot of progress. What is going to happen to them now that IntelliDrive is king?

"We are looking at how to make the Michigan test site sustainable and available to industry," Schagrin reveals. "Under VII, it was a proof-of-concept testbed that was solely for the government and car companies' use – it was a closed environment. We plan on opening it up so the broader industry can use it for their research – like an incubator – so they can develop their products. If there is some commercially readily available technology that could be demonstrated on the testbed that would certainly be a [showcase] opportunity as well."

One of the first major calls from IntelliDrive was for interested parties to attend a workshop in Detroit on V2V safety, "to frame out the technical research that's needed to move the work forward," details Row. "We're working in partnership with NHTSA." Naturally those running the IntelliDrive program want to have good and continuing relations with NHTSA and all of its partners. "We did a lot of engagement with stakeholders under the VII program, although I don't think we engaged enough with them," Schagrin says.

VII being demonstrated with autonomous vehicles at the 15th World Congress on ITS in New York City

VII comes to the desert, at the 2007 ITS America Annual Meeting in Palm Springs

COMMUNICATIONS PROBLEMS

Indeed, soundings by *Traffic Technology International* among researchers elicited comments that they had found the channels of communication within the VII program to be cumbersome. Row accepted the criticism.

"I wish I could tell you that you were wrong. I'm not sure I can, though," she says honestly. "At the same time, I'm not going to feel too bad about that. We are very committed to good communication: in fact, it's essential to the success that the stakeholders are intimately involved."

"We alone can't make this happen, it's going to have to be a partnership arrangement and any time you are trying to get this much of a disparate group of people together to agree on complex issues, some of which, quite frankly, impact the future of an industry, it is a very difficult thing," she says. "It is cumbersome and it is time-consuming and we recognize that. One of our key roles is to be the convenor and help smooth that working relationship."

The sound of silence

Although the auto industry could reap much if the fruits of IntelliDrive are commercialized, its response to enquiries from *Traffic Technology International* have been non-committal and mostly non-existent. Only two manufacturers were able to comment on the new program.

A spokesperson for Nissan USA said, "Nissan has been actively involved in the USDOT VII program for several years, and supports advancing research and development of 5.9GHz DSRC to support safety applications within the IntelliDrive initiative. We continue to believe future DSRC-based vehicle communications systems may have a role in helping to reduce crashes and improve safety."

GM, on the other hand, indicated that it is aware that there is a difference between IntelliDrive and VII. "We are committed to developing new vehicle communication technologies and currently provide wireless services through OnStar to nearly six million customers in the USA and Canada," a spokesperson said. "GM supports USDOT's efforts to promote wireless technologies to enhance vehicle safety and improve traffic efficiencies."

One important step has been to get closer to NHTSA. "They have a regulatory authority so they're very engaged with the automotive industry, which is key to this," Row continues. "We're working really hand-in-hand with them on these programs, including open architecture and setting standards around the vehicle platform."

Schagrin is at the sharp end of this partnership process and expects to attract more partners into the program. "A critical theme that runs throughout IntelliDrive is that we're expanding our stakeholder base to include more than just OEMs, car companies and public transportation agencies," he says. "Aftermarket is a necessary compound, as well as other industries that could find business opportunities here. Our role is to find the kinds of investments that we can strategically place to leverage industry's greater resources. The federal government can't fund it all, nor are we going to. Somehow we have to put those resources which we do have into play in an environment in which we get a multiplier out of industry."

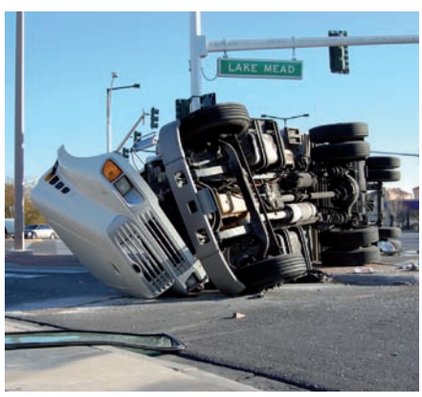
STANDARDS ISSUES

One step toward achieving this goal is the development of an open standard as the basis for an interface between proprietary systems on vehicles or devices and the external ITS network. Schagrin points out that standards already exist for DSRC and that they cannot be compromised because they will be crucial for safety.

"The non-safety side is where we get the opportunity to try to leverage all these other communication technologies," he explains. "The concept behind the open platform, open architecture was how do we leverage these other communication technologies to provide for the better good and complement the safety technology?"

He is keenly aware that car companies would never want to provide a trap door into their databuses. He hopes another kind of portal can be agreed instead, one that perhaps has firewalls to protect the proprietary information of makers of cars and aftermarket devices, yet allows data transceiving for ITS purposes.

In fact, the aftermarket is likely to play a much bigger role in IntelliDrive than it ever did in VII. Schagrin states, "The vehicle development cycle takes a long time so we're looking at how to leverage the aftermarket that could possibly use DSRC to include that in their consumer electronic devices to provide perhaps a beacon that says 'here I am.' It may not have the full functionality



Highway fatalities account for 43,000 deaths a year on the USA's highways network

Safety still remains the prime focus of the program

Street smart

Jim Misener reports from Tokyo at the opening of the Large-Scale Demonstration and Experiment of ITS-Safety 2010 – a vision of the future that is tantalizingly here now

Miraikan is the Japanese Museum for Emerging Science and Innovation, and an appropriate setting for the opening of the 'Large Scale Demonstration and Experiment of ITS-Safety 2010', which convened February 24-28 in Tokyo. The setting and event portends a world – or at least a nation – that is rapidly advancing toward practical realization of road safety delivered by wireless communication.

Visitors were treated to various demonstrations given by public-private consortia of Japanese car-makers, suppliers, other industries, and ITS Japan (acting in concert with government ministries). It was intended to be an organizational and technical litmus test on how wireless connectivity between vehicles and the infrastructure could integrate to provide drivers with alerts and warnings to avoid crashes. The goal? To realize the world's safest road traffic environment and to provide timely, relevant information so that the driver can avoid danger in traffic situations when direct vision is not possible.

All of these demos are unified into a singular Driving Safety Support System (DSSS) Platform, the aim of which is to investigate, promote and eventually adopt road-to-vehicle communication systems, vehicle-to-vehicle communication systems, and ultimately intercommunication between pedestrians, roads and vehicles. The strategy is to reduce the number of traffic deaths to less than 5,000 in 2012 from 7,000 in 2008. It is hoped that inter-vehicle communications will realize this within a tantalizingly short timespan of a few years.

The DSSS is quite an ambitious technical endeavor. One aspect that was revealed with clarity is that within these experiments lies an important and apparently depoliticized technical trade-off, where at least two communication link bands are being considered. The objective is to decide which is best suited to deliver safety applications.

The background includes the fact that the National Police Agency (NPA) – which controls all intersections in Japan – had devoted considerable focus and infrastructure investment in infrared (IR) beacons. However, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has focused on the 5.8GHz dedicated DSRC. More recently, the Ministry of Internal Affairs and Communications (MIC) has allocated a portion of the 700MHz analog TV band, between 715-725MHz for inter-vehicle communication. The challenge for the deployment of DSSS is to determine which works best. Today, the two prime candidates are DSRC and the near-700MHz band.

The stakes for DSSS are palatable as in Japan – unlike any other country – road-to-vehicle and vehicle-to-vehicle communication is very close to realization. To various degrees, key components are present in that country as

"Our role is to find the kinds of investments that we can strategically place to leverage industry's greater resources. The federal government can't fund it all, nor are we going to"

The road-to-vehicle demos were impressive in their diversity, with eight safety services shown in locations near the Miraiken

the necessary in-vehicle devices and architecture may be already deployed. Approximately 20 million cars in the country (out of a total of nearly 80 million cars, trucks and motorcycles, and nearly every new car sold) are equipped with an in-vehicle navigation system. This is enhanced by an 'only-in-Japan' feature – a Vehicle Information and Communication System (VICS). With VICS, road and congestion state information for major arterials and limited-access highways is aggregated by the Japan Road Traffic Information Center, transported to the VICS Center, then sent either by optical IR beam or 2.4GHz radio beacon back to cars. About the same number of cars in Japan are equipped with 5.8GHz DSRC-based ETC. The change necessary for existing onboard equipment architectures is incremental: integrate VICS (navigation) and ETC (short-range wireless) communication into the same 'box' and display. The ingredients are ready for DSSS!

These technical demonstrations also serve a political and institutional purpose as different government ministries and consortia have, at last, cooperated in one of the first public products of the Japanese 'New IT Reform Strategy'. This is the keystone of DSSS and spawns a comprehensive multi-application, multilocation set of field experiments, with the objective to determine how ITS-Safety 2010 services affect safety and reduce the number and severity of crashes.

The idea is policy-driven and part of a national goal. In early 2006 the Japan IT Policy Office, a government cabinet secretariat, set a unified target to establish several 'Ubiquitous Special Zones' to deliver IT for several sectors, including – but not limited to – transportation. A Ubiquitous Special Zone provides a rich IT environment to allow event, destination, medical and commercial connectivity. The basic premise is that these Zones would be the nuclei of concerted IT services to serve the dual purpose of enhancing the lives of the affected citizens, and with the gains to be realized via deployment make Japan a leader in the globalization of the constituent technologies. One of these is the DSSS of cooperative systems for safety.

Based on this policy push, the ITS Promotion Council and Working Group was established, and vitally to the implementation of road safety services, several government agencies – the NPA, the MIC, the Ministry of Economy Trade and Industry (METI) and MLIT – cooperated in a multilateral effort to show DSSS, and to unify concepts in communication and safety services in action.

The program to realize DSSS is to conduct tests in the Tokyo Metropolitan Expressway and nearby arterials, and the ITS-Safety 2010 demonstrations are the kick-off of these tests. After two years, the participants will conduct what is called a coordinated set of 'large-scale demonstration experiments' on arterials in six provincial locations in four locations – Niigata, Aichi, Keihanshin, and Hiroshima.

Based on the results from field trials, DSSS is envisioned to be deployed nationwide, beginning with high-collision concentration locations where the crash typology matches DSSS safety services. These will expand into the realization of the Ubiquitous Special Zones of general IT services. And ultimately? Well, they could enable road-to-vehicle and vehicle-to-vehicle safety, not only in Japan but – at least in concept – throughout the world.

of what may be embedded in the vehicle but, by leveraging aftermarket devices, we achieve safety benefits more quickly."

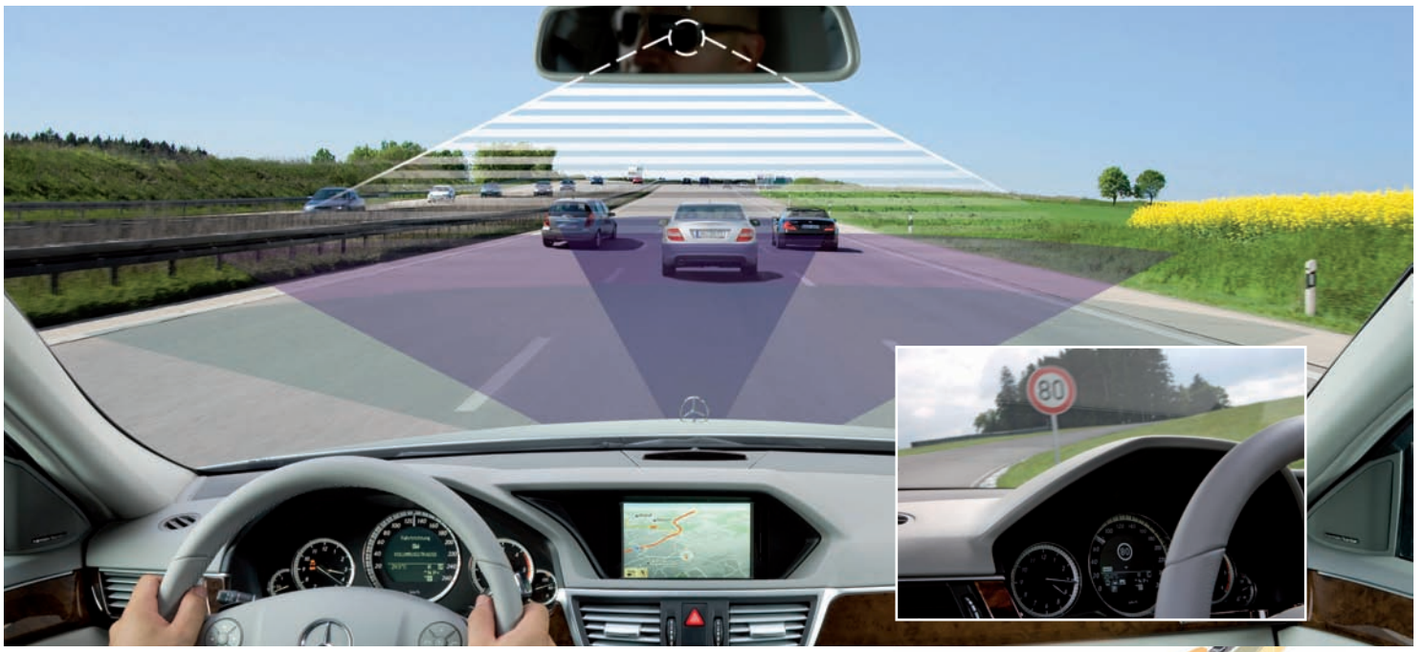
"It's hard to sell safety by itself," Schagrin says. "In terms of these aftermarket devices, one scenario would be that you incorporate it not as a standalone but as part of a PND or Blackberry, or some consumer electronic device in which the cost would just be marginal." Row is eager to support the approach. "If it's an aftermarket device just saying 'here I am', you get some benefits. It's short of what you can get from an embedded device but it's better than nothing," she says. "That's why we think it's reasonable to pursue it and, as Mike says, it gives us the chance to get some benefits much quicker than having to wait for a full fleet turnover."

Schagrin acknowledges that the idea of an open platform to enable the communications necessary for IntelliDrive to succeed won't always be welcomed with open arms. "I'm sure that different people will be feeling threatened at different levels in different times of the program but, you know, not everybody's going to be happy. You've got to figure out some model that's acceptable to the industry. We're trying to create as much transparency as possible," he says. "We're going to be significantly updating our website and enriching it with even more material as it gets produced".

Row knows also the industry that stands to benefit most from ITS is having a tough time. "The auto industry is under stress right now," she acknowledges. "We're working very closely with it through both the Alliance, the Association of International Automobile Manufacturers, the VIIC, and also the road operators. AASHTO has its own strategic planning effort in March to gather its thoughts as well. We're trying to engage all of those folks very actively and they're also doing a lot of thinking on their own, which is great. It continues to be a group effort moving forward."

What's in a name?

What's in a name? For some in the industry 'IntelliDrive' rang bells. It is similar to 'IntelliTrans' but the two must not be confused. IntelliTrans was the title of a short-lived public awareness campaign launched by ITS America in 1997. It came with a logo that, it was hoped, would do for ITS-enhanced transport what 'Intel Inside' did for PCs. There were plans to collect royalties from manufacturers and transportation authorities that wanted to use the logo. Alas, despite a full page 'ad' in the *Wall Street Journal* and a positive feature in the FHWA's magazine by the association's then chief executive, James Constantino, the IntelliTrans campaign wasn't backed by all ITSA members and quickly disappeared. Originating from the USDOT, expect IntelliDrive to have significantly more impact.



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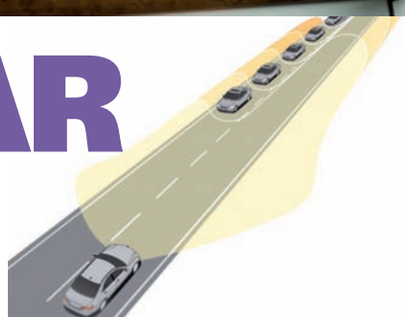


The new E-Class saloon from Mercedes-Benz will offer a feast of new passive and active safety technologies, which John Challen learns could be standard on its entire range by 2012

Images courtesy of Mercedes-Benz

Mercedes-Benz's next-generation E-Class saloon will feature no fewer than 12 new or improved active and passive safety systems, the most significant of which is arguably the 'Attention Assist' feature. Scientific research suggests that 25% of all accidents are caused by driver drowsiness, so this new gizmo is designed to redress that statistic.

"Attention Assist is the result of analysis of over one million test kilometers covered by over 600 Mercedes engineers," says Jörg Breuer, senior manager, Passenger Car Active Safety. "It produces a profile at the beginning of each journey and then compares it every 40ms with current sensor data. The profile comprises more than 70 different parameters, such as time of day, distance of journey, road conditions, and the driver's use of in-car controls, such as the stereo." According to Breuer, all of the parameters are judged by a series of sensors mounted around the vehicle to enable information to be produced and transferred.

"Lateral and longitudinal acceleration is also monitored, but the biggest focus is on the steering inputs made by the driver," Breuer continues. Mercedes feels a focus on steering is vital in providing user information, as drowsy drivers find it hard to maintain a steady path within their lane. As a result, minor and in some cases life-threatening steering inputs are made suddenly to steer back on course. Again, data is passed via a sensor within the steering wheel housing to monitor movements and steering speeds. When showing signs of drowsiness, an audible tone is emitted, followed by a visual alert on the dashboard advising them to take a break.

A BETTER VIEW OF THE ROAD

Whereas Attention Assist has been designed for the motorway or freeway environment, the Adaptive Highbeam Assist has been developed with the main aim of increasing safety in rural areas. Distinguishing itself from traditional systems that switch between low and high beams, Adaptive Highbeam Assist adapts automatically according to the conditions of the road, and controls the light distribution accordingly. Bernd Woltermann is the man at Mercedes-Benz responsible for the system. "Images of the road ahead are received by a camera that is mounted on the inside of the windscreen, which monitors traffic flow ahead and again transfers data every 40ms," he details. "An image-processing algorithm then calculates the distance to an oncoming vehicle and adapts the height of the headlamp beam. High beam is automatically selected as the default and only changes when an oncoming vehicle, pedestrian or object is identified."

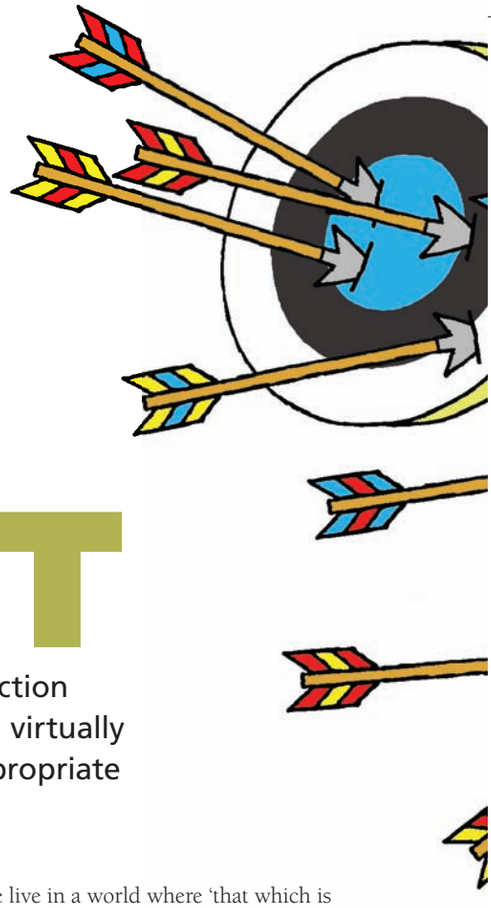
Research undertaken by Mercedes reveals that when using Adaptive Highbeam Assist, pedestrians can be identified from a distance of 260m – 150m earlier than is possible with a conventional low beam. "In this instance," reveals Woltermann, "the beam is gradually reduced as the pedestrian gets closer and then is automatically reset to high beam once the two have passed each other. The system, which Mercedes claims also reduces driver stress through not having to operate the lighting stalk on the steering wheel, is operational above 55km/h (34mph).

Another E-Class development is Speed Limit Assist, which informs drivers of the current speed limit via a dashboard-located reminder, which Mercedes thinks will deter people from speeding as they will be more aware of the limits. A windscreen-mounted camera picks out speed limit signs on the the road and then displays them in the car.

Unlike Volvo and Nissan (to name just two), Mercedes has not put a date on when it will achieve zero road deaths from accidents involving its cars. But technologies such as Attention Assist are a clear message that it will be 'when' – and not 'if' – that vision becomes reality.

EXTRAS ONLINE

What impact could the E-Class have on reducing traffic-related deaths? Log on to **www.traffictechnologytoday.com** to read about the other life-saving features on the new saloon



MISSING THE POINT

Traffic congestion impacts all of our lives, and calls for corrective action – usually 'Why don't they do something about it?' – emanate from virtually every segment of society. But, argues **David H. Roper**, a more appropriate question might be 'Why don't *we* do something about it?'

Illustration by Tim Ellis

Over the past several decades, millions of dollars have been invested in hundreds of schemes and projects, ranging from ride-sharing and ramp metering to various forms of managed lanes and improved transit services – all of which have been aimed at dealing with the problem of congestion. In spite of these best efforts, congestion – with all of its negative impacts – continues to linger and, in fact, keeps on growing.

True, these projects have delivered and continue to deliver benefits – travel-time savings, greater reliability, improved transit, more carpools, accidents that never happened. But it is also true that they have *not* been effective in reducing congestion on our freeways. That is not to say that these programs should be discontinued – quite the contrary. But it does mean that, clearly, it is time to take an objective look at the realities of the situation, to re-evaluate, to adjust, and to redirect efforts to provide congestion relief in the real world of commuter traffic.

COPING… AND HOPING

So why have these best-laid plans 'failed'? The operational strategy itself is seriously flawed, with a focus not on ways to combat congestion but ways to cope with its consequences. It is built upon the notion – an unrealistic hope – that large numbers of people motivated by the prospect of bypassing or otherwise avoiding congestion would shift from the single-occupant vehicle in favor of ride-sharing, transit, and other modes. That shift has *not* taken place – not in great enough numbers to make a noticeable difference in the levels or the duration of congestion. Nor is it expected, even in the face of today's unpredictable gas prices and economy, that the shift will occur in the foreseeable future.

In reality, the approach cannot work. Success is wholly dependent upon the continued presence of congestion – it needs congestion to get people to make the shifts that are needed to relieve it. It's a no-win situation: to the degree that if the program is successful in relieving congestion, the public's incentive to make the shifts to bring about that success is eroded.

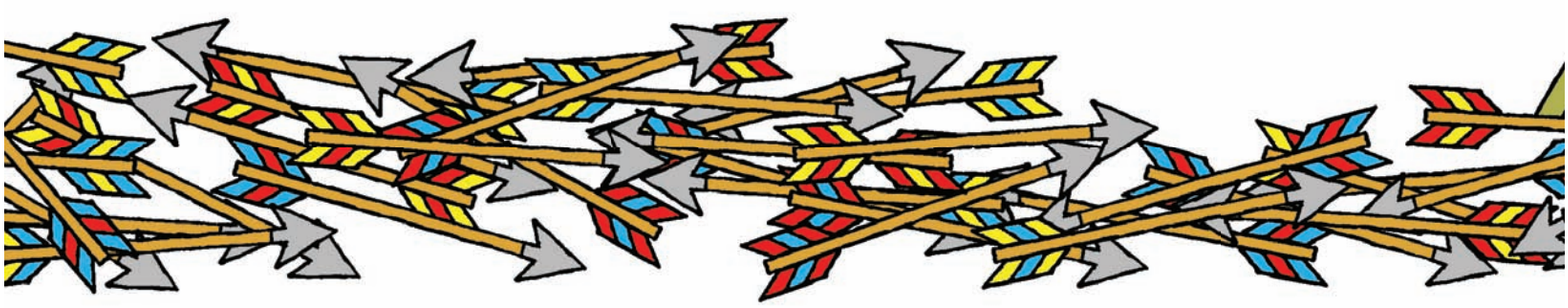
AND CHALLENGES…

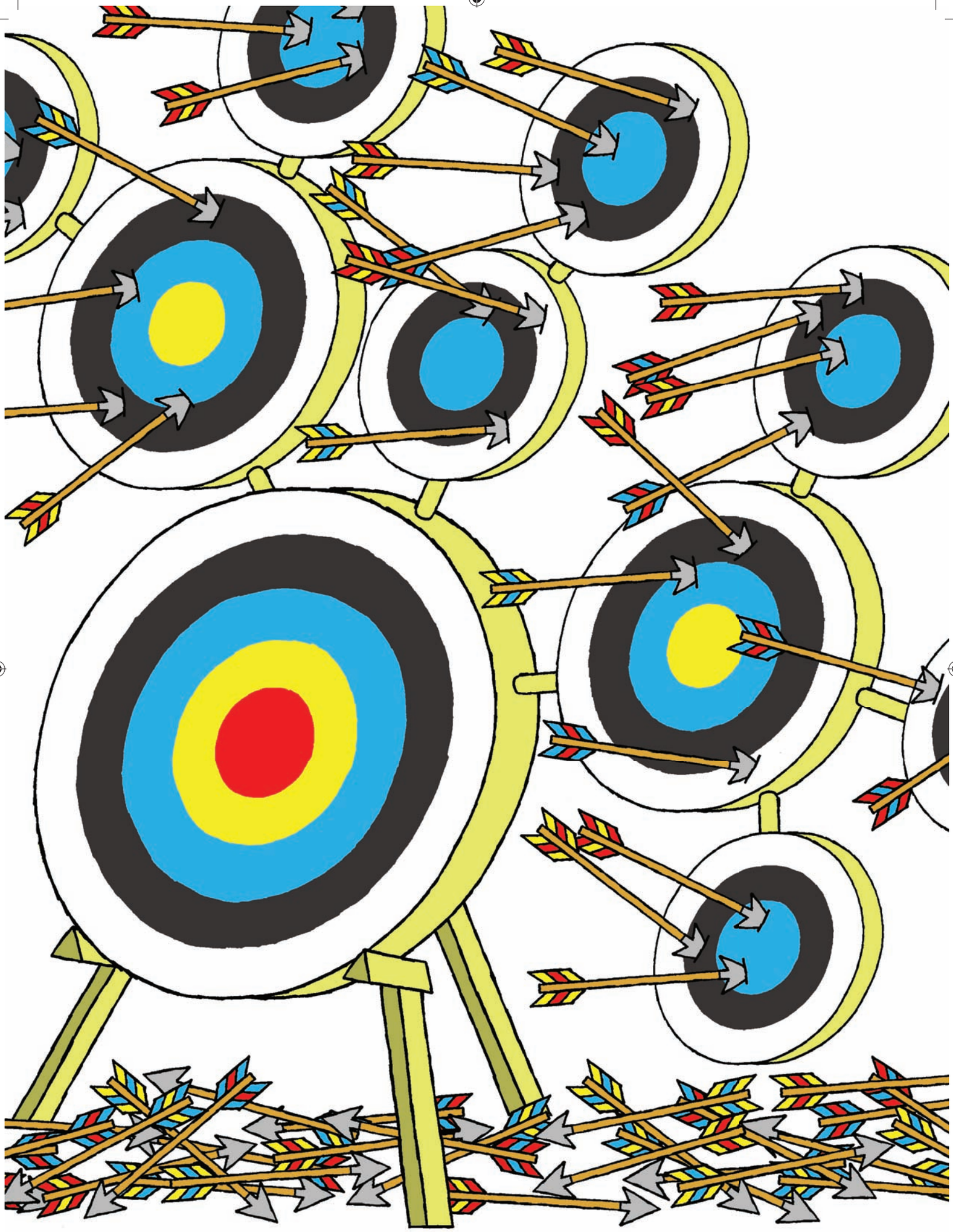
The approach nowadays is reactive rather than proactive. Detection systems detect the presence of congestion after it has formed. At that point in the congestion cycle, the damage has been done and we are faced with not only providing ways for the motoring public to bypass congestion but also in handling the ongoing surge of traffic loads, while trying to re-establish smooth flows on an already clogged freeway system.

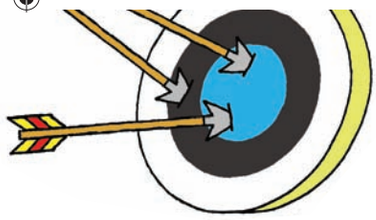
We live in a world where 'that which is perceived is often seen as fact'. In the case of freeways operating at peak efficiency – filled with traffic but still flowing smoothly – the public sees empty lanes, with plenty of space to carry more traffic. The truth is that adding a relatively few more vehicles will cause the smooth flows to deteriorate, so what was once a freely flowing freeway quickly becomes a 'parking lot'. But the call from the public to 'let me in' is loud and clear.

In reality, our congestion management programs are made up of measures aimed at managing demand rather than congestion, seeking ways to modify the character of the demand (i.e. changing mode), and therefore its magnitude. Yet, over the years, support has been built and projects have been moved forward under the banner of 'congestion relief'. The bypassing of congestion has been cited as the number one incentive for drivers to make the shifts that are essential so that congestion will be lessened. Expectations have been built – in management, in elected officials, in decision makers, in the general public – that, in time, there would indeed be a lessening of those intolerable jams. Regrettably those expectations have not been met; realistically they *could* not be met.

Congestion occurs whenever there is an imbalance in the capacity-demand relationship, brought about during each







commute period when demand exceeds capacity. But it is more complex than that – congestion is stochastic in nature. Its development and continued existence over long periods each day are driven by several 'forces' at work within the traffic stream.

As traffic loads build, a spiraling set of events is put into motion: more cars flood onto the freeway, flow deteriorates, congestion sets in, and (importantly) capacity suddenly drops dramatically. Losses in the range of 25-35% or more are not uncommon – the equivalent of closing off one lane of every three- to four-lane freeway when we need every bit of capacity most, at the start of each peak period!

Motorists are continually seeking to make their trip in the shortest possible time, and are quick to shift to what they see as the path of least resistance. In their eagerness to 'fill the gaps' on the freeway, they create a turbulence in the traffic stream, triggering and re-triggering the series of events that led to the formation of congestion. As a result of this seemingly never-ending to and fro, the operation tends to settle into a kind of equilibrium. Regrettably, the system comes to rest in a state of heavy congestion.

Also, few drivers fully appreciate the damaging effect their aggressive driving behavior has on traffic flows. As they try to 'beat out' the 'other guy', crowding onto the freeway, switching lanes, weaving and speeding as they go, they leave chaos behind. This erratic behavior by a few can quickly turn an otherwise smoothly flowing freeway into a traffic-clogged facility.

"If the program is successful in relieving congestion, the public's incentive to make the shifts to bring about that success is eroded"

Traffic engineers have long known that, to a point, lower speeds can open the door to greater throughput, reduced delays, and greater safety. However, speed limits have been raised in response to the public's view that higher speeds equate to moving more traffic and shorter travel times. Although this view holds true out on the open highway, it is not the case on high-volume metropolitan freeways. Field observations confirm that, at a threshold level of 40-45mph, the system is optimized – the freeway settles into a smooth-flow condition and can deliver maximum benefits.

THE REAL PROBLEM IS US!

On the surface it would seem that the problem could be defined as simply a case of 'too many vehicles, not enough lanes'. In a sense, that is true, but there is more to it – it's the result of the way in which we as a society make use of our highway systems. We set our work hours as we always have done in the past – driven by an 08.00hrs-17.00hrs mentality. As a result, we jam the bulk of the commute trips into a narrow time band, such that we overload the system to the point of breaking, destroying its ability to carry the load, and then continuing to pile the peak traffic load upon it in its broken-down condition. And through our aggressive driving we assure that it remains broken, giving it no chance to heal until later, after the heavy load has been delivered. Little wonder our systems fail to do the job!

It is far too early to clearly define how an adjusted program might look, exactly what measures might be used, or how the systems might be operated. We need a program that is built around a theme of 'modest changes by a few that will provide significant benefits to many', instead of (as with today's programs) the other way around.

It most certainly calls for an extensive education program, through which the public can be made aware of not only the damage that is being done by the way in which we make use of the system, but also a call for changes in that usage, and the reasoning behind the need for changes. It must be structured in a way that is seen by the public as an incentive-driven program, with rewards to those who voluntarily make changes, rather than as a mandated program aimed at regulating those who choose not to – or cannot – be a part of the implementation of the plan. And it must be seen as a 'now' approach that can realistically deliver benefits in the relatively short term. Beyond that, who's to say. But what if…?

PREVENTION IS BETTER THAN CURE

What if the transportation community and society in general – drawing upon lessons learned in the day-to-day operations of freeways and in the management of traffic for special events – were to focus on preventing congestion from developing (rather than on ways to cope with it after it has set in), and upon establishing and maintaining smooth-flow conditions on the freeway? And what if an initiative to 'Say No to Congestion' were to be launched that built upon that approach, and made up of an array of operational measures (see sidebar) aimed at managing demand volumes and freeway speeds in real-time?

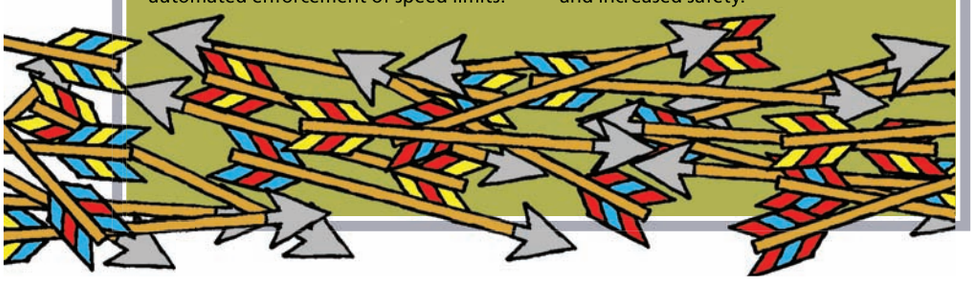
Clearly, the time has come to say 'no' to congestion – 'no' to breaking down the smooth flow on our freeways, 'no' to aggressive driving – in order that we may once again move on our freeway systems.

David H. Roper is president of Roper and Associates, Inc, and is an internationally recognized authority in the operation of metropolitan freeway networks and HOV systems, and in the development and operation of automated traffic management systems

Enough is enough

The following are measures aimed at managing demand volumes and freeway speeds in real-time and could all be implemented as part of a 'Say No to Congestion' initiative:

- A regionwide public educational program (as described in the main article) should be vigorously pursued.
- A limited managed work hour program should be applied as needed on a corridor-by-corridor basis to, in effect, 'spread' the peak. The work hours of a relatively few volunteers (some 200 in each freeway corridor) would be slightly shifted (about 30 minutes earlier) to match on a real-time basis the commuter-demand volumes with available capacity.
- Dynamic speed control systems on selected freeways to assure smooth flow. Freeway speeds would be changed in real-time in response to flow. An essential component is putting into place those systems and laws to provide for effective automated enforcement of speed limits.
- There should be greater application/operation of proven SMART Corridor measures/techniques for a more coordinated operation of freeway and arterial networks, including integrated operation of signaling and freeway access management (ramp/connector metering), information systems, and incident management programs.
- An incentive-driven, voluntary (not legislated/regulatory) program developed in cooperation with shippers/receivers of goods and with the trucking industry to minimize truck traffic on selected freeways during peak periods.
- A demonstration project to prove to transportation agencies, the broader transportation community, politicians, business community, and the public that such a program could, in the relatively near term, deliver benefits such as reduced congestion, smoother operation, increased speeds, greater throughput, and increased safety.



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BACK TO THE FUTURE

Cambridge Systematics' **Matthew Click** suggests that to avoid the further growth of congestion on our roads, the ideas of the past could provide some worthwhile indicators about the future

Main illustration courtesy of Volkswagen/Audi Design Center California

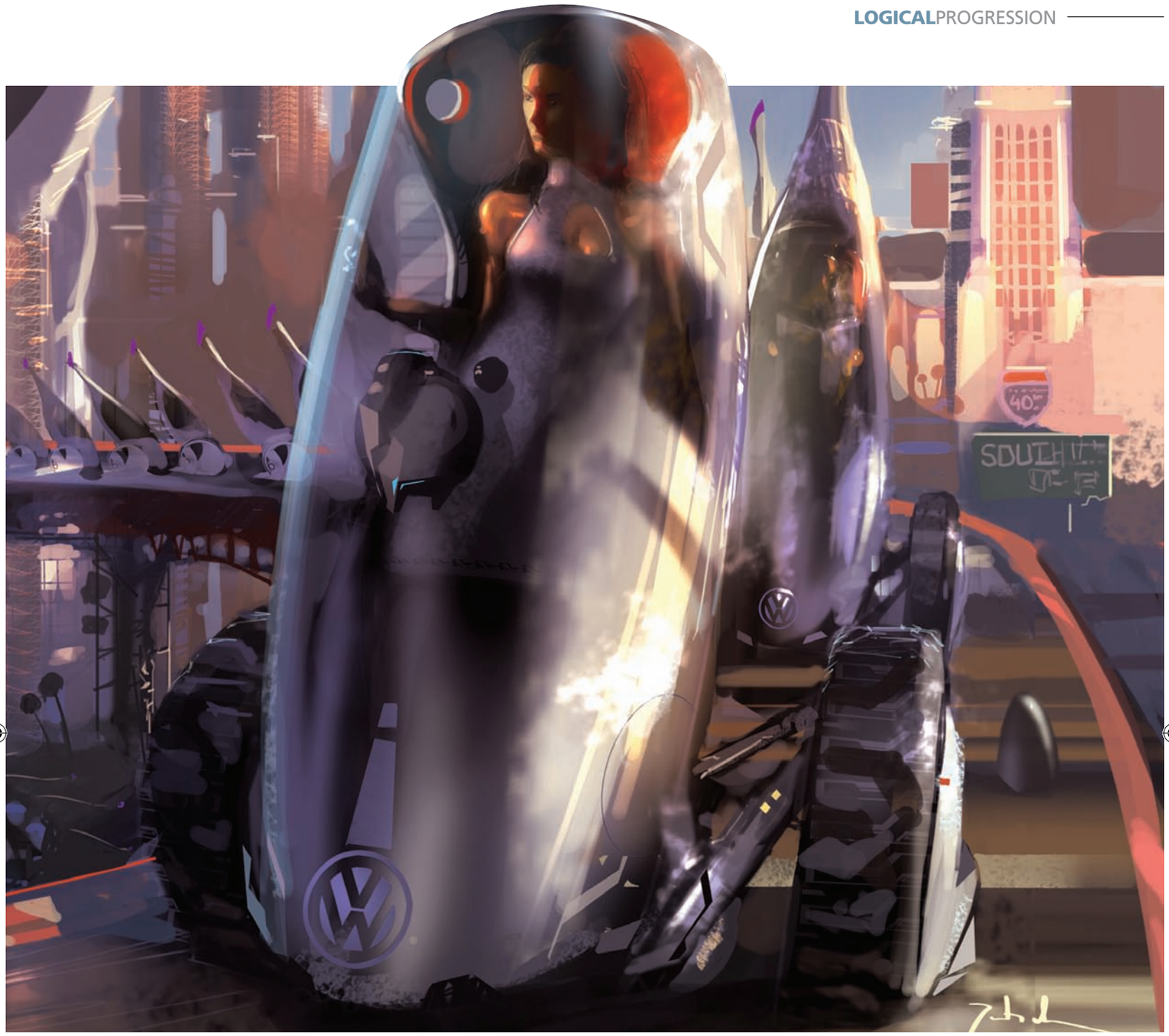
Since cars first took to the streets and revolutionized transportation, people have wondered what the next generation of a modern surface transportation network would look like. Speculation into this has been the subject of past World's Fairs and many Hollywood movies. At the heart of that speculation is the desire for a network that would operate without congestion. This journey into the future outlines how a congestion-free network will develop over the next 50 years, and in a manner that is reliable, sustainable and climate-neutral.

In setting a vision for the future, it is important to begin by reviewing the records of the past, as there is an important lesson in doing so. So, what network predictions were being made 50 years ago? Looking back over the past half century, there were two predominate themes that emerged in an attempt to solve the problem of network congestion: taking flight and riding the rail.

ABOVE-GROUND NETWORK

One major brainwave from the past was the thought that we would escape network congestion by taking to the sky in flying sedans, helicopters and hovering cars (some people still hold on to these ideas). Although these concepts are fantastical – and we all dream of having our own helicopter – they ignore the simple reality that fighting gravity takes a great deal of energy. But what these ideas do highlight is that the public has long been weary of network congestion and there was no golden era when motorists were not stuck in nightly rush-hour queues, illuminated by the ruby glow of brake lights. In fact, a *Popular Mechanics Magazine* cover featuring a personal helicopter was published in February 1951 – a full five years before Eisenhower signed the National Interstate and Defense Highways Act of 1956, beginning the modern interstate era in the USA. This only goes to show that network congestion has always existed.

A second common theme unearthed when looking through the archives is the notion of a seamless transit alternative, effortlessly whisking riders where they need to go. The most emblematic version of these transit alternatives is the monorail. Throughout the 1950s and 1960s, many cities flirted with the idea of constructing monorails, and in fact the city of Seattle built a mile-long monorail for the 1962 World's



Fair. However, the monorail as a practical solution for network congestion never took hold and today's monorails are mostly found at theme parks, airports and zoos.

When looking to the past, it is evident that the ideas of taking flight or boarding monorails to solve network congestion never materialized. Although stirring the imagination, they failed to leverage any market. The lesson of the past is simply this: it is not good enough to invent new technological solutions – you must have technological solutions that leverage markets.

VISION FOR THE NEXT 50 YEARS

As we move into the future to outline how a congestion-free network will develop over the next 50 years, we must remember there are two types of congestion. These are everyday congestion associated with rush-hour(s) – defined as recurring congestion – and the anytime periodic congestion associated with accidents, weather, construction activities and special events, also known as non-recurring congestion. Their impacts on today's network are similar, with total network congestion being subdivided into the two categories almost equally. Armed with our lesson from the past we must ask how we can bring technological solutions to the network that leverage what markets want to solve – network congestion. Although we looked to World's Fairs for ideas from the past, it makes sense that we should look to the automobile industry for ideas about our transportation future.

To begin our journey, we need to start with a review of what the future of the automobile could be. Today's trends and data suggest that the future network will be auto-centric. Many may bristle at that assertion, but that is what the data suggests. Without question, transit ridership will grow with increased network congestion, increasing fuel prices, more transit-orientated design and smart growth strategies. And telecommuting will increase as the locations of modern jobs are increasingly fungible. Likewise, with modern communities being planned more wisely and constructed in a mixed-use manner, there will be higher percentages of walking and bicycling and less of a need for external auto trips. With all of these measures, overall vehicle miles traveled per person will decline, as will the percentage of auto-based travel. However, personal auto

"The lesson of the past is simply this: it is not good enough to invent new technological solutions — you must have technological solutions that leverage markets"

Electric and hybrid cars are a growing market and in the future could be the norm

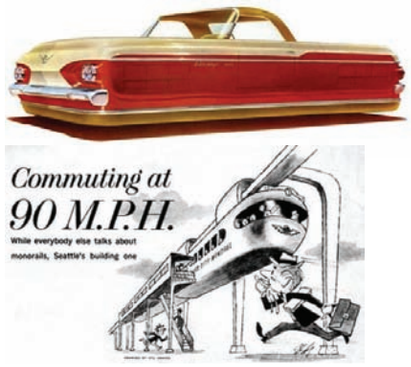
travel and truck-based freight movement will remain globally dominant and at the center of the network.

AVOIDING NON-RECURRING JAMS

So what are Detroit and Tokyo betting on for the future of the automobile? When their R&D efforts and concept cars are reviewed, three trends emerge: highly intelligent vehicles that will have an increasing ability to communicate with each other and the network; deployment of technologies that allow for semi-autonomous driving within 10 years; and smaller vehicles that run on various fuels.

Essentially, we will see the continued embedding of modern computing and communications technologies into automobiles, which will allow vehicles to avoid non-recurring congestion caused by accidents, weather and construction. As the amount of real-time communications improves and motorists can receive updates on traffic conditions, they will have more opportunities to avoid non-recurring congestion with the assistance of next-generation GPS making alternative routing decisions. However, daily rush-hour (recurring) congestion is something motorists will still have to contend with.

Avoiding non-recurring congestion will be wonderful, but what will be even better is preventing it in the first place. An accident-free network should be the ideal we should all strive for. What will begin us down the path to achieving that goal is having vehicles assist the driver with decision making beyond merely routing. The future, safer network will begin with the evolution of onboard vehicle communication technologies that are married to safety



Monorails and aircars were predicted to be the solution to congestion on the ground

technologies such as adaptive cruise control and lane centering systems – think of the lane departure warning systems of today with the added feature of allowing the onboard computer to actually auto-correct and keep the vehicle in the lane. In the future, vehicles will know where other vehicles are and will have onboard safety systems to assist in accident avoidance.

Just as future consumers will demand vehicles with advanced communications, navigation and safety systems, the future energy market will also require smaller vehicles that run on alternative fuels. Most oil scarcities of the past were largely geopolitical. However, in this day and age they are market-based and unless large countries (such as China, the USA and India) stop putting millions of new cars a year on the road, there will be a global shortage of oil in the future and a market need to develop vehicles that are powered by alternative fuels.

Five years before the Interstate, congestion was seen as a problem that needed a solution

Consumer and energy markets will demand future automobile technologies that increase communications and safety, and allow for alternative energy vehicles. A great benefit of this will be the significant decrease in non-recurring congestion. Likewise, future consumers of the network will demand one that is free of recurring (peak hour) congestion once they are aware there is a way to achieve this. The good news is there is modern technology and policy mechanisms to achieve this.

SOLVING RECURRING CONGESTION

Today, the individual cost of using the network is not felt by the consumer of the network in absolute terms: the network of today is mostly funded through fuel taxes. So whether a motorist drives down a rural dirt road at 02.00hrs or drives on an urban interstate in rush-hour, their cost for consuming capacity is virtually the same. Today's transportation funding model does not account for how network capacity is consumed and therefore the most critical links are always over-consumed during critical time periods. The result of this is peak hour (recurring) congestion.

The only way to solve recurring congestion is to price the entire network by time of day, level of congestion and type of vehicle. In 1952, William Vickrey, a Columbia University professor and Nobel prize winner for economics, first proposed the use of pricing to control transportation demand, and is widely regarded as the father of congestion pricing. However, there was not sufficient tolling technology to implement his ideas widely. Today, road pricing truly can be used to control demand and eliminate recurring congestion. Combined with in-vehicle technologies that make vehicles safer and will therefore reduce (and eventually eliminate) non-recurring congestion, the vision of a future network without congestion will be realized.

The power of markets to match supply with demand and fuel innovation is unarguable. However, when the public good is at stake, it is important that policy be in place to protect the public interest and, yes, actually guide the market if necessary. That is the appropriate role of central government and public policy. If central governments today required communications and safety systems in all vehicles, the deployment of these technologies would be advanced, as would the reduction in accidents and non-

The turnpike of the future? High-speed autonomous vehicles traveling safely to their destinations alongside autonomous mass transit

recurring congestion. Good public policy can help guide the market as long as its central aim is not to fully retard it.

Determining the appropriate role of public policy is important when discussing transitioning to a fully priced network. It is imperative that congestion pricing be advanced as soon as possible, especially when the existing ability of roadway trust funds to maintain or improve network facilities is faltering and there is an accelerated decay of current funding mechanisms due to increased costs, inflation and alternative fuel vehicles.

We must ensure the policy foundation of a fully priced network is system efficiency, with the secondary goal of revenue generation. What would be the death knell of any large-scale attempt to institute a fully priced network would be the public perception of turning the network into an unregulated market, where network capacity would be treated as a commodity. This is precisely why good policy and the market must work in concert to ensure system efficiency and reliable transportation funding, while protecting the public good.

NOT ONLY, BUT ALSO...

Today's network is highly inefficient and wasteful in terms of time, money and energy. Most nations today have a network largely funded by fuel taxes that rely on the continued consumption of fossil fuels. Most nations also subscribe to the belief that global warming is real, climate change is a serious problem and a 'green' revolution is necessary. Unfortunately, most nations have a transportation funding policy and an energy/climate change policy that are at odds. Moving to a fully priced network that manages congestion will not only reduce greenhouse gas emissions, but will also finally align the transportation and energy policies of most nations. It will further accelerate market forces to move to alternative fuel vehicles and eventually result in a surface transportation network that is reliable, sustainable and climate-neutral. ■

Matthew Click is a senior associate with Cambridge Systematics, USA, working nationally in the areas of tolling and road pricing, transportation policy, and corridor and systems planning. He previously worked for Florida's Turnpike Enterprise.

A CHANGE IS GONNA COME

The USA has just turned the corner regarding Time, Distance and Place Charging. Likely unable to turn back, **Bern Grush** poses an inevitable question. What must the USA do to prepare for the change?

Illustration courtesy of Nishan Sothilingam

The USA has finally arrived at the political threshold of Time, Distance and Place (TDP) charging. Until now – and with the exception of Matthew Kitchen's work with the Puget Sound Regional Council – the USA has single-mindedly focused research projects on replacing the fuel tax (a la the Oregon trials), and all pretty much away from the gaze of the entitled American masses. Of course, fuel tax replacement is important work, but having that issue as the core driver has caused the US view to be largely dumbed-down to money and mileage. Hence the Americans are now stuck with the weakly descriptive moniker 'Vehicle Miles Traveled' (VMT) charging, to which is frequently apologized, "with likely variations for time and location to address demand" – Shaman-speak for 'congestion pricing'.

Too bad. VMT by itself is an expensive and inefficient replacement for the fuel tax. Calling it that has already caused misunderstanding across the board with criticism of it not being green, on the assumption that one mileage price for all vehicles will encourage the purchase of larger vehicles (how big can a Hummer get, I wonder?). VMT by itself – which no self-respecting transportation economist would recommend – would send weaker consumption signals than the gas tax does. So why make a huge education problem even worse by calling it the wrong thing? Isn't that a bit like naming your son 'Dopey' and expecting him to win scholarships?

To be economically effective the calculation of road use charges must include vehicle type in addition to time and location of use, otherwise the argument for its use

to replace fuel tax is diminished to the issue of the expected switchover to electric cars. I am sure we can find ways to tax electricity for electric cars that would be cheaper than running a VMT charging system. Policy thought-leaders know this well, but have not sufficiently stressed it, and the few journalists that understand it have been too quiet. This raises undue alarm that serves only to make the promotion of the needed tax shift more difficult.

FEBRUARY 2009

The week February 20-26, 2009 saw the US VMT conversation suddenly move from the Few to the Many. President Obama's cabinet and a congressional commission completing work started two years earlier launched a significant debate regarding the USA's surface transportation system. This debate will certainly have many low points, such as the Lahood-Gibbs-Oberstar shouting match that helped sell newsprint for a couple of days, and some high points such as the release of the final report of the National Surface Transportation Infrastructure Finance Commission, *Paying Our Way*.

The debate will cover a surprising number of issues. Although the discussion regarding what the Feds should do versus what the states should do is critical, I'll side-step that as I'd be out of my depth and because I believe we can achieve a full switchover to uniform, nationwide VMT without rewriting the federal-state relationship in any fundamental way. Conveniently blinkered, I think these six issues matter, in order of importance.

1: PRIVACY

Some Americans (and non-Americans) are frankly afraid of GPS and many other mysterious technologies. We will not be able to explain it away to everyone. Other Americans who are not afraid of GPS are anxious not to risk its misuse. Who would fault them? Yet other Americans understand it is possible to have a system that does *not* track motorists but so hate taxes (or new charges) on principle that they will latch onto the privacy argument as a red herring. Attacking privacy fears with 'don't worry' or 'they already know your credit card and cell phone' will serve to make these Americans – who in aggregate may be the majority – only more resistant. We need to acknowledge that, correct or not, the Big Brother perception is powerful. We need to legislate that no VMT meter can permit location (tracking) data out of the vehicle, without specific (signed?) permission of the registered vehicle owner and its operator(s). This is already in progress in the EU. To get this under way now keeps the VMT charging debate on the table and says, 'First thing is to remove Big Brother possibilities'.

2: ENTITLEMENT AND FAIRNESS

The arguments around entitlement to mobility need to be settled. Must some roads remain a free access public good? Should roads be funded by taxes paid only by people who use roads directly, or should they also be paid by through sales and property taxes, as we can argue that all people benefit from roads whether they are motorists or not? Should there be exceptions for certain vehicles and persons? Arguments for exceptions are often meritorious. We do not want to make anyone worse off – but we might. So how do we address that? There are separate credit, tax and assistance schemes to help people move or shift modalities. What are they and how will they work? If they were understood, anticipated, and in place, some would prepare, thereby reducing the pain of change and increasing acceptance. And for those who continue to ignore the writing, political leaders can at least take some credit for preparing for change.

> "We can achieve a full switchover to uniform, nationwide VMT without rewriting the federal-state relationship in any fundamental way"

3: FUNDING VERSUS MANAGEMENT

If VMT is only for funding transportation, then it would be applied in a particular way – in fact, the argument 'just increase the gas tax' would not be out of place if we could ignore an impending shift in energy source(s). But if VMT is also for congestion cessation, we need to build education programs – for politicians as well as for us 'plain folk' – as an amazing number of people really don't understand demand management. And if VMT charging is to be pitched for green reasons, I am further concerned. There is a lot of green print and intention – all heartfelt, stated preferences – but when a majority of people are asked to pay for these, revealed preferences are otherwise. And if the argument is for national security, as it is for some, well, I'll leave that one for the reader. And when you put them all together, as needs doing, you have the debate from hell. If there is anywhere that needs some guidance for the Fed, this might be it. (I should unlist my phone after writing that, shouldn't I?)

4: ACCESS VERSUS ENVIRONMENT

Access, here, is not just entitlement in sheep's clothing. To be realistic, we need access to other places – whether work, worry, wink or worship. Moving people and things from one place to another leaves a footprint. Many of us would like to see that footprint minimized. Do we have a common definition of what footprint we will tolerate? Saying a '50% reduction' or an '80% reduction' – or indeed the 1990 level – really makes most of our eyes glaze over. Many of the promises we have made to date have few realistic plans to get there. We will never all agree to sacrifice mobility for the environment, or vice versa, but a settlement has to be carved out.

5: ROADS VERSUS TRANSIT

Some drivers say, 'put the money into the road network' (makes sense). Urban planners say 'we need better transit so put some money there' (good idea). Then we get hard-to-digest economic arguments about how moving a commuter from a car to a bus makes the road less congested so the motorists left driving should be happy to fund transit. If balanced transportation options are good for everyone, why are motorists so damned nasty to cyclists and transit vehicles? We have truckloads of math on transport modal balance and management, but most people still think their mode is the one true mode. Where else have we heard that rhetoric? This problem won't be solved in a town hall or a newspaper. This will need urban planners with some selling skills and some politicians with testicular courage. And hopefully, what works will be copied by more of the same types. But beware of failure, though.

6: COST

Considering how tough those five are, why even mention this one? Well, if we can't shift the tax base from gas consumption to road consumption at a cost close to that of collecting fuel taxes – 1.01% according to February's *NSTIFC Paying Our Way* report – as opposed to the 20% it takes to collect German truck tolls, or the 40% it takes to collect London's Congestion Charge – then we don't have a deal. There are ways to get to 1.7% according to the NSTIFC report. Can you name one? The Europeans can't.

Rather than try to read the Lahood-Gibbs-Oberstar shouting match to divine what President Obama is really thinking, we need to crack some harder issues. Whether VMT charging will solidify in Obama's second administration or in the one following is less important than preparing ourselves to do it right when it does arrive.

BUILDING BLOCKS

Although ITS systems receive the praise for making highways more efficient and safer, **Leanne Keeble** investigates the foundations of this success – industrial communications networks

Illustration by Magictorch

Unreliable and lengthy journeys take valuable time out of every day, with implications of cost to businesses and individuals. Worldwide, billions of liters of fuel are burned by drivers just sitting in traffic jams. ITS networks provide one of the primary enablers for reducing congestion, not only speeding up average journey times but also making travel more reliable generally. But a primary consideration is that any network solutions should be cost-effective and offer the flexibility to evolve as traffic management requirements develop.

DISTRIBUTING DATA

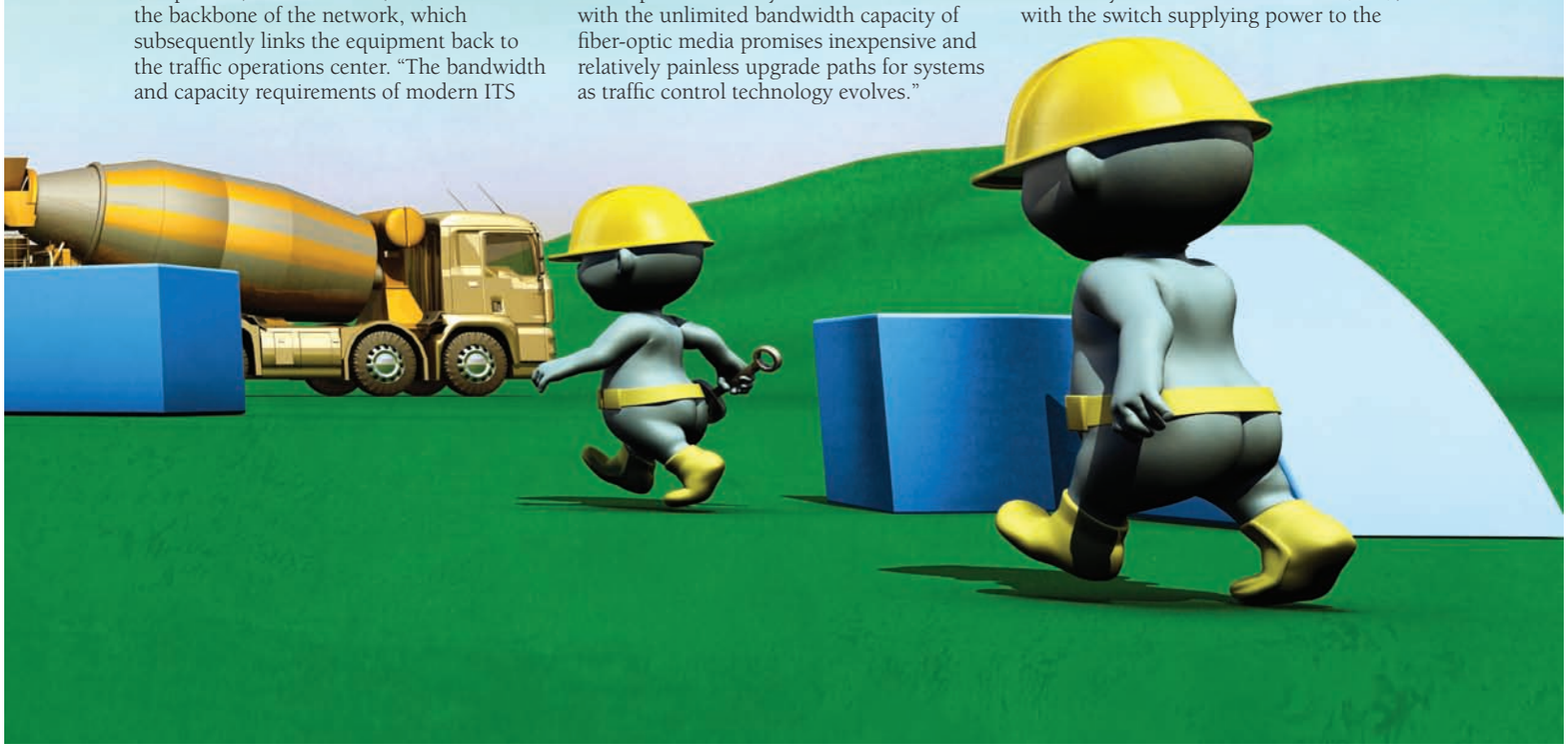
According to David Moss, business development manager at GarrettCom, effective ITS networks depend upon the edge portion of the network, which links the specific data-gathering equipment (telephones, video cameras, etc) with the backbone of the network, which subsequently links the equipment back to the traffic operations center. "The bandwidth and capacity requirements of modern ITS deployments mean that the traditionally used network technologies are no longer up to the job," he explains. "So in terms of the cost of new technologies, not only must the cost of equipment such as video cameras be considered, but also the cost of the networks that will distribute the video data."

As far as Moss is concerned, industrial Ethernet ticks all of the boxes – a cost-effective network technology that is compatible with the latest breeds of traffic management equipment, which benefits from high bandwidth and capacity, flexible deployment, and is able to grow in line with the requirements of the application.

"It [Ethernet] provides the ideal protocol for networking VoIP (Voice over Internet Protocol) telephones, video cameras and other bandwidth-intensive devices, and for transmitting the data back to the TOC," Moss insists. "The scalable Ethernet standard encompasses a variety of bandwidths and with the unlimited bandwidth capacity of fiber-optic media promises inexpensive and relatively painless upgrade paths for systems as traffic control technology evolves."

Any effective and flexible Ethernet infrastructure depends on high-quality infrastructure products, such as switches and routers. So, the latest hardened Ethernet switch products from companies including GarrettCom provide connectivity for cameras, telephones and other Ethernet-enabled control devices, and combine this with fiber-optic connectivity to the control network. Moss adds, "Redundant network technologies such as rings and meshes are also supported to give the network the highest degree of resilience."

For intersection monitoring, a number of cameras can be simply connected into the network via a single switch, with ample Ethernet ports left over to daisy-chain with other intersections, or to provide the flexibility for ongoing development as requirements change over time. "The latest development," Moss reveals, "is the wider availability of Power over Ethernet (PoE), with the switch supplying power to the



connected devices and so eliminating the need for costly cabling of the device back to a central power source."

Modern Ethernet infrastructure devices need to step up to the mark in traffic monitoring and control applications by being specially hardened for challenging outdoor environments. Here, Moss has no concerns. "Our switches are rated for wide-ranging ambient temperatures, are NEBS-compliant for vibration, shock and altitude, and can be conformally coated on request for added protection against moisture, humidity and even chemical attack."

SMART THINKING

But the ability to upgrade systems easily is an especially important point, and something the City of Sacramento, California was recently thankful for. "Many cities in the USA and around the world are installing a new generation of IP-based traffic cameras and controllers to improve road safety," explains Charles Clawson from Actelis Networks. "They are waking up to the fact that they can easily and economically deploy new IP services over their existing copper-based networks, which is making their cities safer, more efficient, and greener."

Often, as in Sacramento, systems installed during the 1990s needed upgrading to provide more sophisticated monitoring and control capabilities, but this has placed much more of a burden on the voice-grade, time division multiplexing (TDM)-based network than it could handle. "In many cases," Clawson continues, "relatively slow legacy communications links are now being replaced with Carrier Ethernet solutions that are running over the same copper networks deployed decades ago."

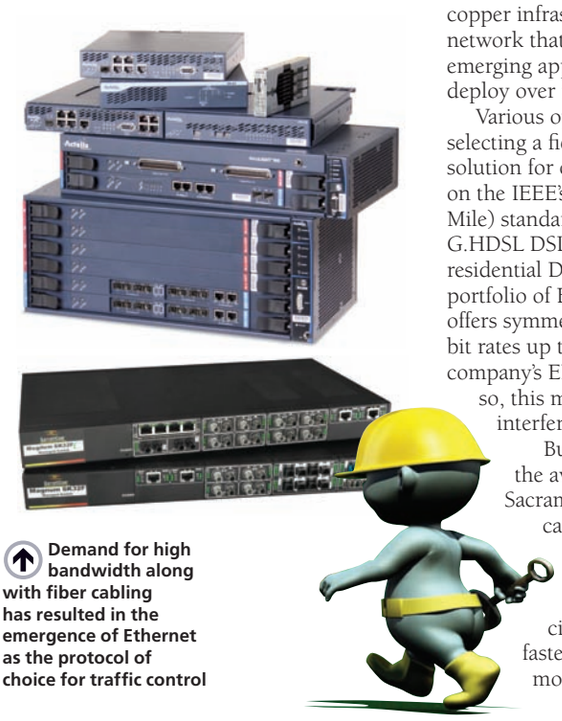
Sacramento had been managing well with dial-up modem links operating at speeds as low as 1,200 baud for managing traffic signals. New traffic cameras, though, require more bandwidth and reliability. "They had deployed a limited number of fiber-optic networks in the ground that were capable of providing high-bandwidth connections straight away, but only to cameras and other devices that lie close to the network's core." IP cameras near the fiber ring were initially connected, although only at the start, as Sacramento needed the capability to deploy more cameras throughout the entire city.

Ryan Bellici is a telecommunications engineer for Sacramento. "Copper cabling was already widely deployed and provided far more extensive coverage than fiber," he says. "We have 50-80 miles of fiber in the ground, but many hundreds of miles of copper." The challenge was turning this copper asset into a medium capable of supporting high-bandwidth telecommunications. "Keeping operating expenditure to a minimum, we needed a solution capable of complementing our fiber network while upgrading the existing copper infrastructure into a next-generation network that could support existing and emerging applications, which we could also deploy over the new fiber network."

Various options were evaluated before selecting a field-proven Ethernet access solution for copper infrastructures, based on the IEEE's EFM (Ethernet in the First Mile) standard 2BASE-TL, and which uses G.HDSL DSL modem technology. Unlike residential DSL products, the Actelis ML portfolio of Ethernet Access Devices (EAD) offers symmetrical DSL bandwidth at bit rates up to 100Mbps, exploiting the company's EFM*plus* technology. In doing so, this mitigates the effects of crosstalk interference between wires.

But what does this all mean for the average Joe on the streets of Sacramento? "The city's new IP-based cameras are already making a big difference to citizens in the area," Clawson suggests. "If a signal fails, technicians at the city's TOC are now notified much faster, making repairs quicker and more cost-effective."

> "They are waking up to the fact that they can easily and economically deploy new IP services over their existing copper-based networks"



Demand for high bandwidth along with fiber cabling has resulted in the emergence of Ethernet as the protocol of choice for traffic control

Ethernet in practice

GarrettCom Europe had a hand in the congestion-busting M42 motorway pilot scheme, in which hard shoulders were opened in peak hours and VSLs implemented to reduce jams. It was also intended to increase safety by using video data, and to offer enhanced driver information about traffic flow, journey times and accidents.

GarrettCom's industrial Ethernet switches were used to network the cameras, while S-Ring redundancy software provided high standards in fault-tolerance. The result of the trial was an improvement in journey times by 27%, fuel consumption reduced by 4%, and vehicle emissions down by up to 10%. The trial also saw the personal injury accident rate fall from 5.2 to 1.5 a month on that particular stretch of motorway.

Ethernet networks as part of an ITS strategy can also play a key role in boosting safety and speeding up arrival times for emergency services. This can be critical in tunnel accidents, and a European campaign over the past five years has forced tunnel safety to the top of the agendum as a key motoring issue, impacting not only personal safety (where tunnel fires across Europe have killed more than 90 people in the past 10 years), but also the transport infrastructure of whole countries.

Recent years have seen a host of companies and universities active in ITS research and development projects associated with tunnel safety focusing on innovative components and integrated systems. Much of this work is already coming to fruition in both new tunnel projects and in reconstruction projects on existing tunnels. One example is the installation of a new VoIP (voice over

internet protocol) emergency telephone network, installed by Italian system integrator, Fort Fibre Ottiche, using VoIP phones from Teleindustria in conjunction with hardened Ethernet switches from GarrettCom Europe.

The hardened switches selected ensure the highest degree of operational reliability, while the ruggedness of the network itself is further enhanced through the use of GarrettCom's S-Ring technology, which delivers high-speed fault detection and correction.

"The systems are going to be invisible to the public," admits Shad Bennett, head of Engineering and Operations in Sacramento. "It's all about efficiency and detection. Technicians can now tune the timing of the signals in response to changing conditions to optimize flow and minimize traffic congestion. These monitoring and control capabilities are also attracting interest from other agencies within the district."

The opportunity to optimize traffic flow is crucial, as congestion in the Californian city – the home of Governor Arnold Schwarzenegger – has grown enormously over the course of the past decade. But the Actelis Traffic/ITS solution is resulting in decreased time on the road and reduced jams, which is subsequently helping to reduce the city's carbon footprint, as cars and buses are not idling for so long. In fact, the concept is catching on, and plans such as this are being implemented in cities including New York and London, where cameras originally installed to enforce toll roads, speed limits, and lane restrictions may soon be available to police real-time traffic monitoring with ALPR for use in tracking suspect vehicles.

NEW KID ON THE BLOCK

Although a new name in ITS, many of the people behind ComNet are old faces with years of experience in the ITS networks market, having previously been with the GE-owned International Fiber Systems (IFS). "What we provide is the unseen aspect of devices such as traffic lights, surveillance, video detection, ETC and VMS – the medium that connects them," explains Rob Gallagher, vice president, Engineering, at the Connecticut-based ComNet. Gallagher and his colleagues – one of whom is

United lines

Tyco Electronics Wireless Systems' Barry Einsig suggests to *Traffic Technology International* that the continued unification of communications systems is essential

You don't have to delve too far into the history books to appreciate the need for a unified approach to communications: Hurricane Katrina, August 29, 2005. Of the failings noted following the devastation, a lack of real-time and accurate traffic information was highlighted, with poor communication in particular singled out for criticism.

Those people involved in evacuation management often cite the need for better communication and coordination between emergency management, transportation, law enforcement agencies and the general public. Since Katrina, several US states have been working to combine emergency management personnel into single facilities and to establish coordinated evacuation policies. Barry Einsig from Tyco Electronics Wireless Systems believes this is a trend that it is set to continue in the USA. "A handful of states have already integrated traffic management and emergency response operations," he says. "But we are definitely moving toward common operational theaters and communications protocols. Just being in the same facility, able to talk face-to-face, able to respond to incidents quickly – as opposed to being in disparate facilities – will have a major impact."

Tyco Electronics Wireless Systems has a great deal of experience in the field. Among the contracts most fresh for Einsig to recall is the Pennsylvania Turnpike Commission (PTC), which recently opted for the company's VIDA (Voice, Interoperability, Data, Access) Broadband communication network. This allows the transmission of real-time video to the PTC's TOC in Harrisburg, and monitors roadway conditions, construction projects, as well as weather conditions that might adversely affect the 185 million vehicles that travel the 545-mile Turnpike every year.

The remote wireless video system is housed in a standalone, self-contained unit. When traffic reduces to 20mph, it alerts the Harrisburg TOC, at which the appropriate response is adjudged. Each unit is also connected to an adjacent traffic alert sign that notifies drivers of road and traffic conditions.

In addition to VIDA, the company provides the Commonwealth of Pennsylvania with its statewide public safety radio network, PA-STARnet. The PA-STARnet network is designed for 95% mobile coverage over Pennsylvania's 45,000 square miles and 67 counties, and employs Tyco Electronics' OpenSky system to

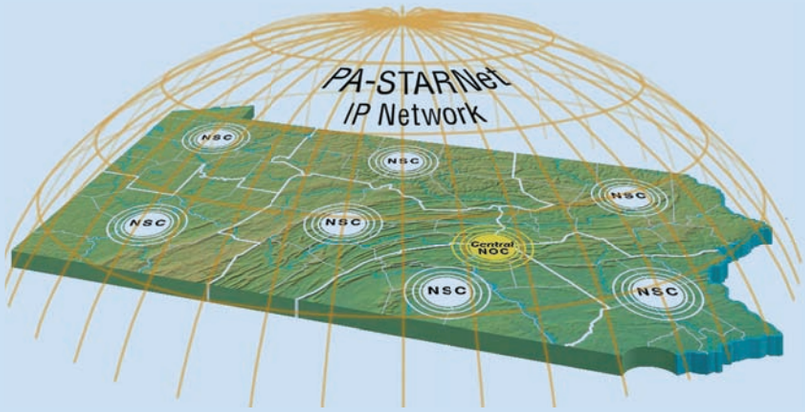
THE CABLE GUYS

Ethernet has become a firm favorite in roadside communications over the past few years as a result of its interconnectivity. In fact, virtually every equipment supplier makes products with an Ethernet port as the preferred choice of connection. "The real benefit of using an Ethernet infrastructure is not that it can transport IP traffic, as many people believe, but that it can transport IP traffic as well as any other protocol that pops out of the generic RJ-45 port," explains Westermo UK's Alan Bollard,

New ITS cameras can now send high-quality pictures using Ethernet as the medium

managing director – referring to its capability to allow many protocols to run simultaneously over the same cable. "This means a single network can handle CCTV, roadside VoIP phones, information displays, traffic management systems, and any other piece of equipment that may need to be temporarily mounted on the roadside."

But several questions arise due to the fact that all of these technologies are running on the same network. For instance, will there be enough bandwidth? How resilient is this now critical network? And how can you tell if it is in danger of overloading? Having been used in many diverse industries for a number of years, such questions have fortunately already been answered. "Bandwidth management is handled by



Pennsylvania's statewide public safety radio network, PA-STARNet, uses Tyco Electronics' OpenSky system to provide state agencies with clear, reliable speech transmission

provide state agencies with clear and reliable speech transmission. "OpenSky data networks are based on Cellular Digital Packet Data (CDPD) protocols and packet-switching technology, which offer CDPD-like services on private radio channels." Mobile applications are provided with end-to-end TCP/IP connectivity, in doing so simplifying application-to-network integration.

"Our goal is always to create shared networks to be more cost-effective," Einsig explains. "In Pennsylvania there's fiber, there's microwave backhaul, OpenSky technology and now our Beta Broadband technology deployed within the state to create a shared-use network for public safety, transportation and turnpike entities. That's a real value because you have a common operational procedure, a common network, and a common communications protocol back at the core, so it's much easier to share data between the systems. Such systems are definitely part of the route forward."

For agencies considering upgrading their existing communications systems, Einsig advises them to look at their entire community and ecosystem and develop shared-use networks in order to create that "common operational theater", which should also be the most cost-effective network theater. "Regardless of the size of the area to be covered, most agencies have multiple communications technologies – wired and wireless – so being able to create and administer one common network is the most efficient and cost-effective for an authority, whether it's a state, a county, or even a turnpike authority.

"We are all looking to create not only single authority-wide networks but also regional networks, so that you can have both regional networks for private use in large metropolitan areas to ease congestion, as well as the national networks that would be provided by the carriers. If you were to look at a Washington and Baltimore regional network for privatization, for instance, that covers three or four states, it covers common operational networks where there's traffic management and multiple modes of traffic, whether it's freight, transit or highway systems that all need a common operational theater. For me, that's where we need to get to: the Integrated Corridor Management-type concept in those bigger regions."

methods such as VLANs, prioritization, head-of-line blocking prevention, and IGMP snooping," Bollard explains. "VLANs effectively provide channel separation and can be used to ensure certain data is only available to certain parts of the network, thereby providing both security and the chance to optimize performance for particular devices."

Prioritization can be used to enable particular time-critical protocols to jump the queue upon arrival at an Ethernet switch to ensure that the quality of a CCTV image or voicecall, for instance, are of sufficient level. "IGMP snooping," Bollard adds, "is a special technique that can be used to control multicast data – the type often created by CCTV – in a switched Ethernet network."

Westermo's Wolverine Ethernet SHDSL extender line can provide data rates up to 5.7Mbps

The management of the network can be handled simply by using SNMP (Simple Network Management Protocol), which provides a mechanism to look at details such as new devices being added to the network, how much data traffic is present, and also when the network has to reconfigure as a result of a media failure. All of this can be handled from single or multiple management stations.

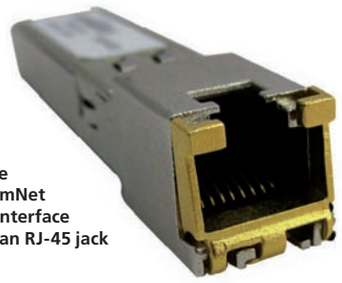
"Network resilience is also critical if all of your data traffic is relying on just one network," Bollard states. Again, Ethernet has many standard solutions. STP (Spanning Tree Protocol) and RSTP (Rapid Spanning Tree Protocol) are standards that allow networks to reconfigure automatically within 0.5 seconds. When safety dictates a faster reconfiguration, then specialist protocols such as Westermo's FRNT can be used to provide ring recovery in 20ms for networks up to 200 switches. (20ms reconfiguration means only a slight flicker on a high-resolution CCTV image.)

One obstacle that Ethernet faces is its transmission range over copper cable. "Ethernet standards dictate that 100m of UTP cable is the maximum

George Lichtblau (interviewed in the January 2009 issue of *Traffic Technology International* magazine, *p61*) – have been working with fiber-optic transmission since before ITS came into prominence. "Over the years, fiber-optic transmission has become one of the best available solutions to link field devices to the TMC in order to monitor and manage the flow of traffic," Gallagher says. "Point-to-point and other relatively simple network topologies used to be the norm, and utilized low-speed serial data and baseband analog video over optical fiber. In time, though, the use of digitally encoded video replaced the previous generation of FM video transmission products, the technical benefits and advantages of which are now well known and widely accepted."

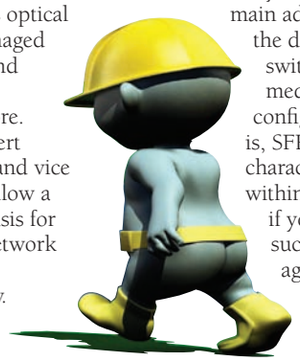
Right now, Gallagher feels we're in the middle of a convergence of IT and ITS. Although fiber-optic transmission is still the medium of choice, he says that Ethernet is the preferred method for implementing ITS-specific communications networks – and this is reflected in ComNet's expanding portfolio. The company has recently introduced a new Ethernet line that utilizes modules known as Small Form-Factor Pluggable Devices (SFPs) as optical interfaces for its line of managed and unmanaged switches and media converters, about which Gallagher reveals more. "SFPs are devices that convert electrical signals to optical and vice versa, small modules that allow a user to select – on a port basis for an SFP-enabled Ethernet network component – the type and performance of connectivity.

"These devices evolved into a standard from an earlier small outline soldered-in component to the field-installable and replaceable devices used today," Gallagher explains. A cooperative agreement or Multi-Source Agreement for Small Form Factor Pluggable Devices was created so that manufacturers and users could specify an SFP and produce or receive a product that is universally understood from an electrical and mechanical standpoint.



The ComNet copper interface SFP has an RJ-45 jack

Available in electrical or optical output, different fiber connector types (SC, LC), numbers of optical fibers required (two or one), distance (up to 120km) and speed (100Mbps FX or 1,000Mbps FX), this offers system designers an incredible amount of flexibility in designing their network. "The main advantage of using SFPs is that the devices, whether they're managed switches, unmanaged switches or media converters, can be custom-configured to the application. That is, SFPs of differing performance characteristics can be interchanged within the same device. For example, if you are using a managed switch, such as our CNGE3FE7MS as an aggregation point, it has three configurable SFP gigabit optical ports. By using different SFP modules, you can optically link to two other devices that can be located at different distances, have different optical connector types, or require the use of one or two fibers. The built-in flexibility of devices that use SFP devices can offer users large savings in the purchase of transmission equipment by not having a distance limitation common to non-SFP (fixed-optic) devices."



In layman's terms, the SFPs are small transceiver modules that slide into an Ethernet network element. Although there are other devices that utilize SFPs, they are traditionally used in Ethernet devices. A locking mechanism holds the SFP in place and they are also hot-swappable, meaning they can be installed or removed in a unit that has power applied. "The advantage here is that they are field-installable and replaceable," Gallagher says.

SFP-enabled devices provide a great cross-section of choices to meet the network interconnect requirements for an Ethernet network design. The selection process is the same as for any optical network where the optical link needs to be evaluated to determine the correct transmitter and receiver choice. However, with a greater choice of SFP solutions, the cost can be kept to a minimum by selecting a suitable device while not having to pay for additional 'dB's' that are not being used. As an added benefit, SFP devices can be installed in the field, which allows additional links to be added to an existing network as future requirements dictate and not as an upfront cost.

MORE ONLINE

For further exclusive detail from Rob Gallagher on ComNet's SFP devices, log on to **www.traffictechnologytoday.com**

distance," Bollard says. "After that, the solution is fiber-optic cable. Although data rates of 1Gbps are possible over the fiber cable, it can be prohibitively expensive to install." Bollard's solution is the company's Wolverine SHDSL extenders. "SHDSL technology can provide data rates up to 5.7Mbps along many kilometers of ordinary telecoms-grade cable, which is often already installed," he says. Westermo's Wolverine extenders are effectively transparent to the Ethernet traffic so can be installed easily and used like a normal Ethernet switch. "The SHDSL ports can be connected over great distances and the DDW-200 series products are fully manageable using SNMP." Redundant rings can also be supported to ensure network resilience.

Westermo supplied equipment for the A14 highway, which was used to control message signs

One recent application that required Ethernet to be used on the roadside was on the A14 highway, linking the Paris central business district of La Défense with Orgeval. "The highway is mainly underground and the total tunnel length is more than 13km," Bollard details. "There are eight tunnels in total, and at each tunnel entrance a message sign and road barrier system is designed to stop the traffic in the case of an emergency."

A central redundant fiber network was built with Lynx Ethernet switches to provide a backbone for a number of DDW-221 SHDSL subnetworks, responsible for controlling the message signs.

By using Westermo's DDW-221, the cost of the installation was kept down as copper cables could be used, whereas fiber would have been the only other alternative. "The use of the Westermo FRNT redundancy protocol also ensured that the network was able to maintain operation, even in the event of a cable break or power failure to part of the network.

"The engineering company, SDEL, and the end customer were delighted with the solution that we provided," Bollard says.

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CRASH SIGHT

Knowledge about what happens to a car and its occupants in an accident is invaluable when it comes to the development of safer cars, writes **John Challen**

Illustration and photographs courtesy of Volvo Cars

Ever since 1970 a small group of individuals at Volvo have been instrumental in the development of future vehicles and technologies. The team does not align itself with the engineering, design or even marketing fraternity however. They belong to the Volvo Cars Accident Research Team and they're currently working as hard as ever to ensure that Volvo cars remain the safest on the road.

The eight-strong team attends the aftermath of over 2,000 accidents involving Volvos every year, mostly in and around Gothenburg – the car-maker's Swedish HQ. The data collected – its database currently includes details on nearly 40,000 accidents – allows them to advise R&D teams about which new safety technologies should be introduced. Moreover, the team can prove to such departments just why these additions could make an important difference.

Some car-makers have only recently started to pay any attention to the analysis of real-world accidents, while others are actually prohibited by the laws of the land to attend crash scenes altogether. Bernd Lökensgård, though, is one of the members of the team at Volvo Cars and has 23 years' experience in the field. "We work all over Sweden, but we always have someone who is on call 24 hours a day, seven days a week around Gothenburg," the Swede states. "The main zone we work within is an hour's drive from our HQ, so we are in a position to be able to respond quickly. When the alarm from the control center sounds – or notification of an accident comes through from the police – we can be on the road straight away.

"Arriving on the scene so soon after the impact is good as it gives us an opportunity to interview the drivers of the cars involved

and we can find out as much as we can, as quickly as we can," Lökensgård says. "If we are close [to the scene of the accident], we get there early enough to follow the rescue operation and see what damage is done, although we normally arrive after the police and once the accident scene is secured."

According to Lökensgård, there is no substitute for real-world data when developing new safety technologies. "We can take some photos at the scene of the accident, go back to the office and analyze what happened and – more importantly – find out why. We can help create technologies that, in turn, help prevent future accidents. It is a bit like a jigsaw puzzle," he explains. "When you look at a crash site, you can see all of the different elements that were involved. It is our job to put all of these parts together and re-create what happened."

WORK BEYOND THE CRASH SITE

Only one member of the team attends when responding to a typical accident. The duration this individual is at the scene can vary greatly, from just a few hours to a day. Factors that influence the time spent at the site include the severity of the incident, how many people are injured and/or involved, and the extent of their injuries. However, Volvo's involvement with the affected cars, drivers and passengers doesn't stop when they leave the crash. Lökensgård explains, "Cars are taken away from the scene of the accident and – depending on the situation with the insurance company – either taken directly to the garage or the workshop." Whether or not the car is a 'write-off' (and therefore the property of the insurance company) – as well as the amount that has to be repaired – affect how long it will be before the team can get their hands on the crashed cars. "It depends on a number of things," Lökensgård says. "Sometimes we keep them for just a few days, but in the case of a big investigation, they can be here for six months. We might look at the impact marks and compare them with the collision- deformation characteristics of Volvos that have been crash-tested internally."

Once the analysis of the crashed car has been completed, the team liaises with those Volvo colleagues in charge of vehicle development. "We use the data we have to develop systems for the future, concentrating on prototype vehicles for verification tests at first. Once this initial phase has been completed, we check that the systems fulfill our own internal requirements, before thinking any further. Systems that have featured on our cars as a result of the analysis from the Accident Research Team include

Volvo's City Safety low-speed collision-avoidance technology was born from research conducted by Volvo's Accident Research Team

the WHIPS head restraint technology and latterly – and to a larger extent – City Safety. Our method for implementing such systems is built on a study of how people's bodies react both during and after the accident. It is vital to understand why the accident occurred, what could have prevented it, and what the driver could have done to avoid it."

HELPING HANDS

A number of partners are only too willing to help the Accident Research Team, as Lökensgård details further. "We have an agreement with one of Sweden's main insurance groups, which provides us with a lot of information and time with the cars. We also send out a survey to the car owner to clarify certain aspects surrounding the accident, such as seatbelt use. In most cases, drivers are happy to help and often provide some interesting information. A doctor will also look at the occupants and detail the types and severity of injuries that were involved. When we have stored all of the information and conducted some analysis relating to how severe or complex the accident was, we invite those involved in the accident back here to look at their car. This can be an emotional experience. Some find it hard to believe they survived, given the state that their vehicles end up in!"

But do the team's efforts actually have any bearing on making roads safer? "There have been cases in which we have been asked for our opinion on some matters, and people do listen to what we have to say. We don't make the final decisions, but changes have been made on the back of our recommendations. It helps that the Swedish Road Administration has supported us, and we have a good working relationship."

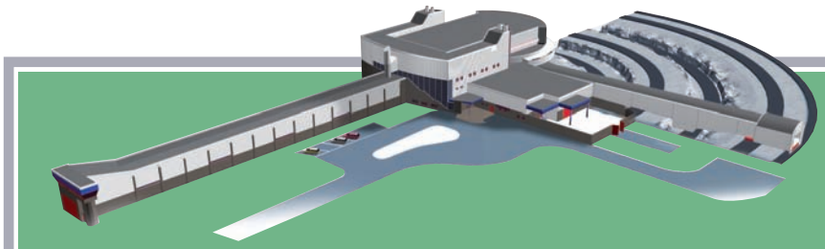
REAL-LIFE ACCIDENT CASE STUDY

With no stone left unturned in an investigation, any detail – no matter how minute – can be vital when it comes to the development of a new safety system, or analyzing the behavior of passengers in an impact. The following example, Lökensgård feels, is illustrative of the point.

A man was driving his family home one evening, his wife and child in the rear of the car, an empty childseat to his right. It wasn't raining and the visibility was good. As he traveled along the Swedish road at 90km/h (56mph), another car suddenly veered from the opposite side of the road into the path of his Volvo V70. At first, the instinct of the Volvo driver was to do nothing and hope – or presume – the oncoming car's driver would correct his mistake and return to the right side of the road. This never happened. Following the crash, investigations revealed that at that exact point, the driver of the car on the wrong side of the road was asleep. With his car traveling at 90km/h (56mph) and the Volvo having slowed to just 20/km/h (12.5mph), the combined speed of impact was 110km/h (68mph). The force of the collision pushed the V70 8m back down the road to its final resting place.

The first thing ascertained by the Accident Research Team member who arrived on the scene was that the road was dry, which helped to detect the path of the oncoming car. There was much evidence to gather. The Volvo driver was laying at the back of the car, having collapsed after checking on the conditions of his wife and child. Medical attention revealed he sustained a fracture at the base of his back. His wife fared worse, however, suffering injuries that required an operation on her lower leg after it impacted on the driver's seat. Her knee was also badly damaged as a result of it smashing into the center console. Close inspection of the child revealed slight bruising, probably from the seat straps, which was testament to the Volvo childseat doing its job. Who knows what could result from this detail? Could center consoles in future models integrate rear airbags, not just to protect rear passengers but also to prevent them impacting occupants in the front? Or maybe it could help in the development of high-speed collision-avoidance systems?

Regardless, Volvo feels research in the lab and the real world is key to saving lives and reducing injuries. But as Lökensgård acknowledges, having the data is only part of the problem – putting it to good use by designing and producing vehicles and systems that may help avert some future crashes is the bigger challenge.



Real world to virtual world

As well as analyzing real-life accidents and reconstructing them, Volvo development and testing activities also take place in the lab. "It enables us to improve the safety of our cars, making them safer in the real traffic environment," says Magnus Krokström, senior manager at the Volvo Cars Safety Centre, Gothenburg, Sweden.

The high-tech facility has performed over 2,000 crash tests since opening in 2000, and now 10 cars are tested every week. Designed to reproduce a variety of accidents, it is equipped with two tracks, one movable and one permanent. The former can be adjusted up to 90° to enable tests of all kinds (from frontal to side collisions) to be carried out between cars traveling at different angles and speeds. The permanent track is long enough to allow cars to be accelerated to speeds up to 120km/h (75mph). A series of other tests, such as roll-overs and animal collisions, can also be performed.

Using advanced computers, crash simulations are performed about 3.5 years prior to the production of a new model, while physical testing commences about a year before launch. However, no physical testing is carried out until Volvo Cars' safety experts are satisfied with the results from virtual testing.

Testing of preventive safety systems has also recently started, but this calls for much more advanced and effective test methods than the first Volvo crash test 50 years ago – when a car was rolled down a hill to hit a concrete wall. This represents one of the biggest challenges facing the Volvo Cars Safety Centre in the future.

The Volvo Traffic Accident Research Team carries out thorough investigation and analysis of accidents and accident sites

"Systems that have featured as a result of the analysis from the Accident Research Team include the WHIPS head restraint technology and latterly — and to a larger extent — City Safety"

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TOUR GUIDE

Plans for the ITS America Annual Meeting & Exhibition are at an advanced stage. So just in case you're undecided as to which technical tours would best suit your needs, allow **Saul Wordsworth** to take you on a guided tour

Illustration courtesy of Nishan Sothilingam

Moving America Forward is the theme of the 2009 ITS America Annual Meeting & Exposition, June 1-3, 2009, National Harbor, Maryland. In these troubled times – with limited funding available – it is perhaps apt that this year's showcase should be on the doorstep of Capitol Hill, so the voice of the ITS industry is sure to be heard. The event will attract key people from local, state and federal departments of transportation, as well as transit authorities, environmental organizations, academia, auto manufacturers and traffic management, whose jobs are to keep America moving… preferably forward.

The 2009 Annual Meeting conference program has been created to impart valuable information for today's domestic leaders and ITS practitioners in all sectors of the transportation industry, and incorporates two plenary sessions, 10 executive sessions, 52 special sessions, five forum showcases, 24 technical and scientific paper sessions, and one interactive session. The preliminary program is available online, and *Traffic Technology International* has invited a dozen speakers to reveal exclusive details about their presentations, which will be posted on *www.traffictechnologytoday.com* over the coming months. In addition to these educating sessions, a 150,000ft^2 exhibition hall will be displaying some of the latest technologies from more than 130 companies, solutions that have been designed not just to help move America forward, but countries around the world. As the build-up to the event starts to gather pace, further details about exhibitor launches will be revealed via our website.

TECHNICALLY SPEAKING

The following pages provide just a snapshot of some of the technical tours that you can attend during your visit, which among others includes a bus tour of Virginia's Megaprojects – the aim of which is to improve mobility on multiple modes of transportation. "The Washington, DC area is a recognized leader in the deployment of ITS technologies and practices," says Connie Sorrell, chief of Systems Operations, Virginia DOT, and co-chair of the 2009 Annual Meeting & Expo Organizing Committee. "The technical tours will enable you to experience them and hopefully bring ideas home to your own region," she adds.

As you would expect, for such a high-profile event, *Traffic Technology International* will be in attendance, exhibiting on Booth 830. If you fancy dropping by to suggest a future article, alert us to a news story – or even rest your weary feet – we look forward to meeting with you.

EXTRAS ONLINE

For updates of exhibitor launches, further details on the conference sessions, and general news about ITS America's Annual Meeting, visit **www.traffictechnologytoday.com**

Dial CATT for advice in an emergency

CATT shows off ITS software and computer games for incident management training

The laboratory of the University of Maryland's Center for Advanced Transportation Technology (CATT) is the region's premier ITS research facility, with a focus on user-friendly data application and real-time traffic simulations. "We're dedicated to transportation data and ways to visualize and mine information on transportation systems," says director of CATT, Michael Pack. "We feel that this is really lacking in the ITS community."

CATT recently played a part in the Obama inauguration by providing Homeland Security and other agencies with software to monitor the DC region in 4D. The lab's 4D real-time visualization system will be open for demonstration, with visitors given the opportunity to stand in front of a large monitor, joystick in hand, and fly around Washington, DC. At road level, the cars encountered during the demo are generated from real-time data based on loop detectors in the roadways. "All of the accident data from the DOTs goes in real-time into the 4D system," Pack says. "If lanes are shut down or police cars and fire trucks are present, this is reflected on the system."

Pack is most animated when discussing the tour's *pièce de résistance*. "We have designed a serious, multi-player video game to teach first responders how to deal with incidents, such as scene management, personal safety and quick clearance procedures." Apparently it's not unlike the game *Grand Theft Auto*, "except that instead of one person running around, there are 40 or 50, all putting out fires, dealing with victims, shutting down traffic lanes," all to show how operations and proper incident management affect traffic.

"We dedicate our time to transportation data and ways to visualize and mine information on transportation systems"

"Other than that, there are a lot of interesting software packages we have put together for analyzing ITS and incident-safety data," Pack reveals. "People don't expect it to be exciting, but when they see it in person and see the kind of flexibility it gives them to explore a data set that previously required a small team of computer scientists and engineers to fathom, they are invariably excited to discover interesting stuff from their data that, normally, they wouldn't be able to see."

Many transportation laboratories are staffed by engineering graduates. At CATT the background is a mix of civil and electrical engineers, computer scientists, geography majors and several arts majors. "We have a lot of different perspectives at CATT," remarks Pack. "As a result of all the personalities and skill sets we have here, we see some really interesting ideas coming out of our lab."

Tuesday, June 2
09.00-12.00hrs
ITS AMERICA

Multipurpose facility for multiple benefits

Planning for this US$150 million super-facility was seven years in the making

The multi-agency nature of the Montgomery County Public Safety Communications Center is something to behold: police, fire, 911 call-taking, and an Emergency Operations Center all rolled into one. Of particular note is the facility's TMC, consisting of traffic-signal and transit operations. It is a unique place to work.

"There aren't many centers in the USA that have so much going on in the same building," says ATMS engineer for Montgomery County, Michael Kinney. "Here we see each other in the hall and deal with things more directly due to our close proximity."

"We are constantly on the look-out for traffic-signal failures, those not timing properly, or flashing when they shouldn't"

The TMC controls, maintains and operates 800 traffic signals. "Almost all in Montgomery County are controlled out of here," Kinney says. "We are constantly on the look-out for traffic-signal failures, those not timing properly, or flashing when they shouldn't be."

The TMC also manages central communications for 'Ride On' – the county's bus system. There are 400 buses in the fleet, of which 300 operate in peak hours. All are fixed with GPS. Computer-aided dispatch and automated vehicle location means the system knows the precise location of each, so drivers get the information needed to help them stay on route, as well as on schedule.

The TMC has access to more than 200 surveillance cameras across the county and also provides highway-advisory radio, or as Kinney prefers to describe it, "little AM radio stations scattered around the county that we broadcast on from our center. We tell people where incidents, delays and workzones are and that same information goes onto the county's website."

To complement this, the center also broadcasts live traffic-camera feeds onto the county's cable channels, with text feed and audio layover to complement it. "Since we started making the traffic camera system available to the public online, people use it every day to plan their trip to work or to the store," says Kinney. "It has been extremely well received."

For Kinney, the greatest challenge for the TMC is dealing with cross-agency operations and coordination. "Interagency communications is still one of the most difficult aspects of the work," he says. "But there has been much progress toward standards development for protocols."

As for the center itself, he thinks tour visitors will find their trip of great benefit. "I am sure they will get plenty of ideas to take away with them. I hope they also bring some ideas of their own, as we all seem to learn better from each other than going it alone."

Tuesday, June 2
13.00-16.00hrs
ITS AMERICA

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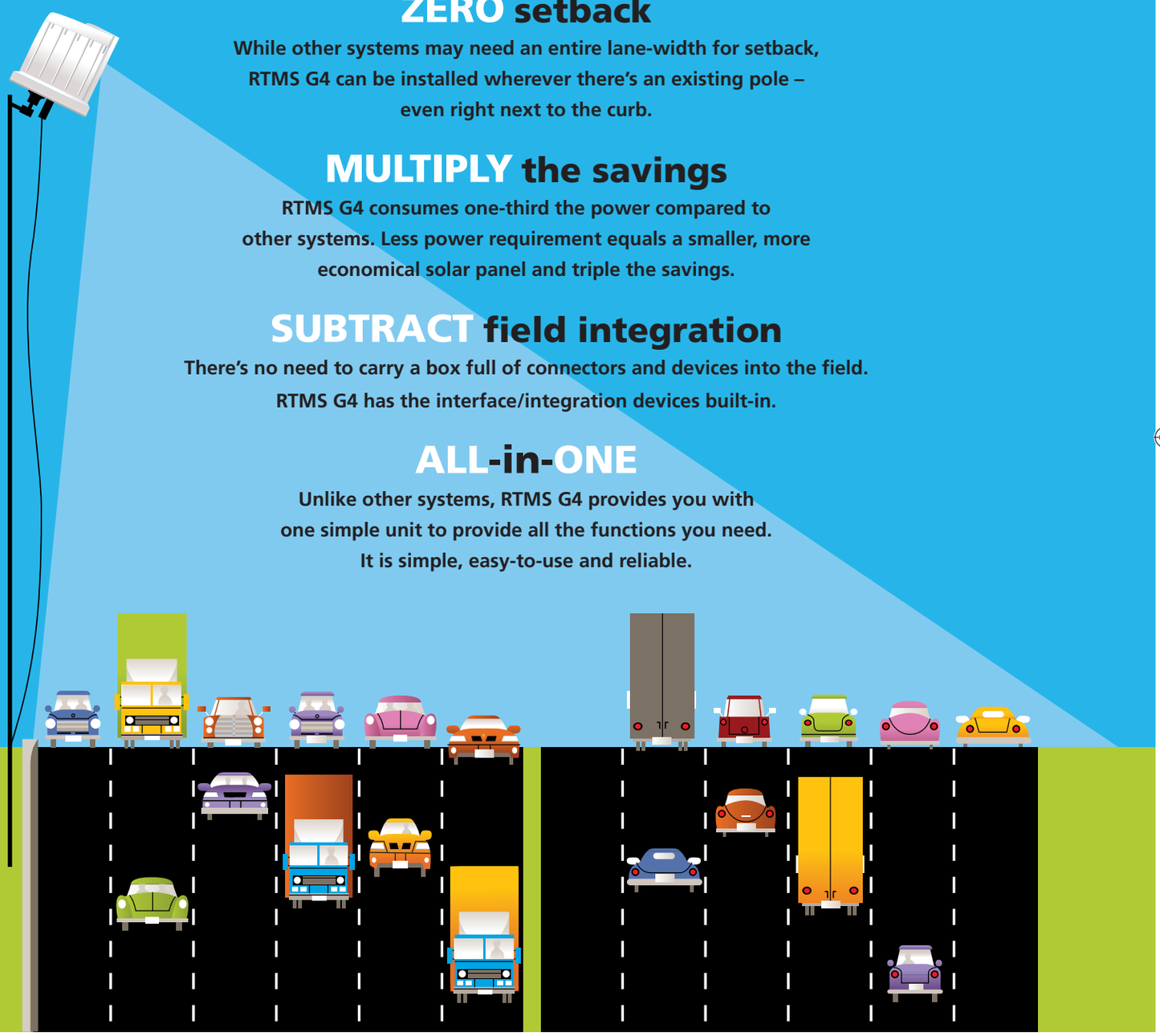

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The bridge across troubled traffic

Putting an end to decades of congestion misery, this US$2.5 billion project is a wonder to behold

Originally designed to handle 75,000 vehicles a day, by 1999 the Woodrow Wilson Bridge was experiencing almost three times that volume of traffic.

And so began the Woodrow Wilson Bridge Project, a reconstruction and expansion program that has put an end to the delays that have made motorists' lives a misery for decades. The new twin structures – which cross the Potomac River just south of Washington, DC – have added two additional lanes in both directions and divide traffic into local and 'thru' lanes.

"The Woodrow Wilson is the world's largest 'bascule', or moveable bridge," states Jim Ruddell, executive project manager on the program. "What is most startling is that we have actually succeeded. Most projects of this size are typically hit by budget overrun and late completion. We finished this US$2.5 billion scheme on time and on budget – and completely addressed the delays that were plaguing the corridor and commuters."

Aside from construction, Ruddell and his colleagues have considerably bolstered the ITS capabilities along the 12km corridor, with traffic camera numbers increasing from two to six. Also, interoperability between Virginia and Maryland has been incorporated into the design, enabling Maryland to view the cameras in Virginia and vice versa.

Further new additions include capabilities for volume, speed and occupancy, along with weather stations for roadway and bridge concrete-deck temperatures to assist in decision making about snow and ice control.

"This helps us come to conclusions about whether to pre-treat the roadways with liquid or to apply salt and sand," Ruddell remarks.

There is also a fully functional workstation for ITS in the bridge operator's tower. Those working on the Woodrow Wilson Bridge are currently considering an experimental application of a variable speed limit system.

Winner of the 2008 America's Transportation Award – the supposed 'Oscar' for state DOTs – the bridge has accrued 'five pages of awards' according to a colleague of Ruddell's, who is busy keeping count. Among these 'gongs' is the American Society of Civil Engineers Outstanding Project Award. "That's an international award and it's flattering to win something so prestigious," he says.

He believes that what visitors on this tour will witness is a truly beautiful bridge with its eight bascule leaves. "It's aesthetically dramatic," he says. "An elegant solution for all the residents in the area and something that resonates with all the architecture in the region." Overall, Ruddell says, the tour "will be a lot of fun".

"We finished this US$2.5 billion scheme on time and on budget – and completely addressed the delays"

Wednesday, June 3
08.30-10.30hrs
ITS AMERICA

Maryland's SOC: USA's only statewide center

The SOC is saving travelers time and money – over US$1 billion a year over the past five

Maryland's Statewide Operations Center (SOC) is the command and control facility responsible for managing all operations throughout the state. It is also the HQ for the Coordinated Highways Action Response Team (CHART) – a joint venture between a number of Maryland agencies to improve the mobility and safety of highway users through the application of ITS technology and interagency teamwork.

The backbone of CHART is a system that gathers and analyzes real-time traffic and weather data and offers both automated traffic management responses and recommended actions to system operators.

CHART has five major functional areas supported by the communications network and systems integration: incident management; traffic and roadway monitoring; traveler information; traffic management; and emergency weather operations. The last of these is crucial as during severe weather the SOC also functions as an emergency operations center for the Maryland State Highway Administration.

Through monitoring highway pavement conditions using embedded sensors and weather towers, wind velocity, road surface and air temperature, and visibility can all be assessed, alerting when to send out salt trucks and generally assisting in managing maintenance resources. It uses technology such as the 'automatic de-icing bridge' along I-68 in Allegany County, where sensors signal automatic sprayers to dispense chemicals onto the surface of the bridge.

The difference between the SOC and many other US centers is it is statewide; most are regional or metropolitan. "We do have a few other smaller centers that function during regular hours," says the SOC's ITS development manager, Egua Igbinosun. "They close at the end of the business day. The SOC, being a 24/7 operation, takes over their functions after that."

It is one of the only programs to have had a cost-benefit analysis carried out. The University of Maryland Department of Civil Engineering has studied how the SOC responds to incidents and what benefit it brings to the county. The discoveries are startling: on an annual basis, over the past five years, the SOC has been able to save Maryland's travelers over US$1 billion per year. Its ability to monitor and control all the ITS devices on the state's freeways makes the SOC a truly statewide operations center.

"I hope this isn't the only center people visit during the ITSA Annual Meeting, but if it is, they won't be disappointed," says Igbinosun. "Everyone is very proud of the program here and dedicated to making it work. We can't wait to showcase it."

"I hope this isn't the only center people visit in the region during ITS America, but if it is, they won't be disappointed"

Thursday, June 4
09.00-13.30hrs
ITS AMERICA

Unified traffic and emergency functions

Washington, DC has its TMC in the Unified Communication Center, ready for emergencies

In Washington, DC the District DOT's TMC is located in the Unified Communication Center, Homeland Security and Emergency Management Agency that hosts the district's cameras for every agency in the city.

The key theory behind putting all the agencies in one facility is to enable live communications during emergencies, in doing so facilitating the coordination of the metropolitan police, DOT, fire, DC public schools, area hospitals, and Department of Motor Vehicles.

The TMC functions include the central software system CapTOP, CCTV cameras, traffic signaling, road weather information, traffic detector system, highway advisory radios, and changeable messages signs. Secure radio communications enable the TMC operators to stay in touch with roadway operations patrollers (ROPs). The TMC can also listen to real-time conversations among all DC agencies in the field.

These systems are the key ITS elements. They collect real-time data, enable situation awareness, control traffic, guide pedestrians and motorists, monitor pavement temperature, and dispatch ROP operators for field-incident management.

The CapTOP, developed in-house, is used by the TMC operators to enter incident data, display traffic situations in a GIS environment and process the data for reporting and analysis purposes. It records daily traffic incident data and shares it via a regional data center with Maryland and Northern Virginia.

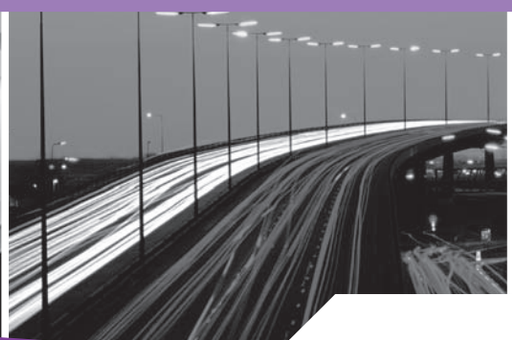
"Washington, DC has its own traffic identity," explains the TMC's ITS division chief, Yanlin Li. "The area has a very dense population of around 500,000, and on a daily basis experiences the same number of commuters, as well as a high number of visitors, plus a lot of bikes and pedestrians. There are 1,600 signalized intersections featuring all kinds of complicated geometries.

"The District of Columbia is the USA's capital… providing a traffic management situation that is especially challenging"

"The District of Columbia is the USA's capital and therefore very political, providing a traffic management situation that is especially challenging."

Li is looking forward to the prospect of presenting his cutting-edge facility to people from outside the USA. "ITS America's Annual Meeting and Exposition is always an exciting event within the ITS community. We look forward to welcoming visitors from all over the world to our city."

Monday, June 1
12.00-16.00hrs
ITS AMERICA



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A MORE INTEGRATED APPROACH TO WEATHER AND TRAFFIC DATA HELPS END CUSTOMERS ACHIEVE BETTER RESULTS, CHEAPER. MARK HOLLAND IS PUSHING FORWARD DEVELOPMENT IN THIS SECTOR

Interviewed by Louise Smyth

Here in the UK, several inches of snow recently brought the country to a grinding halt: schools closed, the transport network went into meltdown, and the economy lost around £1.2 billion (US$1.75 billion) as a result of employee absenteeism. When it comes to coping with such adverse conditions, the USA definitely seems to be a few steps ahead of whatever Mother Nature throws at it. Hence North America has a thriving ITS and weather sector, while the UK has a TV forecaster who will forever be remembered for telling viewers there wasn't a hurricane on the way – the evening before the worst storm to hit the British Isles for three centuries killed 15 people and wiped out 15 million trees.

One man who pays particular attention to such extreme weather events, especially when they impact the transportation sector, is Mark Holland, division president of Quixote Transportation Technologies (QTT). The organization is pretty unusual in that it has a thriving slice of both the traffic data collection and weather information markets – not an easy feat to accomplish, yet one which QTT seems to have mastered.

The latest weather innovation to join the QTT family is the new generation of its popular Surface Patrol mobile weather sensor. "With Surface Patrol HD, we have further enhanced the capabilities of the previous generation – a product we already believe to be the most accurate in the world for mobile surface temperature readings. 20 units are currently being tested in the field with key customers."

IMPROVED MOBILITY

For those unfamiliar with the technology, Holland provides a useful explanation as to why mobile temperature sensors are valuable: "In America, the FHWA recommends installing a fixed RWIS site every 30 miles. That's all well and good, but what do you do between those sites? If that section of road is getting near the freezing point, you really want to know about it. Surface Patrol can be mounted on a snowplow or a DOT truck and can provide a live feed on what's happening. We can integrate it with automatic vehicle location (AVL) systems and even into the snowplow controller and allow DOTs to make decisions based on the information received. With our new Surface Patrol HD, we've advanced this somewhat. We still have a non-contact infrared temperature sensor, but we also have a separate relative humidity sensor mounted on the vehicle hood or roof, so we can monitor air temperature, relative humidity and surface temperature."

Those combined readings allow Surface Patrol HD to perform a dew point calculation, which is critical in determining

the formation of black ice or frost, and Holland is clearly excited about the potential: "We think this is a life-saving technology, which will take off around the world," he says. "You only have to look at all the lives lost each year as a result of weather-related accidents. We have a unit that we can offer to ministries of transportation, private trucking companies, or police departments, and they can actually be out there on the road and know when the road surface is reaching a critical point in terms of these dangerous conditions."

The data gathered from the Surface Patrol HD is sent to an LED screen display unit within the vehicle, inside of which is a microprocessor. Alarms can be generated when temperatures are getting close to below freezing. As well as being a valuable tool for the drivers of the vehicle, the ability to transmit the data back to local authorities is where things get really interesting. Additionally, Surface Patrol HD is designed to be integrated with other OEM AVL systems based on GPS location, so instead of one snowplow receiving live weather data, the operator who manages 50 snowplows can see where best to deploy them. Holland also hints to what may be around the corner for QTT. "We are currently working with a partner on what we call MWIS – a mobile weather information system."

QTT's long-term plans for its mobile products are to go after some of the larger private bus or truck fleets. Holland (a father of two) would love to see QTT's products deployed on school buses to aid the safety of both driver and passengers.

FIXED, MOBILE OR BOTH?

But if take-up of mobile products does increase massively, is there still a market for fixed-site RWIS? Could QTT be increasing one side of its business to the detriment of the other? Holland thinks not: "You're always going to have a fixed-site RWIS. With the mobile products, we can conduct dew point calculation and give surface temperature and ambient air, but fixed-site RWIS have their own list of plus-points. For example, you need to know the true freeze point of that road. If you're putting de-icing chemicals or salt down, there's a huge expense and huge amount of environmental impact of putting all that salt on the road. The worst thing you can do is apply too much or apply it too soon so that it doesn't have any effect. RWIS is a part of weather forecasting. We do two things: we have passive sensors that perform algorithm calculations to give the chemical index for the road, then we have active sensors that will give you true freeze point."

As far as Holland is concerned, for the foreseeable future, a combination of fixed-site RWIS and mobile weather sensors will be the optimum solution. "Many people think of RWIS just for winter weather, but it's so much more than that. RWIS also covers visibility – all over the world there

"So many people think of RWIS just for winter weather, but it's so much more than that. It also covers visibility, standing water and high winds on bridges and other infrastructures"

are fog problems. Aquaplaning is another critical aspect. We know that with 6mm of standing water you begin to have a hazard on the road. We can determine the water depth on the roadway and can notify authorities when it begins to be a concern, so motorists can be alerted. Wind sensors on a fixed-site RWIS, meanwhile, can determine wind load to alert drivers as to when a bridge is unsafe to cross."

Combining traffic and weather data in one product is a key focus for QTT, and as with many applications in the ITS market, going wireless is an emerging trend. The company recently brought to market the WxT/G-10 sensor, offering wireless weather and traffic data in one package. Wireless products have many advantages, from needing less maintenance than inductive loops, to lower installation and communications costs. Combining traffic and weather data also gives end customers improved decision-making capabilities. "In the past we could detect traffic (count, speed, classification and volume), and we had one temperature probe on the unit," Holland says, outlining the evolution that led to this new launch. "That one probe was on top of the unit, so it experienced a rate of increase or decrease faster than the pavement. As a result, our customers asked for more temperature probes. Now we have a sensor that extends out of the side by about 12in, which allows us to get true pavement temperature. We also have a subsurface probe that can be inserted 12-15in into the earth, in doing so enabling you to obtain the thermodynamics of the earth. All of that is in one wireless sensor, plus you've got the traffic aspect."

Looking further ahead, Holland predicts a boom in the measurement of environmental pollutants: "In urban corridors, the capability to measure traffic volume and be able to determine the pollutants in the air will be invaluable. We are currently working with a partner and will release a complete package where we can measure weather, traffic and air pollutants," he reveals. There are two key applications for such a product. The first relates to decreasing the amount of carbon monoxide in urban areas where there are many people breathing in the pollutants: providing traffic data, wind flow, and pollutants in the air can help authorities to manage traffic (e.g. through intersection control) to get motorists through these pollutant hot-spots quicker. The second application is for environmental data analysis, as Holland details: "When you look at transport and carbon dioxide, in the USA 79% of CO_2 comes from automobiles. We're going be able to measure CO_2 levels at specific sites and tell you the traffic flow. The key is that we have found a cost-effective way to deploy this with RWIS. In the past, monitoring air pollution was a very expensive venture. Working with our partners, we have now got the cost down to work within what DOTs can budget for. We will be the first company in the world to combine all of these elements in one unit.

SERVICE-LED SUCCESS

"A lot of people think technology is your asset and while I know we have cutting-edge technology, in my view our people are our asset," Holland says proudly of the team around him. "They are committed to doing the job well and they go beyond the call of duty for our customers." Holland certainly has the ear of those customers and a substantial part of his role is engaging in dialog with them to further strengthen the company's level of service.

A recent traffic-counting project in Bangkok, Thailand provides the perfect example: "It consisted of 32 permanent count-station sites and 140 of our 'Groundhog' units – our wireless in-the-road pavement sensor to detect traffic count, volume, speed and classify lanes," he says. "To my knowledge, this is the first major traffic-counting project in Bangkok. We received the order in September 2008 and conducted a quick turnaround to achieve full installation." Although the technical benefits of the Groundhog – compact, maintenance-friendly, accurate, low product lifecycle cost – helped secure the deal, Holland also cites the high level of service and technical support offered by QTT's distributor, New Trend. Going forward, such a blend of service and technology is sure to help Holland and QTT weather the current stormy economic climate. ■

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AS THE RECESSION TIGHTENS ITS GRIP, **CHRISTY PEEBLES** FEELS THAT TECHNOLOGY CAN BE A DECISIVE FACTOR IN THE ROAD TO STRESS-FREE, COST-EFFECTIVE MANAGEMENT

Interviewed by James Gordon

She heads Siemens Traffic Solutions USA, and is currently overseeing a series of major traffic contracts, but amazingly Christy Peebles describes herself as "a new kid on the block". Although it's true she has only been working for the Traffic Solutions division for seven months, don't be fooled by her modesty. For this is a woman who has spent the past 13 years at Siemens as a strategic planner and a project director, where among the many projects she headed up was a US$400 million program to replace and modernize the US Postal Service's sorting systems. And now Peebles must grow the Siemens traffic business, in what many regard as the most challenging economic climate ever. But she hopes to use the Obama Administration's Economic Stimulus, which has allocated over US$48 billion to transport projects.

STRESS-FREE DRIVING?

Peebles admits that the Stimulus has the ability to change the way people think about traffic, herself included. "Before I took this job, I thought about traffic in a very negative way," she says. "Sitting in congestion equated to stress. But the Stimulus funding has the ability to increase the awareness in the public sector about the technology available to alleviate the traffic jams and improve our quality of life."

Asked what effect the Stimulus has had on the output of Siemens Traffic Solutions, she adds, "We're busier now that the funding is finally starting to trickle down. It appears that the business may not be as negatively impacted by the recession as it could have been without the funding."

When quizzed about how DOTs should spend their Stimulus windfalls, she urges that any investment is spent "intelligently". "Adaptive traffic control is a definite trend, accompanied by a growth spurt in the interurban solutions. Currently we have been allocated more than 15 SCOOT adaptive control contracts and the FHWA has awarded us three contracts, worth US$1 million for development of ACS-Lite (see sidebar). "For the three FHWA contracts," Peebles says, "there is a strict criterion that must be adhered to. All projects must be low-cost, work in a closed-loop system using NTCIP communications, and be easy to install. Lastly, the FHWA has stipulated that all systems introduced must operate with low baud rate communications, which ensures that we don't have to spend money on expensive infrastructure."

Interurban solutions such as congestion charging systems and HOT lanes are proving

"It appears that the business may not be as negatively impacted by the recession as it could have been without the funding"

very efficient and effective ways of reducing congestion in cities. It could be that congestion pricing schemes – which have proved unpopular in the past – make a comeback as cities find themselves strapped for cash, as these solutions not only solve congestion problems, but also have the potential to raise funds needed to invest in public projects and save taxpayers money. For example, the congestion pricing system in New York City was rejected last year. However, the Metropolitan Transportation Authority (MTA) announced recently that it would be increasing public transport fares simply because the city buses are spending more time stuck in traffic and using up more petrol in the process. Here at Siemens, we want to focus our efforts on the total traffic solution. If we are to alleviate congestion in the USA, we must concentrate on the interurban solution."

In Baltimore City, a new more efficient traffic signal system is being deployed at more than 1,000 intersections, which uses the i2TMS central software to manage traffic signal controllers from multiple manufacturers using the NTCIP communications standard. Network monitoring will provide traffic managers with a complete overview, while variable message signs will ensure that drivers are given clear, concise, reliable travel information. The first phase of this multimillion dollar project will be completed in mid-2009, while a further US$1 million will be provided to carry out expansion work, which will begin in the third quarter.

But the Baltimore City ATMS is not the only scheme that Siemens is working on in Maryland. The company has also been collaborating with Montgomery County Transportation Services over the past decade and is currently under contract to modernize the county's entire traffic signaling system, which includes installing communications, controllers and ATMS. The latter includes incident management and response plan development, in addition to device monitoring and control.

CONCERT EFFORT

And 400 miles south of Maryland, in the state of South Carolina, Siemens is working on an even more ambitious traffic management project. The system is being developed using the Siemens 'Concert' innovation – a universal traffic system used to integrate numerous subsystems and components – which has been developed in Europe and already successfully implemented in Berlin, Germany. The Concert system is designed to allow traffic managers at South Carolina DOT to access traffic flow information, operational data and device status much more easily than before, in doing so greatly alleviating congestion in the state.

The Concert Freeway Management System, which is being implemented statewide, will be delivered in phases. The first, which has a budget of US$1.16 million, is set to be implemented as this issue goes to press. Phase two will focus on the incident management system, and the third involves the delivery of maintenance and support.

Peebles concedes that bringing freeway management systems to the USA has been a challenging process. "The main issue is to get everyone talking," she explains. "We need to get the cities to talk to the counties, and the counties to have an open and clear dialog with the state. Most important is to stress the environmental benefits along with the economic benefits. For instance, the more accessible a state's transport network, the more chance state officials have of attracting companies to the region."

A third project, an Advanced Transportation Management Information System (ATMIS), is being installed in the ports of Long Beach and Los Angeles, California. The project aims to improve mobility and reduce travel time by managing traffic around port areas. VMS will be employed in nearby locations to provide up-to-date congestion and incident information to commuters. The information will be relayed to the message signs through a control center. "Implementation has commenced," says Peebles. "The ATMIS system should be up and running by the end of 2010."

The project also involves integration with several existing traffic management systems in the area to both collect data generated by various subsystems and to provide information to other systems, as well as directly to the public."

Finally, Peebles is keen to stress the benefits of parking technology systems. Many US states, she says, are still using coin-operated parking meters that date back to the 1960s. "We are looking to work with cities across the country to revolutionize revenue collection. We also have the ability to install parking-guidance technology at car parks, which inform drivers exactly how many spaces are available." ■

Advanced adaptive control for closed-loop systems

ACS-Lite is the FHWA's Adaptive Control Software, and offers small and medium-sized communities a low-cost traffic control system. Developed for use with on-street master systems under contract to the FHWA Research, Development and Technology Traffic Operations program, ACS-Lite monitors traffic flow at and between intersections, and calculates beneficial adjustments to the signal timing every five to 10 minutes.

In late 2008, the FHWA awarded Siemens a two-year deal to enhance the software. Despite already being a street-ready technology that provides important benefits, engineers at Siemens Traffic Solutions believed the performance of the software could be improved. Under the recently awarded contract – which spans from 2008 to 2010 – ACS-Lite will be enhanced to adjust cycle lengths longer or shorter for increasing or decreasing traffic congestion, and to provide more advanced handling of vehicle detector failure scenarios.

This can provide benefits as traffic flow changes in the short-term (for example, due to diversion around an accident, construction, or flooded area) and in the long term (for instance as commercial and residential development permanently affect traffic flows).

The resulting system was evaluated in the laboratory (using traffic simulation software) and in the street and shown to provide notable advantages. On an arterial in Houston, Texas, it reduced vehicle delay by 35%, vehicle stops by 29%, arterial travel times by 11%, and fuel consumption by 7%.

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FEDERAL SIGNAL

Network opportunity

Vehicles traveling roadways are a common focal point for many professionals. ALPR is a valuable tool to provide data on these vehicles to benefit transportation planners, toll authorities, law enforcement and Homeland Security professionals alike

by Brian Shockley, Federal Signal, USA

Federal Signal's Spike cameras in situ in London, where they are used in the city's Congestion Charging Scheme

Advances in ALPR technology are enabling new, exciting and never-before-realized applications through a shared ALPR network. The following will outline a vision of how the proliferation of this technology can serve multiple purposes throughout a community, a region, or even an entire country.

ALPR is being used in literally dozens of different standalone applications around the world, but the data is typically held within the confines of a specific organization – such as a toll authority, state or local law enforcement, department of transportation, etc – and not used for the benefit of all parties. Despite the many standalone systems that clearly illustrate the value of ALPR, there has not yet been a true representation of an integrated ALPR network to improve transportation and enhance public safety and security. However, every day, these systems are proving their worth in a number of real-world situations.

LAW ENFORCEMENT IN CINCINNATI

An armed robbery at a gas station in Cheviot (a suburb of Cincinnati) Ohio was solved through the use of the Back Office System Software (BOSS) component of their ALPR network. After seeing a report on the incident, Captain Jeff Butler of the Cincinnati Police Department contacted the Cheviot Police Department to determine if there was a license plate associated with the robbery. Cheviot reported that witnesses had reported the plate number of a vehicle seen speeding away from the scene of the crime, but that the plate belonged to a man in prison, which gave them little information to work with in their investigation.

Captain Butler then turned to Heather Whitton in the Information Technology Section of the Cincinnati Police Department to investigate what information they could provide on the vehicle. She queried the license plate in the BOSS system, which collates all of the data collected by the city's seven mobile ALPR systems. Within a matter of minutes, she was able to report, "It's a light blue Honda with some damage to the front end of the vehicle, and I have pictures of it on the morning of the crime." She was then able to map all sightings of the vehicle, finding that it was frequently seen on a certain street, parked in front of a stone wall.

"With the intelligence provided by the Federal Signal BOSS system, we were able to locate this vehicle, set up surveillance, and wait for the suspect to arrive," Captain Jeff Butler says. "The suspect arrived, at which point an arrest was made. The photos were shown to the suspect, and he knew that we had him. Without the system, this individual would probably still be on the streets presenting a danger to our officers and to the public. This is one of many cases that the system has helped us solve, including several homicides. As a result of the great success we've experienced, we are planning to invest in building out the system to include additional mobile systems and fixed cameras."

The Cincinnati ALPR network, since inception, has collected more than two million reads with over 50,000 vehicles of interest identified and more than 1,000 arrests made as a consequence. Additionally, the system has enabled the collection of almost US$250,000 in revenue due to the city for unpaid fines associated with vehicles.

LONDON CONGESTION CHARGE

In what is arguably the most well known and advanced congestion charging initiative worldwide, the Federal Signal Spike+ ALPR system enables Transport for London (TfL) to encourage the use of mass-transit alternatives, reduce emissions, mitigate congestion, and improve the overall quality of life for the residents of the city. The

system was supplied through a relationship forged with Siemens.

The program has proven itself effective with more than 100,000 motorists paying the charge each day. Traffic has declined by roughly 20,000 vehicles per day, and travel times have improved due to increased traffic speeds within the zone. Peak period congestion delays declined by about 30%, bus congestion delays declined by 50%, while taxi travel costs declined significantly (by 20-40%) due to reduced delays. Vehicles can cover more miles per hour, so taxi and bus service productivity (riders per day) and efficiency (cost per passenger mile) increased substantially. Mass transit has also seen notable increases in ridership.

HOMELAND SECURITY IN ITALY

The Campania and Calabria regions of Italy will be protected by a network of more than 230 of the new SpikeHD ALPR cameras from Federal Signal, deployed by Sintel Italia, and the cameras are part of a larger CCTV-based Homeland Security initiative.

The cameras not only capture and read license plates of regular cars and commercial vehicles, but will also capture and read license plates of powered two-wheelers. The system will then provide license plate information to a central application, where comparison will be made against a known list of vehicles of interest to Homeland Security. If a positive comparison is made, the user will be notified and the CCTV system will be used to track the vehicle.

Additional applications of advanced ALPR technology include toll violation enforcement, open-road transponder-free tolling, electronic vehicle registration, and even identification of stolen vehicles and wanted felons. Patrol cars can also monitor tollways to identify chronic toll violators, while accurate real-time travel-time data can be utilized for driver information networks and transportation planning purposes. More recently, ALPR has also been put in place for the monitoring of speed and travel delays through workzones, as well as pattern analysis of vehicles for Homeland Security, narcotics trafficking, and general protection of critical infrastructure.

The Federal Signal system set-up that is used for commercial vehicle enforcement applications

Spike cameras are part of the landscape in many locations, including New York

Mobile ALPR is a valuable tool for traffic law enforcement

One of the more recent applications of ALPR is speed enforcement. Differing from point-in-time radar checkpoints, the SpeedSpike system monitors speed over road networks by monitoring travel time over a known distance and calculating average speed. This approach, commonly referred to as average speed enforcement, is of interest to intelligent transportation and law enforcement agencies around the world for obvious reasons.

Average speed enforcement, by its very nature, modifies driver behavior. Drivers can no longer slow down at speed checkpoints to avoid detection, creating travel disruptions and bottlenecks in the process. Average speed enforcement creates a system that educates drivers; if they choose to speed they will pay.

Although accepted in certain parts of the world, the concept of average speed enforcement is not yet ubiquitous. Many parts of North America do not yet allow for the practice due to the automated nature of the enforcement, although Federal Signal is in the process of deploying pilot sites in several states to validate the effectiveness of the technology to policy-makers. As awareness grows – and as the potential for improved traffic flow and road safety are realized – average speed enforcement will become the accepted and preferred method of regulating speed on the road network.

All of the above examples are exceptional success stories for ALPR technology on their own merit. Now imagine all of the above needs being satisfied by one comprehensive network, providing benefit to an entire region or country. This is Federal Signal's vision, and it will soon become a proven reality. ■

To find out more, contact Brian Shockley at Federal Signal by calling +1 865 392 5546, emailing bshockley@federalsignal.com, or visiting the company's website at www.federalsignal.com

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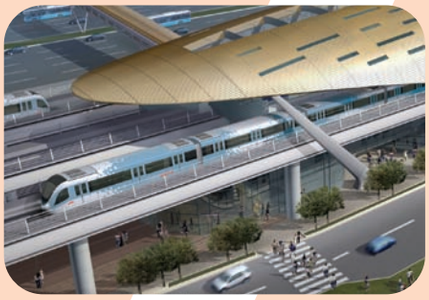

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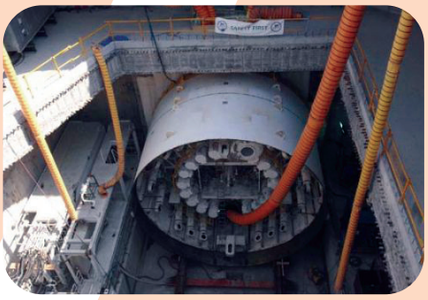

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Reading list

What do the following applications have in common: wanted car capture, access control, tolling, vehicle classification, section control, and hazardous vehicle recognition? They all rely on ALPR technology for success

by Malcolm Smith, Vitronic, UK

The capability to capture and read license plates under many different lighting and weather conditions is a key requirement for many traffic applications. ALPR technology has evolved greatly over the past few years: today it is a sophisticated yet cost-effective solution that is deployed widely worldwide.

The Wiesbaden, Germany-headquartered organization Vitronic is a specialist in both stationary and mobile ALPR tools. Its PoliScan*surveillance* is an ALPR system with a laser-based Detection and Tracking Unit (DTU). Up to three lanes can be covered by one DTU when the system is mounted at the roadside, or two lanes when it is gantry mounted. When mounted from a bridge or gantry, the lane in which a vehicle is traveling is determined via evaluation of the detection angle. The corresponding ALPR camera is then triggered. Where vehicles are detected between lanes, both adjacent cameras are triggered to ensure that these plates are read.

When deployed at the roadside, the distance from the vehicle to the DTU is used to select the most appropriate camera for image acquisition. Both cameras are aligned to the detection axis of the system, and together provide the depth of field and magnification required to cover two lanes.

The ALPR system waits for the DTU trigger signal and then simultaneously activates the infrared flash and the image acquisition. The captured image is transferred to the volatile memory where it is decoded by ALPR routines. These routines decode all plates visible in the camera image. Specialized filters then suppress unwanted plates, such as those from vehicles parked in the image area. With its 800-LED flash unit and adapted cameras, the system is well suited to harsh environments and high-speed applications.

STRAIGHT TO VIDEO

Another of the company's popular products is PoliScan*smart*, a small and unobtrusive video streaming camera system. The trigger for the camera is derived by using the reflectivity of the license plate. Continuous video images are taken and when a vehicle license plate enters the field of vision, a large infrared return is seen by the processing software. The Vitronic-developed image-processing algorithms determine the best image taken from several sample images, and then carry out the OCR process to determine the license plate details.

Vitronic's PoliScan*surveillance* range uses laser tracking to conduct license plate recognition

Discreet, concealed installation is a prerequisite for some ALPR applications

Developed from the PoliScan*smart* system is the company's mobile unit, PoliScan*in-car*. This is mounted in police patrol cars and captures the license plates of vehicles while in motion. There are a number of benefits to such a system, including the fact that it can be used in all kinds of traffic, from dense city jams to high-speed motorways. The system achieves high read rates in all weather conditions, while the IR flash allows operation at night.

Both the PoliScan*in-car* and PoliScan*surveillance* ranges are proving especially popular in the Middle Eastern market. In these regions it is important to be able to capture license places of vehicles traveling at extremely high speeds. Motorways there can also be six lanes (or more) in width, so systems need to be able to cope with high traffic density, high speeds, and multilane roads. Harsh climatic conditions (notably extreme temperatures) are also a challenge. All Vitronic products delivered to the Middle East are fitted with climate-controlled protective housings. Color detection is also important in this market, as license plates come in many colors and designs, so distinguishing between the same plate in different color variations is crucial. Special software has therefore been developed to cope with this demand.

As well as diversifying its geographic markets, Vitronic is focused on expanding its capabilities into new application areas. R&D staff are busy developing solutions for in-vehicle monitoring of parking offenses, bus lane incursion, and illegal u-turns.

The latest product to be announced is PoliScan*redlight*. Using hardware and software developed for PoliScan*surveillance*, this new laser-based system detects and enforces red-light violations. The use of LIDAR means that no in-road equipment is required, which reduces installation and maintenance costs and time. PoliScan*redlight* can also be combined with the company's existing PoliScan*speed* system to allow permanent red-light and speed enforcement from a single system. ■

To find out more, contact Vitronic by calling +44 115 840 8244, emailing malcolm.smith@vitronic.com or visiting the company's website at www.vitronic.com

A new path to safety

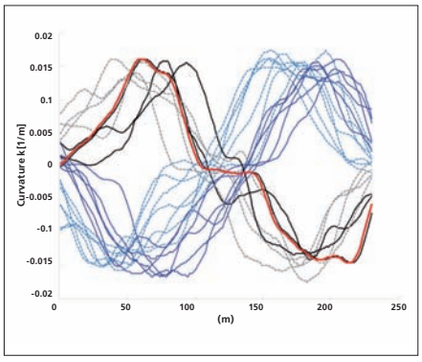
Experts in Austria believe they have a tool to more quickly and accurately assess the relationship between road infrastructure and traffic accidents, in doing so mapping out a brand-new route toward crash-causation research

by P Saleh, S Deix, P Maurer & R Stütz, Arsenal Research, Austria

With the aim to move a step beyond 'accident hot-spot' identification, a tool called Model for Assessing Risks of Road Infrastructure (MARVin) has been developed by Arsenal Research for use in road transport and traffic safety. The general objective is to link and correlate road infrastructure parameters, such as skid resistance, ruts, crossfall, alignment, etc, with accident statistic data – specifically, the very detailed road database of the Austrian road network measured with the RoadSTAR (Road Surface Tester of Arsenal Research).[1] This road database is associated with the Austrian accident database, via the position of the accidents. In this accident database, about 580,000 accidents are registered (1994-2007). As a result, the relationship between the road database (approximately 24,500km) and all relevant road infrastructure parameters and the accident database was established. Any analysis with MARVin uses this combined database. Arsenal Research's vision is to use MARVin for innovative accident prevention – i.e. not to wait for accidents to happen!

SIMILARITY SEARCH

One of the most important developments in MARVin is called 'similarity search', a patented method for the valuation of similar road segments. With this software tool, the road safety analyst is able to identify similar road sections in the network. But this is not an easy task, as searching similar sections is not only about finding an identical stretch of road, but more about looking for all parts that are similar to the sample.



Result of the similarity search. Example for curvature (red line shows template)

One of MARVin's results projected on the real road: skid resistance versus accident spots

Almost every accident hot-spot has a special characteristic and using similarity search makes it possible to identify critical road sections with the same characteristic to that of an existing hot-spot, yet across the whole Austrian network. A road safety analyst is therefore able to improve critical spots just in time before accidents actually occur on a particular section.

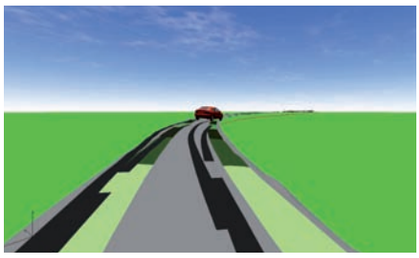
The task of identifying similar road sections was solved by applying a computer-aided method that was originally developed for automatic speech recognition. The so-called Dynamic Time Warping (DTW)[2, 3, 4 & 5] is a method that allows you to find an optimal match between two given (multi-variate) sequences (e.g. time series) with certain restrictions. In this case, DTW yields a non-linear similarity measure of different parameters with a given road section – the template. By employing this development, it is actually possible to analyze even a 'virtual' as yet unbuilt road section.

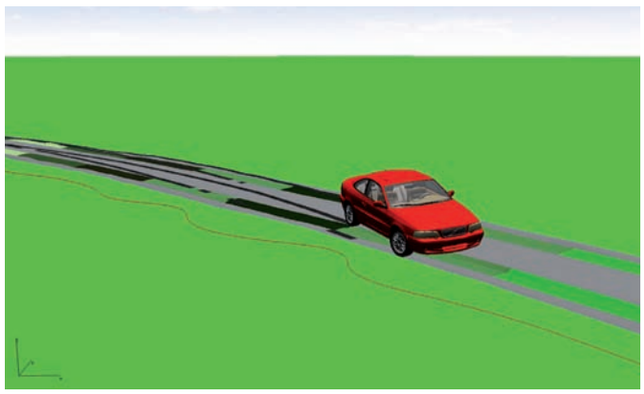
A road in the design stage with a specific trace geometry and road condition parameters can be analyzed by comparing it to already existing road sections. This is a very important step to test planned and designed roads on their safety characteristics. Applying this method in the design phase will support the accident prevention greatly by identifying potential hazardous road risks before they are built.

Another approach of MARVin is to consider all accidents as objectively as possible ('unbiased'). This is conceivable as the parameters of every accident are considered as discrete coordinates in a high-dimensional space, while correlations are perceived by different densities of the points (accidents) in this multidimensional space. Based on this approach, methods are developed to analyze the enormous amount of data. Computer-assisted solutions using statistical methods and/or data-mining methods are proper tools for this task, although the processing demands to handle both accident database and road database requires remarkable computing power and should not be underestimated.

PRACTICAL WORK

The first practical work with MARVin was a road safety check of a typical motorcycle route in Austria, to analyze correlations between the number of accidents on specific sites and the road infrastructure parameters. The interesting but not surprising result was that although the infrastructure quality of this road was very good (high skid resistance,





These images are from the VII simulation and show three snapshots – real skid resistance, rut depth and unevenness values used in virtual reality – all causing a critical driving situation

perfect radii relations and curvature, etc), the accident rate was rather high. The significant facts for the high-risk potential of this road are the number of motorcyclists each day (especially at weekends) and the driven speed. Speed enforcement and awareness campaigns may lead to an accident reduction in this case.

Moreover, MARVin was useful to support the development of a national directive for motorcycle safety within a national framework. A detailed check of motorcycle accident events on rural roads and their correlation with curve radii revealed some particularly interesting results. Specifically, the run-off accidents mostly occur in small radii between 50m and 150m; the maximum ratio of run-off accidents in curves is exactly for radii of 100m, followed by 110m and 200m. A detailed analysis on the relations between curve radii, curvature and changing crossfall and their influence on powered two wheeler (PTW) accidents is necessary. The 'similarity search', which identifies similar accident events on similar road sections, will also be helpful for this task and within further research projects.

SIMULATION

The main objective of a new research project, Vehicle Infrastructure Interaction Simulation (VIIS), is to model the interaction between vehicles and the road infrastructure. In this sense, the simulation will describe the effects and consequences of road parameters on vehicles in various driving situations. With this approach, the simulation will use the findings and results of MARVin to model the respective road sections based on all available road parameters (RoadSTAR Database). It is then possible to simulate and analyze the event of a specific accident. The combination of infrastructure and vehicle models means that the spectrum of analyses is much wider.

MARVin has therefore been upgraded with traffic density data to obtain more significant results to be used in VIIS. With this approach, the crash causations regarding poor surface characteristics or in-harmonic road geometry will be identified with a higher reliability. Road segments to be used for simulation purpose are designed in virtual reality, but using the RoadSTAR Database with real measured data and a high sample rate. Crash reconstructions and crash-causal combination will be highly relevant with this. The vehicle infrastructure interaction (road/tire, suspension/tire) in a crash situation (or near accident) have a major impact on accident risk. New in-vehicle sensors, active safety systems, real-time accident risk assessment, interactive road condition maps, etc, are developments to compensate that risk – and testing those in a virtual testing framework under realistic conditions will accelerate the process.

VISIONS AND FUTURE

A vision for the future evolution of the proposed approaches and project results is to combine theoretical accident research with practical preventative solutions. It is likely that policy-makers, road operators, vehicle manufacturers, map providers, and most of all road users will have a recognizable benefit from this research.

The next step toward that vision is to verify MARVin results with an innovative vehicle-infrastructure simulation and to derive preventative measures either on the road construction side or within in-vehicle safety applications.

With the MARVin research project, it is possible to identify significant correlations between road accident events and the quality of the road infrastructure. Various road parameters highly relevant for transport safety and an accident database are combined in this analysis, and the road parameters are measured with the high-tech RoadSTAR measurement vehicle on the Austrian road network. The research and development has already been useful to solve practical problems and analyses, and the development of the 'similarity search' especially opens up new paths in crash-causation research. The verification of crash-causal combinations with an innovative simulation framework is an objective to improve the understanding of infrastructure-vehicle interaction during an accident. Based on this understanding, a wide range of preventative measures to reduce accident risks are conceivable. ■

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Non-invasive procedure

An established range of speed and red-light enforcement products has gained some new, non-invasive tools to help traffic managers around the world in their fight to uphold laws that are designed to make highways safer for all users

by Ralf Schmitz, Robot Visual Systems, Germany

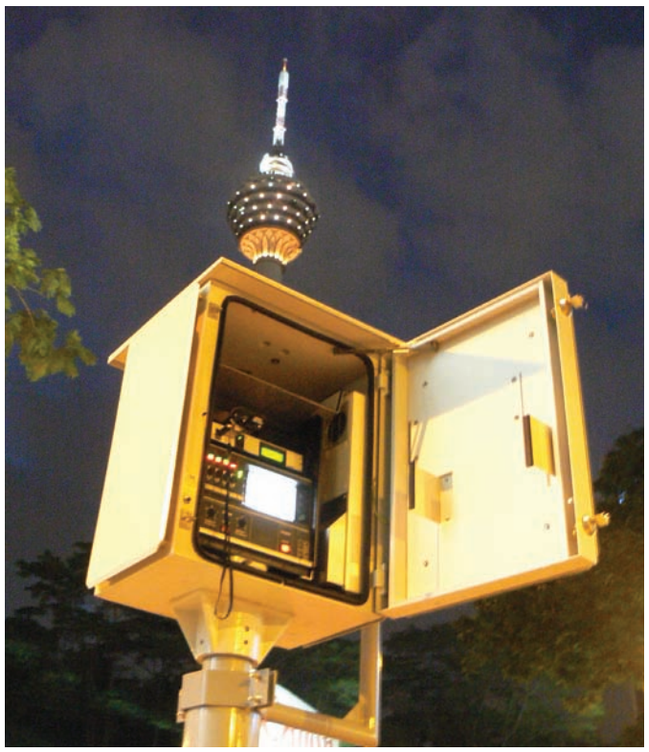
Speed and red-light running offenses do not just affect the driver committing them. If a vehicle jumps a light at a busy intersection, the potential interaction with other (law-abiding) vehicles could be catastrophic. Likewise, if a car is traveling at 60mph in a 30mph zone and hits a pedestrian, you don't need to be a genius to figure out the outcome of such a coming together. Whatever your opinions on speeding – and there are some who will argue that speed alone is not a killer – every country in the world has laws that traffic managers and enforcement authorities must aim to uphold.

And while these laws are still in place, companies such as Robot will continue bringing to market new technologies to assist those responsible for road traffic management and enforcement. The company's latest announcement is an addition to its established TraffiStar portfolio. The TraffiStar SR590 provides completely new application areas for traffic monitoring systems. It is a reliable way of conducting red-light and speed enforcement using a single system. The technology is quick and easy to install, and images of infringements offer crystal clear detail across many lanes. Full control of all systems is available at any time via remote access.

The key to this product's effectiveness is the combination of Robot's field-proven technology and advanced sensor technology. A high-resolution, non-invasive 3D radar sensor logs the position and speed of several vehicles simultaneously over and beyond lanes (multi-target tracking). This therefore eliminates the cost-intensive and complex work on the road surface required for traditional technologies, such as piezo sensors or inductive loops. The 11 megapixel camera guarantees pin-sharp images, while the optional video camera enables uninterrupted documentation of an offense. If the required infrastructure is available, up to 100 units can be operated in a network (using TraffiNet software), all of which can be centrally controlled.

The tracking radar sensor features high-performance DSP electronics and complex calculating algorithms, making it ideal for monitoring traffic. It does not record only the speed as other radar sensors do, but also the absolute distance and angle to the vehicles. In conjunction with the long range of more than 100m, objects can be tracked at high resolution for long periods. This is achieved by determining and evaluating the position and speed of each object in the recording range of the sensor more than 20 times a second. Vehicles are therefore tracked in the radar beam simultaneously, providing real multi-target tracking.

Selectable trigger lines can be set up throughout the tracking range of the radar sensor, providing great flexibility. Assignment to individual lanes can be achieved over four lanes with just a single sensor, and all at minimal installation cost.



Robot's TraffiStar product is a reliable solution for both speed and red-light enforcement

REAL-WORLD APPLICATION

The TraffiStar SR590 is already being put to use in a number of countries, including Australia, the USA, and Syria, while a recent launch in Russia makes for an interesting case study on the merits of this technology. Robot's application engineers installed the SR590 system on several specially selected crossroads around Moscow. Red-light and speed offenses are not such a problem in the city during the day, as traffic jams on the overcrowded roads make it difficult for drivers to move at all. But at night-time, there is a very different scenario. Although there is still heavy traffic, the average speed had crept up to around 100km/h (62mph).

With this knowledge in mind, the engineers carefully investigated the situation around Moscow and indentified the most critical and most dangerous crossroads. As a fair way of introducing the new enforcement concept, for the first pilot phase the system operated in a special test mode. The units were fully activated and the flash was triggered with every red-light violation, but

the images were not processed and therefore no citations were issued.

By the end of the pilot phase the team in charge were still registering a huge amount of infringements. But after having the full system installed for several months, the number of red-light violations has declined significantly and is now on its way to a more typical range for this region. Robot has a great deal of experience in bringing systems to areas where red-light offenses and traveling at dangerous speeds had previously been without (or with minor) consequences for the drivers. It is understood that a learning process is required and that the introduction of new enforcement systems needs a fair approach. Case studies such as the example above also indicate the importance of red-light and speed enforcement. Without it, many drivers simply do not adhere to the existing rules.

SMART THINKING

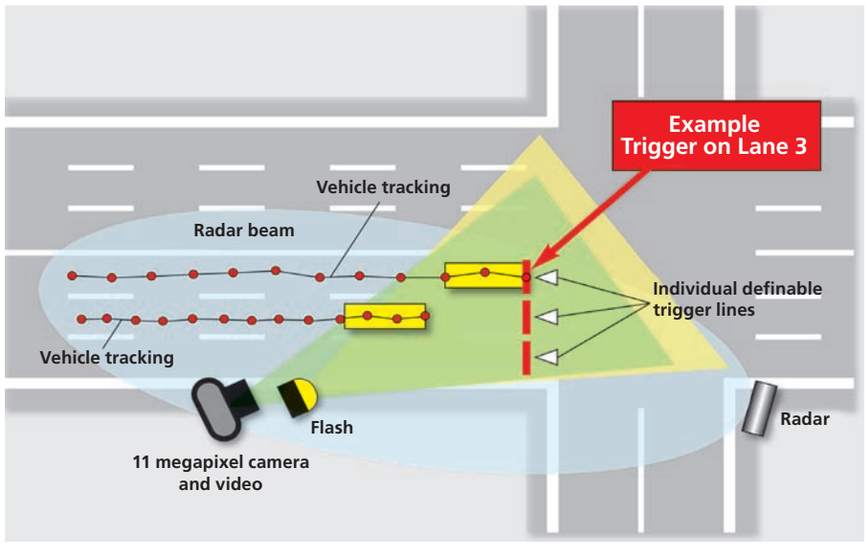
On the camera side of the business, Robot offers the field-proven SmartCamera III, a combination of its SmartCamera III head and its SmartCamera III MPU (Main Processing Unit). The heart of every camera head is the progressive monochrome or color CCD sensor. This is a reliable industrial camera with 11 megapixels, making it suitable for surveillance of intersections or multiple lanes.

Together with the main camera in the traffic-monitoring system, the video camera provides increased strength of evidence and certainty in the documenting of violations. The video camera shows events before and after the traffic infringement, and therefore serves as an addition to the image from the main camera. When evaluating the main image, the video camera provides additional information, such as changing of lane, overtaking maneuvers, or supplementary documentation of a red-light violation.

NETWORK FOR IMPROVED SAFETY

Robot also supplies remote-controllable stationary measuring technology that can be monitored from a central processing center, made possible as a result of the company's network management software. First, all the digital units must be equipped with a TraffiNet control box and the units must be networked to the processing center via an ADSL/VPN connection, or wirelessly via a UTMS+ connection. An Ethernet interface and network switch (10/100Mbps) on the control box provide the prerequisites for rapid integration in a PC network.

The software uses satellite images of the region in BMP format or vectorized geographical maps. On the basis of the GPS coordinates, all the measuring sites appear on the map as icons, which can be selected by the operating personnel, to allow status inquiries, and be parameterized at any time. The software can be used by several people at once, with various different access levels available, which makes it possible to define different user rights and also serves as a camera control program. It is therefore also possible to perform remote inquiries about camera status and adjustment of parameters.



Graphic explaining how the tracking radar system works

Example of Robot tracking radar installation using existing infrastructure

The basic version of the TraffiNet control box installed in the outer housing is simply a status and alarm system. It features a temperature sensor, a vibration sensor, and a sensor for the door lock. Opening the door prompts a sabotage attack and 'camera system' or 'power failure' report to be generated. The TraffiNet control box is permanently connected via TCP/IP to the national processing center. Alarms and status messages appear on the screen in real-time, so appropriate measures can be taken immediately. Robot's network management maximizes camera operating times and minimizes loss of data in case of infringements. In effect, it plays a critical role in bridging the gap between the digital units on the road and the back-office.■

To find out more information, please contact Robot Visual Systems by calling +49 2173 3940 0, emailing export@robot.de, or visiting the company's website at www.robot.de

Turning point

Machine-vision technology can be employed to reduce traffic delays, fuel consumption and emissions, in doing so extending the life of public transportation infrastructure, while helping to turn the world green – one light at a time

by Erik Wood, Image Sensing Systems (ISS), USA

The 2007 National Traffic Signal Report Card from the US National Transportation Operations Coalition (NTOC) revealed, "Congestion causes the average peak-period traveler an extra 38 hours of travel time and an additional 26 gallons of fuel, amounting to a cost of US$710 per traveler per year." NTOC findings also state, "One third of the respondents reported having minimal or no management of traffic signal operations, and almost one half do not have staff or resources committed to monitor or manage traffic signal operations on a regular basis."

Transportation managers are faced with countless challenges in 2009 and beyond. With clever, proven and efficient ITS detection solutions in their toolbox, though, they will be able to meet many of their problems head-on and straight away.

Today, more than ever before, a smart and efficient transportation infrastructure is a basic requirement to keep traffic flowing smoothly and safely, as well as to compete in the global economy. Junction-control detection technologies provide major traffic-flow and safety improvements that positively affect economies, the environment and quality of life.

Improving traffic flow reduces delays and vehicle idling, thereby decreasing vehicle emissions and travel times. Transportation managers continue to face traffic problems in a harsh economic climate, as they attempt to maintain and keep up with traffic demands using limited personnel and budgetary resources. This greatly increases the desire for higher performance above ground and non-intrusive ITS detection systems with low installation costs and minimal maintenance.

The Autoscope Phoenix video detection system provides a complete adaptable solution for junction control

INFRASTRUCTURE ISSUES

Shrinking budgets challenge governments and transportation authorities to manage transportation networks at publicly acceptable levels. To grasp an understanding of the +375,000 traffic signal operations in the USA, it is insightful and educational to examine the 'D' grade in the 2007 National Traffic Signal Report Card, as ranked by NTOC. This ranking combined with the current economic landscape and lack of consistent transportation funding provides multi-faceted challenges to the government and the public.

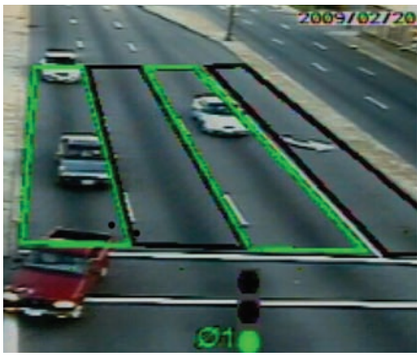
In these uncharted times, the US transportation system is subject to close public scrutiny as a result of the 2009 Federal stimulus package-induced transportation project funding, the very apparent decrease in overall roadway quality, and the 2007 I-35W bridge collapse in Minneapolis, Minnesota.

Ideally, the end goal should be a safe and efficient transportation system worthy of a Grade 'A'. Such infrastructure improvement produces a series of key benefits (see left). However, without the proper funding and support such a goal may not be feasible. Countries around the globe are undoubtedly faced with similar and equally difficult transportation infrastructure challenges.

NTOC: Benefits of an 'A' Grade for the US National Traffic Signal Report Card

- Reductions in travel time up to 25%. If you commute two hours a day to and from work, you would save 50 hours a year due to improved traffic signal operations.
- Reductions in fuel consumption of up to 10%, resulting in a saving of 17 billion gallons of motor fuel a year.
- Up to 22% reduction in harmful emissions (carbon monoxide, nitrogen oxides, volatile organic compounds).

www.ntoctalks.com



Autoscope video detection from ISS is ideal for signalized intersections, and is a cost-effective alternative to embedded loops

IN THE PRESENCE OF TRAFFIC

Vehicle presence detection is required to manage signalized intersections in our roadway systems safely and efficiently. Inductive loop detectors have usually been the choice in much of the world for detecting vehicles at an intersection.

The installation of loops is time-consuming, labor-intensive, costly and it obstructs the flow of regular traffic. The sawcut installation – which needs a water source to cool down the saw blade – requires inconvenient and costly lane closures for significant periods of time.

Over the past 20 years, video detection systems have made major breakthroughs in accuracy and reliability for intersection control, leading to increased deployments and a shift in the mindset of traffic engineers. One such system is Autoscope from ISS, which among many capabilities, detects the presence of vehicles at the stop bar line. This information is communicated to the intersection controller, and reduces vehicle wait times and optimizes traffic flow based on real-time traffic conditions. Autoscope communicates with the controller which adjusts signal timing based on traffic demand, adjusting when vehicles are not stopped at the stop line, or when no vehicles are on the less-traveled cross-street.

At large intersections, it has long been more cost-effective to use video detection instead of loops, and now this is also true for smaller intersections. When costs associated with the two are compared, including maintenance costs over the product lifetime and initial system costs, it's also important to acknowledge the increased performance and flexibility that video detection offers. Video detection is highly adaptable to changing roadway conditions such as lane reassignment and lane closures, as well as reducing installation and maintenance costs and time. It is flexible to accommodate changing intersection geometries, which is beneficial in normal applications as well as during road construction projects, particularly as only a mouse and monitor are required for set-up and changes.

The Autoscope Phoenix detector card contains 16 outputs, each with status LEDs

Autoscope is a non-intrusive above-ground technology that detects the presence of vehicles using virtual detector zones. Most often, the existing infrastructure (such as conduits and poles) may be used, in doing so avoiding the need for expensive poles and additional trenching. Typically, the Autoscope cameras are mounted on intersection mast arms or light poles.

At the core of this technology are advanced algorithms that process continuously in real-time, learning and adapting to the environment and providing signals to the intersection controller when vehicles are at or approaching the intersection. Using a variety of machine-learning and object-tracking techniques, these algorithms provide accurate vehicle detection throughout adverse weather and lighting conditions, including shadows, in both urban and inter-urban environments.

RADAR AND HYBRID SOLUTIONS

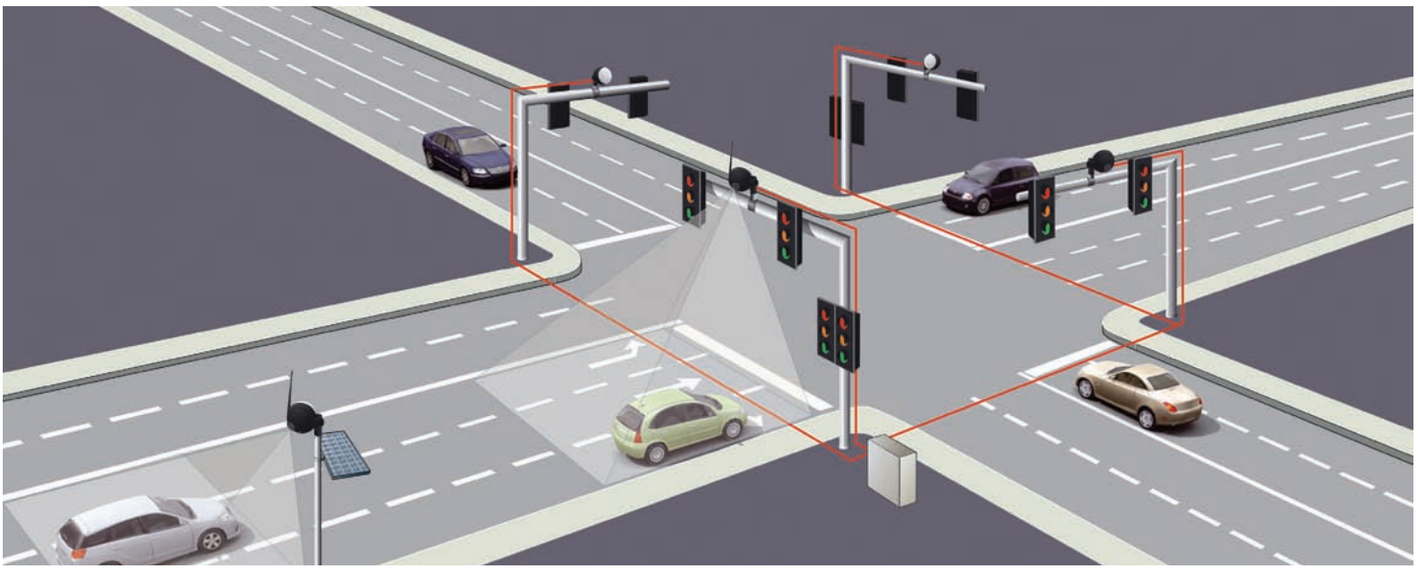
A side-fired radar can also be deployed for upstream traffic detection, in doing so expanding the capabilities within the intersection environment. In the future, though, video/radar hybrid solutions will provide transport managers with a more powerful tool for junction control management. The partnering of video and radar leverages combined technologies to create novel hybrid offerings, which are predicted to deliver unparalleled technology and performance for intersection management applications. ■

For further information about ISS, please call +1 651 603 7700, email ewood@imagesensing.com, or visit the company's website at www.imagesensing.com

Future-focused

Creating a globally popular product would be success enough for some. But for one player in the video detection market, the initial challenge was just the start of a wave of continuous technological evolution and diversification

by Stijn Vandebuerie, Traficon, Belgium



In 2003, video detection specialist Traficon brought to market its flagship product, the TrafiCam. When the product was created, the company was already one of the leaders in the video detection field with its VIP/P presence-detection module with dedicated camera. This technology will remain the solution of choice for bigger and more complex intersections. But for some applications it proved too sophisticated and costly for the user's needs; customers indicated that they were impressed with the technology, but that they wanted to use it for smaller crossings (for example, side streets) as well. There was evidently the need for a product that was just as valuable for users as the high-end modules, but could be used not just for high-profile projects: a cost-effective, democratic solution that could transform traffic management at all intersections.

So what is this product? TrafiCam is essentially a concept that combines a CMOS (complimentary metal-oxide semiconductor) sensor (camera) and video-detection technology in one. It is primarily used for stop-bar and advance detection at signalized intersections. Traficon was the first company to launch such a product,

TrafiCam PC software interface showing the four directions of the intersection

and although the original incarnation has evolved somewhat over the years, the ethos surrounding it remains as it was when it first came to market: to combine the benefits of video detection with the benefits of sensor technology in one easy-to-use, compact box.

GREEN FOR GO

The goal of deploying such technology is to better manage traffic at intersections: to turn traffic light controllers into active management devices. The addition of

TrafiCam allows users to turn traffic light controllers into highly flexible active management devices

intelligence and the optimization of signal-timing plans to allow dynamic control could reduce delays by anything up to 20%, according to World Road Association (PIARC) studies. The controller program can be optimized so that it reacts to various scenarios as needed. One popular strategy is 'green on demand', meaning that if a vehicle is detected as waiting the light will be immediately switched to green. Lengthening the green time is another valuable application as this delays the amber light to allow any detected vehicles through. Combinations of 'green on demand' and lengthening the green time can also be used.

Vehicle-actuated signals go a long way to reducing waiting time, which has a number of positive effects. For a start, the traffic flow gains are obvious. Reducing waiting time for drivers increases throughput on the network. An additional advantage that smoother-flowing traffic brings is to the environment (and also to the driver's pocket).

As the TrafiCam has evolved, it has become both more streamlined and more aesthetically pleasing in its design

TrafiCam detects both moving and stopped vehicles and has a recognition rate of more than 98%. The user is able to view the intersection and position up to eight detection zones (also called 'virtual loops').

Although video detection is a sophisticated and intelligent technology, TrafiCam is easy to use. Installation is simple and fast; then it is simply a matter of connecting the device and starting work.

10,000 AND COUNTING…

Repeat business is a big part of TrafiCam's success story. Indeed, one repeat contract, in June 2008, saw an additional 140 units being sent to Vilnius, the capital of Lithuania. The order enabled Traficon to reach a new record: more than 10,000 TrafiCam units sold. Today, more than 700 sensors are installed in Vilnius.

It is fair to say the product has become a trusted and field-proven technology over the years. But Traficon is always looking to push the boundaries of what can be achieved by this deceptively straightforward solution.

In 2006, the second generation of TrafiCam was unveiled, which was partially in response to the 'sympathetic design' trend that was sweeping across the town planning and architectural/engineering communities. In recent years, there has been a massive backlash to the perceived invasion of technology into our urban spaces. The more CCTV cameras that appear, the more complaints there are about them spoiling the aesthetics of our urban spaces. Speed cameras, electronic signs and, of course, traffic detectors have all been criticized.

Fitting discreetly on traffic lights, the 'second-generation' TrafiCam is stylish and sympathetic to its environment. However, Traficon is not just concerned with looks. Based on customer feedback from the time-pressed intersection industry, improvements were made to make installation even easier and faster than ever before.

CONTINUOUSLY EVOLVING

Responding to the global trend of environmental awareness, in April 2008, the first solar-powered standalone working video detection sensor was added to the TrafiCam product range. Also in 2008, at the 15th World Congress on ITS in New York, Traficon introduced TrafiCam x-stream. The basic concept remains the same, but with a new element: IP addressability, allowing local and remote control and MPEG4 compressed streaming video.

The company is now expanding the range to focus on a number of new applications. An example was the announcement of the TrafiCam Collect-R, a cost-effective solution for gathering traffic data, monitoring traffic flow, and emulating or simulating loops on highways and inter-urban roads. It can be used for temporary or permanent applications, plus its low power consumption is suitable for a standalone solar-powered installation.

TrafiCam Collect-R is designed to be a durable alternative to inductive loops. For many years, inductive loops have been widely used for traffic management and detection applications. But the dominance of loops has not been without its pitfalls. They can be troublesome to install and maintain, which therefore means high labor costs, so have not proved to be the cost-effective solution they were originally touted as. Installation usually means disrupting traffic flows, which causes huge headaches for those individuals attempting to manage their road networks. Another problem with loops is that they quite often have a high failure rate. TrafiCam Collect-R offers all of the data that can be supplied by loops (such as volume, speed, occupancy and classification) across multiple lanes, day and night, and in all weather conditions, as well as fast and unobtrusive above-ground installation.

Depending on sensor positioning (overhead/side-fired), up to four lanes can be covered. Data is provided for each lane and each vehicle class. Integrated data is stored in the sensor and can easily be transferred via an open protocol SDK (Traficon Management System) or an offline download tool. Downloading this data to a PC can be achieved locally or remotely. This transmission of data can be conducted at predefined times or on operator command.

For traffic flow monitoring, the sensor uses flow speed and zone occupancy to automatically distinguish between five levels of service: normal; dense; delayed; stop-and-go; and congested. Alarms can be generated on the outputs for each of these service levels, or can be transmitted to the Traffic Management System. In addition to the traffic alarm, an image can be sent for visual verification. TrafiCam Collect-R can also be used to trigger third-party systems, such as flashing lights, barriers, CCD cameras and VMS panels when traffic flow exceeds a certain predefined level.

The system is also used to simulate or emulate single or double loops. Physical inductive loops are simply replaced by 'virtual loops', where a sensor detects vehicles when they cross over. The outputs of the TrafiCam Collect-R can be connected to a controller board to ensure predefined actions, similar to single/double loops, while an advanced CMOS camera is used and features an intelligent day/night-detection algorithm for accurate and relevant data collection around the clock. Advanced filters, meanwhile, suppress unwanted detection that may be caused by changing light conditions or the effects of extreme weather conditions. ■

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Allied forces

Integrating ALPR systems with video management will be a crucial part of evolving and diversifying the applications that the technology can be used for. One company is already making rapid progress in this field

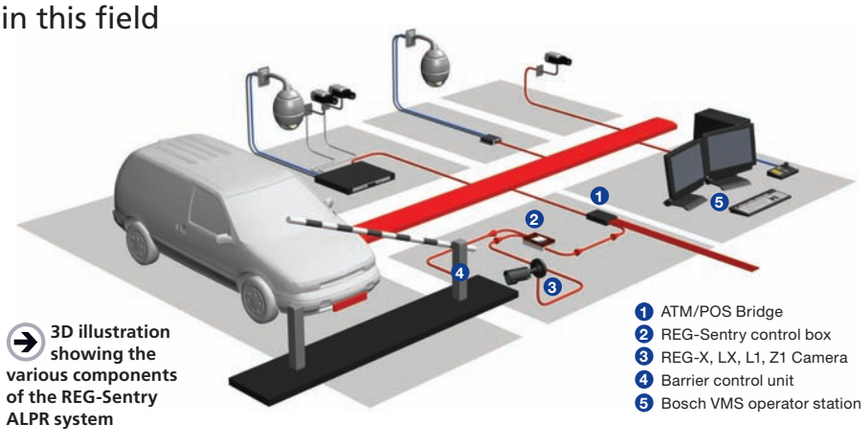
by Ian Crosby, Bosch Security Systems, UK

Automatic License Plate Recognition (ALPR) technology is firmly established worldwide as a valuable tool for many advanced surveillance applications in the fields of security, speed enforcement and access control. These sectors usually employ specialized infrared-sensitive ALPR cameras that are capable of capturing the license plates of even fast-moving vehicles in ambient light levels, from bright sunlight to complete darkness.

The video stream is then converted into a computer-readable data format and compared with a database of registration numbers. Until recently, ALPR systems tended to be standalone and operated alongside CCTV management systems, with little or no interaction. However, following Bosch Security Systems' 2008 acquisition of Derwent Systems (an LPR specialist), the company used the integration capabilities of its BVMS (Bosch Video Management System) to develop a solution that allows its ALPR-based REG-Sentry access control system to be added to the BVMS.

The BVMS manages all digital video and audio of an IP-based CCTV system, plus all the security data being transmitted across the IP network, combining the company's IP cameras and encoders, digital video recorders (DVRs), and Allegiant matrix systems. It also incorporates graphical user interface features that make configuration and management simple. A processor in the REG-Sentry control box converts license plate images from the camera to ASCII characters and appends date and time information. This data can then be monitored at the time of conversion via the control box's communication ports. The user's black/white list can contain up to 10,000 registration numbers, and can be updated and uploaded with the system's PC-based Sentry-Viewer software.

REG-Sentry is one of the first automated vehicle access control systems based on ALPR, and can operate as a standalone solution or be integrated with other equipment. It is a flexible technology for a range of access-control applications, including access roads, parking lots, gated communities, ports, offices and schools.



3D illustration showing the various components of the REG-Sentry ALPR system

The system comprises an ALPR camera, a control box with an embedded processing engine and dedicated software to intelligently control traffic barrier applications. The camera is programmed to operate at high shutter speeds to ensure the license plate images are captured in high contrast and high resolution, without motion blur. Special infrared illumination enables the cameras to deliver consistent, reliable images under any ambient lighting conditions.

The camera captures the license plate of any vehicle approaching an access-control point and transmits the data to the control box, where it is processed and compared with the black/white list. A signal is then sent to the barrier to open, or remain closed.

BENEFITS OF INTEGRATION

Integrating REG-Sentry with a CCTV installation offers several advantages, from providing 'context shots' – photographs with a wider field of view to identify make, model and color of vehicles at the barrier – to automatic recording of the scene around the barrier for a given time after triggering.

Such integration is possible using the Bosch ATM/POS bridge. The bridge offers a range of functions, including interfacing between REG-Sentry and DVRs. This allows license plate data to be recorded and linked to specific images.

Once integrated, the control box output can be read by the BVMS server to alert the control room when, for example, a vehicle with restricted access approaches the barrier, and to display a CCTV image of it.

In addition, each vehicle's arrival is automatically recorded and the footage can later be retrieved from the CCTV storage device by a simple search action of all or part of the number. In this way, every attempt to gain access is registered both in REG-Sentry and, as stored video in the BVMS, can provide video evidence if necessary later on.

One recent application for this technology is preparing to go live in Portugal. The client has purchased seven REG-Sentry units to be used in a shopping center in Lisbon, units that will be integrated with the BVMS. The purpose of the scheme is twofold. The system will be used for car counting and vehicle monitoring for security, but the client also has plans to use the data gathered for customer profiling and intelligence purposes. The potential for such systems is wide reaching. Shopping centers being able to profile their visitors will enable them to better market their offerings and may even allow progress to be made in terms of introducing parking schemes, such as variable pricing. It is the integration of ALPR and video management that is making such developments possible. ■

To find out more, contact Bosch Security Systems UK by calling +44 1895 878 088, or visiting the company's website at www.boschsecurity.com

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Reliable solutions

501 The RocketPort and DeviceMaster products from Comtrol offer a broad range of port densities, from 1-32 ports, making Comtrol the preferred connectivity choice by systems integrators of Idris vehicle-detection technology.

Idris is well known and widely used throughout the tolling industry for its highly accurate vehicle-classification technology. Tolling integrators, road authorities and DOTs choose Comtrol's RocketPort products when integrating multiple Idris detectors to one controller. Comtrol and Idris are working together to provide a complete solution to the tolling industry. The two companies are dedicated to ensuring that the communication between the controller and detectors is reliable and highly functional. Bob Lees of Idris says:

"We have found Comtrol to be excellent to work with. They have been very responsive to the needs of our technology partners and are always looking for ways to better their product offering." Idris and many others look to Comtrol for robust connectivity to multiple serial devices.

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Safer tunnel tech

502 Turkish company Savronik has signed a contract with Bechtel and joint-venture partner Enka to provide an electromechanical traffic system for a new tunnel currently being built in Albania.

The tunnel will be located on the 61km, four-lane highway coming from the town of Rreshen (in the heart of the country) up to the north-eastern village of Kalimash. The 12m-wide tunnel will be 6km long in each direction, and is set to open to traffic by June of this year.

The electromechanical system to be integrated by Savronik will be consistent with PIARC Tunnel Control Systems Classifications, and will have a variety of the latest safety technologies, including lighting, air control, linear fire and gas detection, as well as intrusion alarm and emergency call systems. To further aid safety, there will also be a CCTV network, a tunnel radio system, traffic control, a SCADA system and a control center. An optical fiber line will be used to handle the flow of data that is obtained by relevant PLCs and other systems to the control center.

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> "Success is wholly dependent upon the continued presence of congestion — it needs congestion to get people to make the shifts that are needed to relieve it"

see page 32

LPR for blacklists

503 ALPR solutions are considered to be one of the most efficient technologies for capturing blacklisted vehicles in the modern traffic law enforcement industry.

Keon-A's In Vehicle License Plate Recognition system (V-AVNI) is an ALPR-based patrol car blacklist vehicle-capturing system. Authorities in Korea began to use the system in 2004 and it is currently widely used.

When a police patrol vehicle is equipped with the system, officers are able to capture all kinds of criminal vehicles promptly. The system photographs all vehicles traveling in an area and uses OCR technology to capture plates. The license plate data is then compared with a criminal vehicle database that is updated periodically by the police. If a blacklisted license plate is discovered, the vehicle information is displayed in the patrol car and an alarm is also generated.

The police use the system to apprehend various kinds of criminal vehicles, such as wanted vehicles, stolen vehicles, tax evaders, and more. V-AVNI has been installed in around 130 patrol cars for 60 Korean police authorities nationwide and has had an effective performance and record for capturing blacklisted vehicles. Fifteen police stations in the Choongcheong province have been operating 34 systems, and their results show that in 2007 the systems captured a total of 2,315 blacklisted vehicles, while in 2008 1,411 were captured.

As the systems become even more widespread, results such as this will increase, keeping Korea's roads clear from illegal vehicles.

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Award-winning design

504 In April 2008, during Intertraffic Amsterdam, Swarco Futurit launched Futura – the first-ever eco-designed polycarbonate LED traffic signal. The product has since been installed at many intersections, including locations in Austria, Germany, Romania, and Kazakhstan. In fact, Helsinki has selected Swarco's signal head for all of its 2009 projects.

Futura is the result of a scientific life-cycle analysis of the previous signal generation. Following eco-design principles with regard to all product phases – from raw material extraction via production processes to end-of-life management – this is 'state-of-the-art' signaling, characterized by brilliant light output, high energy efficiency, and a 60% lower Global Warming Potential (GWP) compared to previous generations of signal head products.

This new approach is already award-winning, as Swarco Futurit is now allowed to carry the highest quality seal of the Austrian state. The Neutal-based company (with new office premises in Perchtoldsdorf) obtained a nomination for Austria's National Award, 'Focus 2008', for Efficiency in Climate Protection.

Swarco Futurit has customers in over 60 countries worldwide,

which rely on the company's solutions to help improve traffic fluidity and road safety.

All of its products are subject to ISO 9001-certified quality management procedures, and comply with international standards, having been approved by independent test institutes such as BASt and INTRON.

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Required reading

505 TransCore has tested its Encompass 6 IAG 'Plug 'n' Play' (PNP) RFID reader system on The Southern Connector toll road in South Carolina. In use over the past three months, it has shown an accuracy of 99.95%, and has greatly reduced the violation rates in installed lanes when compared to older equipment in other lanes. The Encompass 6 PNP equipment configuration supports both IAG and SeGo protocols. The significance of the successful deployment is that Northeast toll authorities, which use IAG-only protocol hardware, now have multiple manufacturing sources. The system is a modular high-speed, multi-protocol 915MHz RFID reader technology that includes Encompass 6 readers and IAG reader emulators in a single housing. It provides quick and easy replacement of existing IAG readers, and requires no modifications to lane controller software or configurations.

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> "VMT by itself — which no self-respecting transportation economist would recommend — would send weaker consumption signals than the gas tax does"
>
> see page 41

Phones for emergency

506 CASE Systems' emergency call box products can be connected to a variety of cellular technologies, such as CDMA 800 and 1,900MHz, and GSM 850, 1,900 and (900MHz, Europe). *Standard call box*: With CASE's call boxes, everybody has access to a cellular telephone. These systems are easy to install, secure to operate, and feature reliable cellular connections. The standard call box is also available in a landline version, and meets the necessary ADA guidelines.

TTY call box: After 10 years of developing the standard call box, a need was recognized to broaden accessibility standards. CASE's TTY product offers communication for the hearing-impaired and speech-impaired user, thereby providing service at everyone's fingertips. It exceeds ADA guidelines, while an electroluminescent screen can provide foreign text, and can even depict international symbols. *Hands-free call box*: The hands-free call box was designed for use in areas where vandalism is of great concern. The product has the same features and functionality as the standard call box product, but does not include the handset unit.

CASE sees many potential opportunities for the application of its time-tested and solar-powered wireless communications devices. As the market demands more from products and services, the company is prepared to meet the needs for solar-powered solutions.

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SCOOT off to China

507 Two Siemens PC SCOOT systems have recently been installed in the Chinese cities of Nanjing and Wuhan, and more equipment has been supplied to Chengdu and Dalian. In Nanjing, located in the Yangtze River Delta, 95 junctions will be managed and controlled by PC SCOOT and in Wuhan, capital of the Hubei province, 426 junctions will be monitored.

The Wuhan contract represents one of the company's largest overseas orders in recent years and forms part of a prestigious World Bank project, including the provision of a new Urban Traffic Control (UTC) system with PC SCOOT and the supply and installation of more than 400 signal controllers and 1,000 detector units over a period of 18 months.

According to Peter Gorton, Siemens' general sales manager, cities in China are among the most progressive in all Asia, building infrastructure for the future to deal with growing populations and increased levels of road and pedestrian traffic. "Supporting this continued development, our systems and equipment will help both cities manage the additional traffic more effectively," he said. PC SCOOT offers users numerous benefits, including ease of use,

simple installation and migration, and reduced equipment and maintenance costs, all operating on a PC. The features reduce maintenance requirements and provide more opportunities for implementing a range of traffic control solutions. PC SCOOT includes all the major features of the Siemens UTC/SCOOT system, monitoring traffic in real-time, it optimizes traffic signal operation and adjusts the signal timings to match prevailing conditions, in doing so increasing network efficiency.

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Feature-rich technology

508 The VMS, traffic light and arrowboard products designed and manufactured by Data Signs in Melbourne, Australia, are trailer-mounted, solar-powered and packed full of features.

Compliant with the applicable government standards, Data Signs' VMS range can be utilized for traffic management and control, event management, notifications, advertising, and much more. As well as being easy to set up, the ease with which new messages can be uploaded is a plus. Ways to update the VMS include:

- Direct connection: Use the serial port on the VMS to update it from a laptop;
- GSM: Dial up the VMS and update it with a new message, or locate where the VMS is;
- SMS: To quickly and easily change the displayed message, a new message can be sent from a cell;
- Internet: The 'Web-Send' feature allows updates from your desk using the Data Signs software;
- GPRS: Real-time updates mean you always know about your sign and can easily update it;
- Satellite communication POCSAG also available.

The SMS/VMS Designer software packages are included with each Data Signs VMS board. This easy-to-use software allows you to create and change messages for your VMS signs, and much more. The integrated mapping feature also means you can locate your sign at any time.

The recently released VMS Fleet Manager software sets a new standard for variable message sign fleet management, as you can: track your signs; view the current status of each at a glance (including battery voltage, message showing, etc); or update your sign with a new message with one click. The VMS Fleet Manager program is available to download from the Data Signs website once the products have been purchased.

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DAKTRONICS

Q With 5.9GHz proved in a tolling project in Denver, how would you make the case – or even not make the case – to a toll agency for its wider deployment?

A "The 5.9GHz RFID ETC systems are being proved in the USA, although their broad implementation is a question of business, not technology. They may ultimately be utilized in IntelliDrive applications, but toll agencies are among the few agencies that can afford widespread deployments. Given the major deployment of existing 915MHz ETC technology, significant investment is needed to 'swap out' the systems. To implement this improved technology, we need a combined effort between multiple parties, including the federal government, to help support migration. As many regions are interoperable, it will be the responsibility of all toll agencies within those regions to switch to the 5.9GHz system to ensure compatibility into the future."

Jack Finn
national director, Toll Services Group, HNTB, USA

A "I make the case for deployment and believe it pivots on a key word in this question – 'wider'. This means more than geography; it's services too. The case for 5.9 is plain. It was developed to provide a wider suite of important interoperable services on one, scalable platform, via familiar, AMD-based systems. How do organizations today cost-justify deploying stove-pipe technologies given their need to get the most for their money, and the limitations of proprietary solutions? The challenge is not the deployment path or transition costs – they can be met. It is education, leadership and will."

Tim McGuckin
executive director, OmniAir Consortium, USA

A "The 5.9GHz technology has clearly been proven here at E-470. By all measures, 5.9GHz will be able to provide every possible advanced DSRC functionality envisioned by IntelliDrive. Organizations such as the OmniAir Consortium and RITA are working to encourage stakeholders to define and certify its use in future transportation solutions. Because its use has not yet been clearly defined – and a demand within the toll industry does not yet appear to exist – I can't make a case where the cost of its adoption, at the expense of decommissioning our 915MHz systems, would bring value to toll industry customers."

Dave Kristick
director of operations, E-470 Public Highway Authority, USA,

A "In addition to tolling, 5.9GHz is the planned communications method to support IntelliDrive – focused on rapidly deploying a safety infrastructure to identify and avoid hazards, such as accidents, poor weather, etc. Proponents state that safety aspects should have priority over 'buy-in' features such as tolling. Tolling has recently increased in popularity as an alternative to extra taxes. As a basis for safety and tolling, 5.9GHz can serve as a potential source of revenue collection as well as to 'jump-start' a significant portion of the infrastructure's deployment. As the two applications are not mutually exclusive, the question should be 'How can we not collectively support a case for wider deployment?'"

Ed Mulka
company principal, Jafa Technologies, USA

A "5.9GHz ('Gig') and its suite of standards is by all accounts a superb mobile communications system and toll roads should be – in fact, many are – considering how to make best use of it. For toll collection alone, it's hard to justify a system so capable in terms of vehicle-to-vehicle communications, long range, huge bandwidth, large memory, and GPS. Its capabilities are built around the needs of a bunch of safety applications. For today's American toll roads 5.9 Gig is overkill. But for tomorrow's road pricing, 5.9 Gig with GPS makes a lot of sense. Hopefully the E-ZPass Interagency Group (IAG) in its present procurement will find a way to accommodate this new technology. Beyond the IAG, the strongest case for North American toll interoperability is in trucking, so the Feds could push for 5.9 as the successor communications technology to ASTMv6, as used in truck weighstation bypass, and work to get it picked up for other applications, including tolling."

Peter Samuel
editor, tollroadsnews.com, USA

A "Denver showed that 5.9 can effectively be used for ETC, but it showed there is no cost or performance advantage over existing systems. Ultimately, its value will be about the new services made possible by longer ranges, faster data transfer speeds and volumes, and most importantly the convergence of technologies into a single device, including RF, GPS and integration with other onboard devices. Such a device could also enable VMT taxation, which will surely dominate the public-policy debate over highway finance during the coming years."

Paul Manuel
vice president, sales and marketing, Mark IV IVHS, USA

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