traffic
technology
INTERNATIONAL

JANUARY 2010

Fatal distraction
Expert opinions on one of
traffic's silent (but deadly) killers

Image is everything
The increasing use of machine vision
technology in the traffic market

Come together
Richard Harris on the need for
further cooperation in CVHS

Street
smart

How telemanagement is taking
street lighting to a whole new
level of intelligence

BILL HALKIAS, ATTIKA TOLLWAY • HAVEit • GBS BINDRA, LOGICA • VMS • ERIK DIJKSHOORN, INTERTRAFFIC
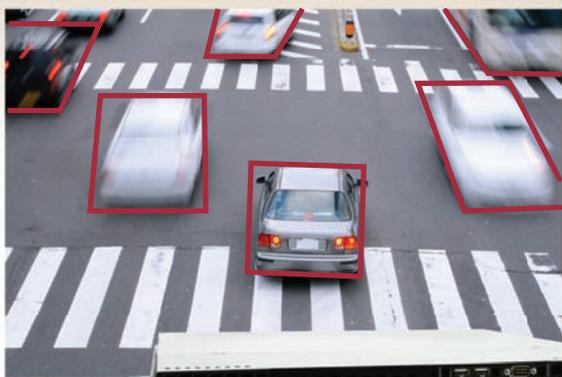
COVER STORY

36 **STREET SMART**
INTELLIGENT STREET LIGHTING FOCUS

From LEDs to telemanagement, Saul Wordsworth investigates
the genuine revolution taking place in the illumination of our roads

TRAFFIC TECHNOLOGY INTERNATIONAL WHO'S WHO

Somewhere in America...

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IME FOR ACTION
РЕМ ДЕЙСТВОВАТЬ

Moscow fuel

President Dmitry Medvedev has stoked up the Decade of Action road safety campaign with a stirring speech at the UN Global Ministerial Conference on Road Safety

Main: **Russian President Dmitry Medvedev delivers a powerful speech at the Road Safety Conference**
Below: **Michelle Yeoh, the Global Ambassador for the Make Roads Safe campaign**

→ NICK BRADLEY

Moscow, Russia Talking with *Traffic Technology International* following the first-ever UN Global Ministerial Conference on Road Safety, FIA Foundation director general, David Ward, couldn't have been happier. Around 1,500 ministerial delegates attending from 120 countries left the conference with ideas in hand to cut the road death toll in their respective countries, many of which were low-

and middle-income countries where around 90% of the 1.3 million road deaths occur every year. "Russia's president, Dmitry Medvedev, made a powerful speech," Ward reported, "making comments that I hadn't heard before, which when you think about them are quite obvious. The whole world has been concerned with global recession and the loss of GDP, but he made the very valid point that countries are losing between 2-3% of

GDP every year as a result of road traffic crashes – an ongoing economic downturn, and we just ignore it. If there was an outbreak of a disease – such as with swine flu – and it was killing more than a million people a year, there would be a concerted and immediate international response. Take those two factors together, there's a huge economic cost and there's a huge health cost, and we just tolerate it. It's the first time there has been that level

Detector gadget

St Paul, Minnesota The latest-generation RTMS G4 radar units from Image Sensing Systems are being deployed as a part of the TOPICS IV project in New York City. The solution is being used in mid-block traffic detection at nearly 200 intersections, where high quality and reliable data is a major requirement. "Rigorous procedures were put in place to ensure the most applicable detector technology matching our deployment criteria was selected," said Mohamad Talas, deputy director of NYCDOT system engineering.
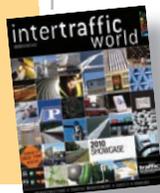
192 …pages, more than 60 articles and support from 50 of the industry's key suppliers just about sums up the huge success that is the launch issue of *Intertraffic World*. "When we announced *Traffic Technology International* and Intertraffic Worldwide Exhibitions would collaborate to produce the world's most important publication for advanced traffic management and urban mobility, the response was overwhelming!" recalled Mike Robinson, publication director. "The partnership has been a great success and we look forward to working with Intertraffic to produce the next edition in 2010."

intertraffic world
2010 SHOWCASE

Keep a cool head

Brighton, UK A patented brain-cooling device for crash helmets that could save hundreds of lives a year has been developed at Sussex University's Innovation Centre. ThermaHelm acts like an instant ice pack when activated by impact, so reducing brain swelling and the risk of long-term damage. It also extends the critical window that paramedics and A&E teams have to perform their life-saving skills.

that targets have been included," Ward explained. Second, the World Bank and six leading multilateral development banks issued a 'Statement of a Shared Approach to Managing Road Safety' – a pledge to make road safety a priority in the banks' operations. "Each year these banks are spending US$4 billion in building roads, road maintenance and rehabilitation of existing roads. We've been arguing they should ensure that investment is better targeted on road safety and that they're properly quality-assured to ensure they're not making situations worse. Quite often, road infrastructure improvements actually raise speeds, so roads end up having a worse crash profile than before."

Finally, significant investment was announced for the Decade of Action campaign's recommended US$300 million start-up fund for road safety, including a US$150 million donation from the Bloomberg Foundation. These

The head of Russian traffic police Viktor Kiryanov and Prince Michael of Kent

of political interest. The event exceeded our expectations."

Three Conference developments in particular put a smile on Ward's face. First, the Moscow Declaration itself was approved, so establishing a basis for a global governmental framework for road safety. "In the spring, the UN General Assembly has to decide whether to authorize it, but it's encouraging that such a number of countries endorsed the idea and

funds will allow the FIA Foundation and partners, including the Road Assessment Programmes, to keep up the pressure over the next 10 years.

"Road safety works best when there is clear political support from leaders in government, which is why this Ministerial was so important as a gathering of leaders," Ward concluded. "This Moscow Conference is a political event and the Moscow Declaration is a political statement of intent."

A solution to the texting menace

Rochester, New York A new anti-messaging technology (AMT) has been unveiled by Drive Safely Corporation that could help enforce proposed texting legislation. GPS data is used to ascertain whether the user's cell phone is in a moving vehicle. If the user accesses the phone's messenger services – to receive or send a text, for example – a prompt advises 'Texting While Driving is Illegal'. It then asks 'Are you a driver?' If the answer is, 'yes', the phone's messenger capabilities are disabled until the phone has been at rest for a period of time. If 'no', AMT will then allow the user to access the messenger services only if the user is able to input a series of letters, numbers and symbols within a restricted time frame: a process called the 'Attention Validation Sequence' (AVS). Following the initial AVS screen, AMT will periodically – and without warning – initiate additional AVSs to ensure the user is not driving a vehicle. If the user fails to respond exactly – and in the required time period with respect to every validation screen – it will disable messenger services until the phone has stopped moving for a period of time.

FOREWORD

Often rebuked at home for leaving the lights on, the fridge door open, overfilling the kettle, and putting electrical devices on standby, my eco-record at the office fares only slightly better. Invariably the last person to vacate, I'm forever leaving the photocopier and printer switched on (although the powers-that-be should note I never forget the alarm!). All in all, I'm probably not the type of person to be on Al Gore's Christmas card list.

In my defense, though, I recycle whatever my Local Authority demands. The menacing array of five waste bins in my driveway – for plastics/paper/cardboard, glass/metals, food waste, garden waste and lastly anything that doesn't fit into any of the above categories – are testament to this. I make a monthly donation to Greenpeace, and even if I do leave some lights on at home, they're at least energy-efficient bulbs. And as I sit there in 60% of the light, I am searching for a new car that ticks all of the environmental boxes.

At the time of writing, the Climate Change talks in Copenhagen are but hours away, and flanked in controversial claims that the human influence on global warming has been 'exaggerated'. Whether true or not, transportation's role in polluting the planet is hard to dispute. In the USA, it accounts for one-third of CO_2 emissions, around 80% of which are borne from cars and trucks. Although the finger of blame is often directed toward vehicle manufacturers, the lack of focus on the role of traffic congestion in CO_2 generation perplexes me. You only have to browse through a copy of the *2009 Urban Mobility Report* to see that, in 2007, 2.8 billion gallons of fuel (and 4.2 billion hours) were wasted while sitting in traffic jams.

With cooperative vehicle highway systems (*p14* and *p32*), road pricing (HOT lanes, cordon charging, etc) and better traffic management (informing travelers with more intelligent VMS, *p28*), our industry has much to offer. Driver assistance systems, too, can help, and advances such as adaptive cruise control can indirectly influence climate change, while systems that result in fewer accidents ensure smoother traffic flow. Even the way we light our roads (*p36*) can lower transportation's carbon footprint.

So, as we usher in 2010, one of my resolutions for the coming year will be to highlight more the positive impact of ITS in relation to the environment. And who knows: by showcasing your successes more prominently, I might make that Christmas card list next time round…
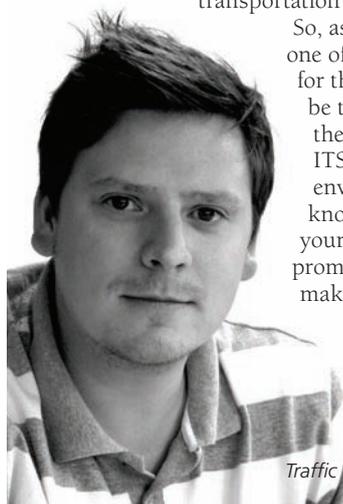
Nick Bradley
Editor
Traffic Technology International

A DECADE OF ACTION

Our new regular columnist suggests the deployment of proven life-saving road safety vaccines now can prevent more than five million people dying over the next decade

by Adrian Walsh, director, RoadSafe, UK

More than 120 of the world's transport ministers met in Moscow recently to review what they can do to reduce the huge toll of death and injury on our roads. The first-ever Global Ministerial Conference on Road Safety called for a 'Decade of Action for Road Safety'.

By 2015, road crashes are predicted by the World Health Organization to be the leading cause of premature death and disability for children aged five and above. Earlier in the year, Lord Robertson, chairman of the Commission for Global Road Safety, launched a report calling for action. "This epidemic on wheels – which already kills on the scale of malaria – will continue to rob even more families of their loved ones and their livelihoods, as the number of those killed doubles to well over two million per year by 2030," he said.

The Decade of Action for Road Safety is likely to be launched by the United Nations in 2010, with the goal of reducing the forecast level of road deaths in 2020 by 50%. The Make Roads Safe report recommends that governments should commit to attaining the 'Decade goal' by implementing a five-pillar Action Plan designed to first build management capacity, influence road design and network management, influence vehicle safety design, influence road user behavior and lastly improve post-crash care.

Vehicle safety technology will play a big role, but many countries in the developing world have the chance to leap ahead – for instance, by mandating ESC as standard on all new vehicles. Imagine the impact in India or China if this were to happen: these two countries alone currently account for nearly 200,000 lives lost each year! The cost of these innovations is small, but the benefits are great – stability control, for instance, costs less than US$100 dollars but can reduce crashes by some 30%.

Simple road design features such as a white line cost little but save many – more advanced retroreflective paint have an even greater effect. Making the knowledge of how to 'fix the problem' readily available to road designers in the developing world and encouraging governments to take action is our new challenge.

As Lord Robertson says in his report, "Five million lives: this is what is at stake in a Decade of Action for Road Safety. Five million people whose potential can be realized, not wasted; five million families that need never know the sudden loss and lifelong grief of a road crash bereavement. This is a prize well worth investing in, safe in the knowledge that the returns – human and economic – will far outweigh the investment." ∎

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

Advance warning

Dubai, UAE A severe weather early-warning system is being introduced across Dubai to prevent traffic accidents, such as the 250-car pile-up that claimed four lives on the fog-bound Abu Dhabi-Dubai highway in March 2008. Alerts will be displayed on roadside VMS and text alerts will be sent to Etisalat cell phone users, warning them about poor weather conditions. Alerts will also be broadcast on the radio network. Due to the intense humidity, the type of fog experienced in Dubai is different to many other parts of the world. This system will monitor fog density and the subsequent decline of vision and then process the collected data and formulate the necessary models to predict the low level of visibility. Six stations have already been set up to monitor weather conditions, which also includes an offshore station, although eventually a total of 14 stations will be in operation under the RTA scheme.

Congestion relief for City of Corona

Santa Ana, California The City of Corona in California has awarded Iteris a US$2.27 million contract for the integration of Phase 2 of its Advanced Traffic Management System (ATMS) project. Once complete, the project will deploy Ethernet-based communications to 95 signalized intersections and include the upgrade of nearly 50 traffic signal controllers. The project will also deploy six new Gigabit Ethernet communication hubs, 30 new CCTV cameras, eight DMS, one microwave Gigabit Ethernet backhaul link, while 29 existing video-based traffic detection systems will be upgraded to Ethernet-based communications.

Corona is a gateway to and from Orange County and plays a key part in the flow of traffic on the SR-91 and I-15. The Iteris system will manage traffic and assist in relieving congestion as commuters cut through the city's local streets to bypass the clogged freeways.
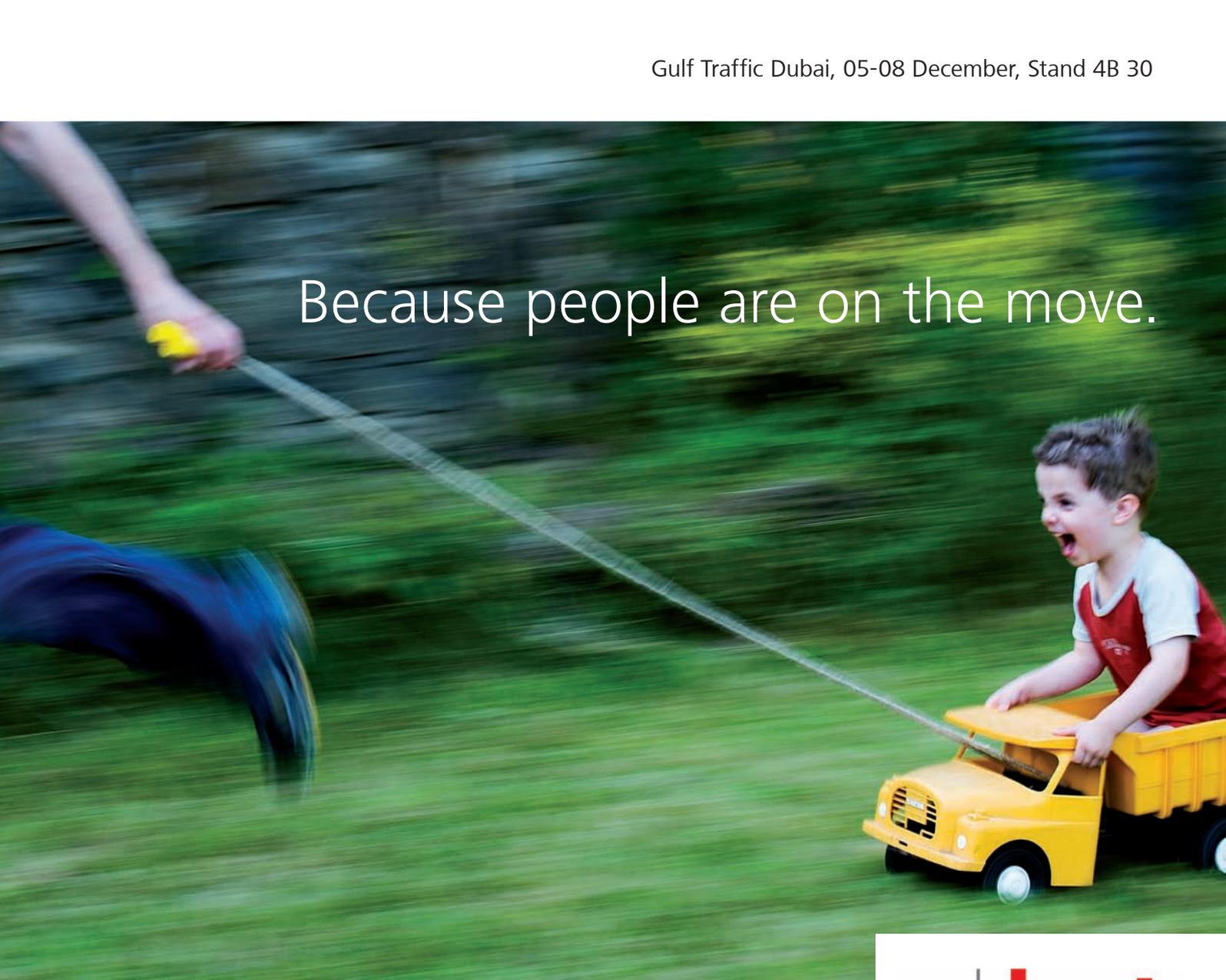
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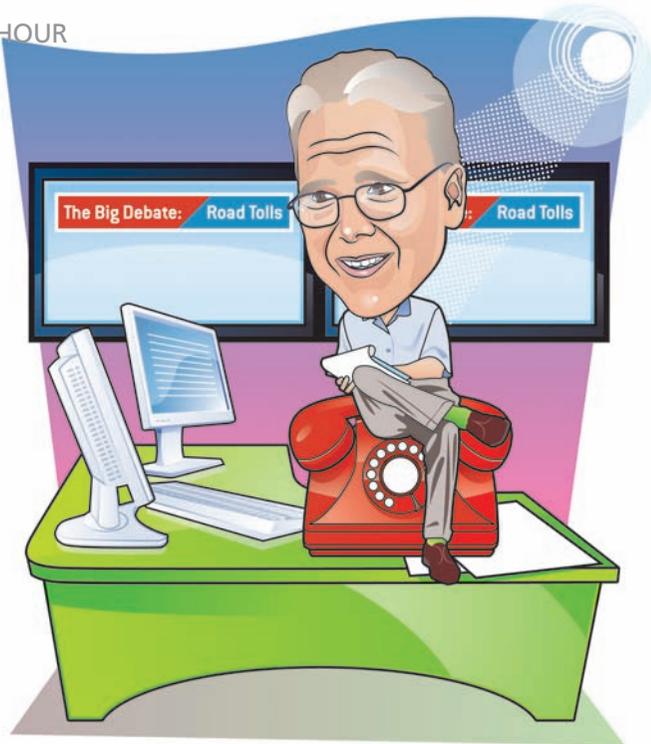
NOT LISTENING YET…

As our road pricing guru hits the big screens, he learns that pleasing all of the people all of the time ain't gonna happen. But some people are coming round to his school of thought

by Bern Grush, www.grushhour.com

Recently, I was on a local call-in show debating road tolls. The two live guests were an auto journalist and myself and two phone-in guests were a transport consultant and an economics professor. I explained how GPS-based, road-use metering worked, how it could be used for parking and insurance as well as tolling, and why data privacy rules did not permit location data to leave the vehicle.

The journalist complained, "We already pay way too many taxes – this is just more government intrusion". He also insisted that automotive emissions were too little to be considered further in the matter of global warming. Then he said that fuel tax should be raised, contradicting his "way too many taxes" comment a minute earlier.

The transport consultant pointed out that pricing (and PAYD insurance) was important for people to become conscious of the costs of their travel choices, that PAYD transportation sent 'pricing signals' to commuters, some of whom would make better choices, in doing so benefiting everyone – including those who continued driving on now-less-congested roads.

The professor – a long-time advocate of road pricing – said that road tolls are critical to transportation funding. He said this with authority, as he is one of a few respected Canadian academics to have written extensively on the subject.

Half of the callers were pro-pricing and half repeated the journalist's mantra – "I don't like tolling – just raise the gas-tax." This means US drivers are beginning to recognize the funding problem. Some blame it on political conspiracy, but others understand that the gas tax has not been raised in years, making the problem real.

Unfortunately, few are able to grasp two key issues: fuel tax does not address congestion (the consultant's 'pricing signals') and engine efficiency diminishes the tax base – i.e. greener driving hurts road funding. In illustration, while a caller was insisting that raising the gas tax was the answer, I interrupted, "…but I have an all-electric car. How long are you willing to subsidize me?" He paused, "Oh, that's different. Maybe tolling is needed for that."

"The problem is efficiency standards," the journalist responded. "Governments should force vehicles to get less than 10 miles to the gallon." Such a step would multiply fuel costs per distance by 250% or 10 times more than the tolls I describe.

Most people have no way to grasp arguments about pricing signals or demand management. Rather, drivers of cars with IC engines will start to ask for a new tax structure for greener vehicles as soon as fleet electrification reaches, say, 3-5%. Why? Because a 3% drop in vehicle miles travel bankrupted the US Highway Trust Fund during the recent recession, and has already sent the USA scurrying to road tolling to close this funding gap. ■

Any comments to bgrush@skymetercorp.com

Getting a measure on distraction

Dearborn, Michigan In the final phase of its research into the cause and effects of distracted driving, Ford is using high-tech goggles that measure the amount of time drivers take their eyes off the road in order to help validate in-vehicle technologies such as GPS navigation systems. The special 'occlusion' goggles are being used in testing at the company's Human Machine Interface Verification Laboratory – or 'Distraction Lab'. The gleaned data will accelerate the safer design of in-car telematics systems, such as Ford's SYNC system.

Safer by smiles

Cambridge, Massachusetts Scientists at the Massachusetts Institute of Technology (MIT) are developing a robot, Affective Intelligent Driving Agent (AIDA), that will help change the way people interact with their vehicles. Along with partners Audi and the Volkswagen Group of America's Electronics Research Lab, the AIDA team is designing the robot to be embedded within the vehicle's dashboard, which pulls in real-time information from the internet about traffic, among other things. Programmed to remember a driver's usual routes to and from work, AIDA will also monitor the driver's facial expressions for signs of fatigue or agitation. Communicating through visual cues such as winks or smiles, as well as verbally, it will offer information on alternate routes or vehicle fuel levels. "AIDA can give you feedback on your driving, helping you to achieve more energy efficiency as well as safer behavior," said Assaf Biderman, associate director of MIT's SENSEable City Lab.
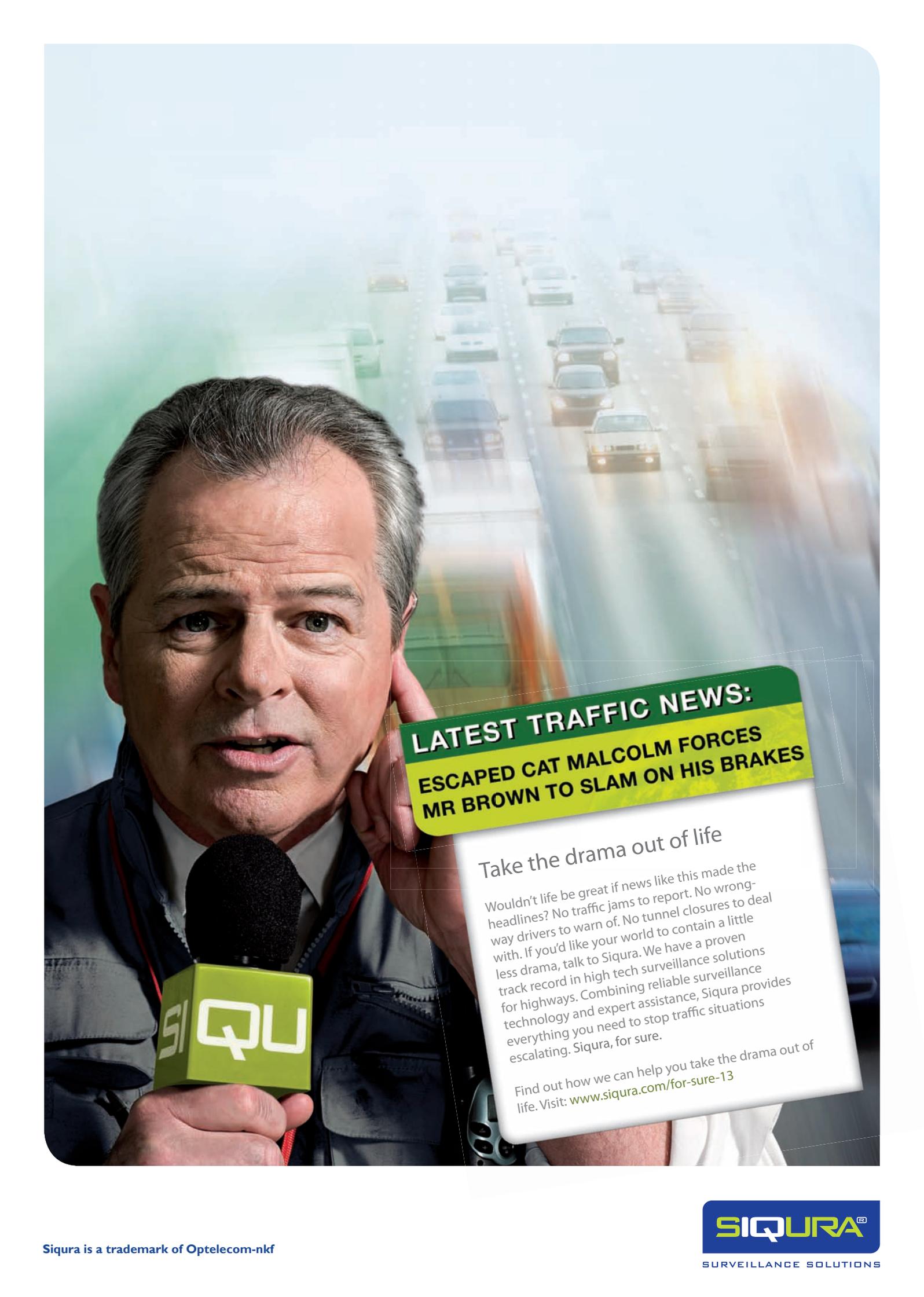
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A toll order

Hummelstown, Pennsylvania
A US$35 million contract has been awarded to TransCore from the Bay Area Toll Authority to design, develop, test, install and maintain a new advanced toll collection and accounting system (ATCAS II) for seven San Francisco Bay area bridges. Design is under way and is due for completion by 2012. The seven toll bridges accommodate on average a total of more than 348,000 vehicles a day, supporting 73 toll lanes. The new ATCAS II project will include the replacement of in-lane and toll booth equipment, development and installation of hardware and software systems for a new toll collection system, and ongoing maintenance for the system. The new RFID equipment will include TransCore's multiprotocol Encompass 6 reader in all of the lanes.

Ho Chi Minh to trial congestion charge

Ho Chi Minh City, Vietnam Plans are afoot to introduce a congestion charge in the center of Ho Chi Minh City, according to Municipal People's Committee chairman Le Hoang Quan. He stated that the Tien Phong Technology Joint Stock Company has been selected to install an electronic road pricing (ERP) system in a six-month trial. "The city's roads, which account for only 5% of all those in the country, have to accommodate one-third of the country's cars," Quan said.

Tran Quang Phuong, director of the Municipal Transport Department, says the city center is seizing up. "Congestion has been a major problem for many years. It is unacceptable for a major city to have 61 serious traffic jams in the first nine months of the year – of which 12 lasted for four to nine hours." He noted the success of ERP in London and Singapore, where the number of cars entering their centers was reduced by 20%.

ERIC**SAMPSON**

by Professor Eric Sampson

WE NEED PROFESSIONALS IN WHITE COATS

Taking a leaf out of the medical world's book, our transport expert argues that when deploying life-saving solutions, the rewards for many should outweigh the risks to a few

Thinking once again about healthcare, it struck me that compared to transport, healthcare is far more innovative because it has a much better understanding of – and relationship to – risk. In particular, it is accepted that a new treatment offering benefits to thousands should be and will be deployed, even if it has some unfortunate side-effects for a statistically very small sample.

Healthcare has a well-established route from 'blue skies' research to deployment. New surgical procedures, treatment regimes, or drugs can all be researched in a lab and then assessed in focused clinical trials subject to a risk-benefit assessment by an Ethics Committee. Innovations showing particular promise can then be tested in a wide-ranging trial, again subject to scrutiny by the Ethics Committee, to gather more evidence regarding the likely success in regular use and therefore contact with far more variability of patient. And in the final stages, an innovation – a new type of transplant operation for instance – can make it to widespread use as the success rate in treating most patients will be substantially higher than the percentage of 'failures' from severe side-effects or even deaths.

Why don't we have such an approach in transport? Why do we allow good ideas to be shot down at an early stage because we can't 'prove' they are 'safe'? Why can't we live with the situation that invariably there is no proof that something is 'unsafe' and instead have the transport equivalent of a clinical trial, recognizing and accepting that although there is an increased risk of a severe injury or fatality, it is far more likely that the majority of travelers will benefit from our actions?

Why are we dithering over technology-based safety innovations with the excuse that it isn't clear who carries the risk if the system should not work as planned or even fail? One of the most stubborn road safety issues is child pedestrian deaths in urban areas. Most automotive manufacturers have some form of radar anti-collision system but very few of them are routinely deployed due to worries about performance that might be lower than 100% perfect. Why can't we emulate the medical world and say that we are going to carry out serious trials. Government will underwrite any litigation deriving from accidents that the systems have not prevented, and although not waiting complacently we will accept any injuries or deaths from accidents because we are confident that the technology has reduced the overall number?

We probably haven't done this because the UK hates new ideas – if they work, it may set a precedent [horror!], or require something else to change [horror[3]!] and if they don't, then that just proves you would have been right not to adopt them.

Why can't we run some trials to establish the truth? ■

THE 'PEDESTRIAN-AWARE' SMART CAR

Developments in pedestrian detection technologies excite our Smart Cars guru, both in-car and at the roadside, but he laments the fact that they might have saved a friend a decade ago

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

This month marks the 10th anniversary of the passing of my friend Tom. A pedestrian (and a rather fast one), Tom was struck by a van as he recklessly dashed across the street. Yes, Tom was not obeying traffic laws or common-sense. It was a midblock crossing, unmarked and therefore unprotected. To compound the situation, he was enjoying a pre-dawn run, oblivious to the darkness and the traffic. So, in the end, it was not the driver's fault – it was Tom's fault.

His legion of friends was devastated by his death. But this friend, i.e. me, could do something – or at least I thought I could. I could refocus my research on transportation safety. And I did. I started working on smart cars, smart intersections and recently smart cell phones that 'talk' to cars. My aim was to harness innovation and technologies to address the not-so-smart societal problem of pedestrian fatalities. Although the research is interesting, it is frustrating. I have not yet saved even one pedestrian's life.

However, these days, research is quickly catching up to reality. Soon enough, perhaps in the next model year, there will be a Volvo and indeed a very special smart car on the market with a fused radar and computer vision system that will detect and recognize pedestrians. If the car is traveling at less than 25km/h (16mph), it will even brake automatically for pedestrians up to about 60m away.

For sure, Volvo does not have a corner on the technology. Toyota has a 'Night View' system that uses the infrared or heat signature of pedestrians ahead, highlights them in yellow, then displays the enhanced image on a high center dash console screen. BMW has a similar infrared system. In Japan, OKI has shown with several car-makers a 'Safety Personal Area Network' which uses 5.9GHz DSRC. It communicates to cars a low-latency 'I am here' signal from a special DSRC- and GPS-equipped cell phone. The trick is for the pedestrian to be carrying a cell phone though. Tom, the runner, would be an unlikely candidate to tote such a device, but he would have an infrared signature.

Moreover, while cars are getting smarter in detecting pedestrians, the roadside with more available computational power and the advantage of high sight lines is also becoming smarter in detecting pedestrians. There are a host of microwave, computer vision and even multisensor systems for the purpose. This detection could actuate a traffic control or warning signage, or the detection could be transmitted via DSRC or other wireless means. This strikes a chord with me: the vehicle that struck and killed Tom was traveling at a slow rate of speed, fitting well into the operational capability and limits of these smart systems. So with all this, what if such a car was driving in a desolate street in Las Vegas in 1999? Tom could have finished his run. ∎

65 …million Euros is how much the Irish Republic will pay the GoSafe consortium for the long-awaited network of speed cameras. Speed checks will be performed at 700 locations identified as emergency black spots. The consortium, led by the Irish Spectra company, also includes the French company EGIS Projects and Australia-based Redflex, which will provide camera vans and its Image and Infringement Processing System (IIPS). The scheme will be revenue neutral.

Growing concern

Melbourne, Australia In a further bid to tackle road trauma, the Labour Government in the Australian state of Victoria has delivered an extra 25,500 drug-testing kits to Victoria Police to rid the roads of drug-affected drivers and reduce the road toll. Police Minister, Bob Cameron, and Assistant Commissioner, Ken Lay, announced the Roadside Drug Testing program expansion and released results of the latest 'Operation Ardent' traffic tests. The statistics revealed a greater ratio of drivers were found with drugs in their system than with blood alcohol concentrations (BAC) levels above 0.05. "Testing showed police are nearly three times more likely to detect impairing drugs in drivers, compared to drivers with a BAC reading over 0.05 and we are taking action to curb this behavior," Cameron said.

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IT TAKES TWO

Cooperative vehicle highway systems are doomed to failure unless car manufacturers work more closely with road operators. **John Challen** investigates efforts to get them to communicate, as well as some of the projects getting it right

Illustration by Flatliner

Noting an increasing number of Cooperative Vehicle Highway System (CVHS) programs cropping up, Richard Harris saw an opportunity within the market to pool resources to improve the overall safety and efficiency of vehicles. With this in mind, three years ago he formed a Joint Task Force made up of FISITA (the world body for automotive engineering) and PIARC (World Road Association) representatives in order to urge more dialog between vehicle manufacturers and road network authorities. "The Task Force was set up because a few of us in the World Road Association recognized there were not just technical issues with CVHS – there were other aspects

that were just as important," says Harris, who is now the director of intelligent transport systems at the IT and business services company Logica. The World Road Association (WRA) represents the ground operations of 12 different countries, and as a result Harris says that the inconsistencies from country to country are a hurdle. "If you take England, for instance, the Highways Agency is in charge of all the main routes but it covers just 3% of the network. If you want the engagement of the ITS developer with the road operators for the remaining 97%, who do you talk to? We saw a major gap in the ability of the road operators – and those people developing CVHS systems – to get the dialog going."

All aboard the road train?

Researchers regard road trains mainly as a major benefit to commuters who cover long distances every day by motorway, but they could also be of potential benefit to trucks, buses, coaches vans, and other commercial vehicles. As the participants meet, each vehicle's navigation system is used to join the convoy, at which point an autonomous driving program takes over. As the road train approaches its final destination, the participants can disconnect from the convoy and continue driving as usual to their end destinations.

"I do appreciate that to many people this sounds like Utopia," explains Erik Coelingh, technical director of active safety functions at Volvo Cars. "But this type of autonomous driving actually doesn't require any hocus-pocus technology, or any investment in infrastructure." Instead, he goes on to say, the emphasis is on development and on adapting technology that is already in existence.

Coelingh is going to let actions speak louder than words, too. He and Volvo are involved in a new EU project, known as SARTRE (Safe Road Trains for the Environment), in which the aim will be to develop and test vehicles that can drive themselves in long road trains on motorways, helping to improve traffic flow and journey times, offering better comfort for drivers, reducing accidents, and improving fuel consumption and emissions.

The first test cars equipped with the technology will roll onto test tracks as early as 2011. The vehicles will be equipped with a navigation system and a transmitter/receiver unit that communicates with a lead vehicle.
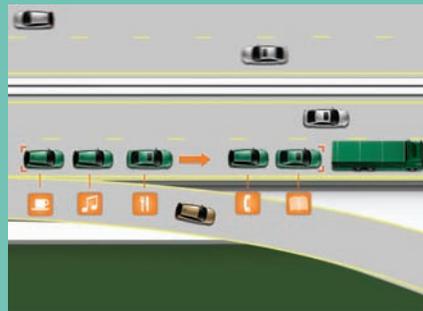
As the system is built into the cars from the beginning, there is no need to extend the infrastructure along the existing road network. The idea behind the operation of the system is that each road train or platoon will have a lead vehicle that drives exactly as normal, with full control of all the various functions. This lead vehicle is driven by an experienced driver who is thoroughly familiar with the route. For instance, the lead may be taken by a taxi, a bus, or a truck. Each such road train will consist of six to eight vehicles.

A driver approaching his destination takes over control of his own vehicle, leaves the convoy by exiting off to the side and then continues on his own to his destination. The other vehicles in the road train close the gap and continue on their way until the convoy splits up.

By Lloyd Fuller

"There needs to be a guarantee that the community will benefit rather than individual drivers. In the past, we have failed to find the community-wide benefits"

Richard Harris, *director, intelligent transport systems, Logica, UK*

PLATOON POTENTIAL

Representing the operators in the WRA, Harris suggests that there are many possible developments that could improve safety and efficiency. He cites in particular the potential gains from a platoon of trucks traveling along the freeway and linked electronically, so if the first truck brakes, the others brake also. The benefits of such a transport mechanism would mean no accidents, as well as savings in terms of performance, pollution and efficiency. However, Harris maintains that it leaves the Task Force with challenges to overcome. "If you have that platoon operating on your motorway network, how do you get people to join and leave the motorway if there is a kilometer of trucks in the way? And if the platoon is in the nearside lane, how will other road users see roadsigns, or know what exit they're at?" One of the key drivers behind the Task Force is that Harris wanted to make sure that the road operators understood the impact of how roads would be managed.

Initial communications between PIARC and FISITA have moved things forward: "It has raised the profile of the issues," Harris states. "Christoph Huss, the current FISITA president and vice president of traffic management at BMW, recognized the potential that the collaboration with the Task Force could have to smooth the way for these new cooperative systems. We built up a committee of experts, which included road operators from PIARC and vehicle manufacturers from the FISITA side of things, such as Audi, BMW, Toyota, and Honda. We set out our vision for the road operators and FISITA mandates, and now we have refined this and come up with a draft content."

THE COMMERCIAL CASE

For widescale deployment of CVHS, it will be necessary to achieve a commercial case for investment both on the public and consumer and societal levels. At the 16th World Congress on ITS in Stockholm in September 2009, the Task Force highlighted a number of deployment predicaments, such as the benefits to network operators, prospects for new approaches and strategies to tolling, new business models, the speed of market penetration, and the consequences of non-involvement of road operators.

Concentrating on the business case of CVHS – and the impact of what happens if road operators do not become engaged in helping to deploy these systems – Harris feels there are a number of questions that need to be answered: "We need to know how we can justify public authorities

In this project, Ford research vehicles with active safety technology download data about the intersection

Photograph courtesy of Ford Motor Company

Audi's Travolution project is exploring communication between vehicles and traffic signals

investing in these systems," he says. "There needs to be a guarantee that the community will benefit rather than individual drivers. In the past, in many respects, we have failed to find the community-wide benefits, even though our projects have brought benefits to individuals." Logica's ITS guru points to road charging as an example: "Everyone says road pricing affects them personally, but no one recognizes the benefits for the community in terms of the free-flow of traffic."

The Task Force may have set out its stall, but Harris has his own personal dreams: "I'd like to see more cooperation between transport modes rather than competition," he says. "I'd like to get away from 50% of truck journeys running without any loads, and bus services that run with two people on them rather than 50. If we're to get people to switch how they travel, we have to educate them. They will only travel the way they know. By joining up modes, there is a lot more that we can do that we are not currently doing. We quite simply haven't got the governance in place to make it happen."

Harris believes that the output from the Task Force will inform policy-makers and thereby help them to accelerate the correct

"The traffic lights send a signal to the vehicle, then the system calculates what speed the car should drive so that it doesn't have to stop, decelerate or accelerate"

Professor Fritz Busch, *director, Institute of Transportation, Munich University, Germany*

deployment of technologies for CVHS. "At the moment, there are so many unknowns that nobody wants to promote anything," he says. "Unless these systems actually contribute to policy objectives, it will be an uphill struggle. The dream is to make a breakthrough worldwide, but we are more likely to see regional breakthroughs in areas such as Europe, Asia, the Americas, and Australia. There are encouraging signs of cooperations, and the USDOT and European Commission have signed an agreement to work more closely on ITS, but they have different agendas about what should be achieved with ITS."

According to Harris, the next six to 12 months could be critical: "If the Task Force is to create something that is useable and relevant, we've got to maintain the

momentum that we are beginning to build. My hope is that we would have achieved recognition for all these soft issues in parallel for all the real-world trials that are going on at the moment in Europe, the USA and Japan."

ENGINEERING INPUT
Part of the FISITA contribution to the Joint Task Force comes courtesy of Professor Fritz Busch, director of the Institute of Transportation at University of Munich. "As the German delegate to the PIARC Group, part of my contribution is to give engineering input," he explains. "There are a lot of issues coming out of the cooperation regarding standardization, or at least harmonization. A lot of those have to do with implementation strategies, i.e. who

Eastern experience

Nissan is arguably the most proactive Japanese car manufacturer when it comes to ITS and CVHS. In 2004, the first iteration of the SKY project – organized by Nissan, NTT DoCoMo, Panasonic, and Clarion – included intersection collision avoidance, intelligent speed advisory, and a floating car principle (probe) for dynamic route guidance. As director of the IT and ITS engineering department at Nissan, Masao Fukushima is a driving force behind the company's efforts. "Today the trial applications [within SKY] are expanding to include pedestrian traffic safety, especially for small children and elderly people by using RFID and GPS-enabled mobile phones, hazard warnings such as skid incident information on the winter roads using floating car data, and wrong-way driving prevention on highways." The SKY project concept, he explains, is evaluated through field testing as well as long-term testing. The field testing involves a large number of 'naive'

drivers participating under real traffic conditions. "This helps us grasp quantitative and objective effectiveness of the applications," Fukushima adds.

"The long-term testing allows us to grasp the influence of the participants' experience, such as adaptation to the applications or negative effects such as over-dependence. We are seeing good quantitative results such as modification of driver behavior toward safer driving, a high degree of user acceptability, and an HMI that avoids negative effects of ITS, including over-

dependence, misunderstanding, and even driver distraction."

Fukushima also plays a key role in ITS-Safety 2010, a national initiative that is conducting a number of verification tests on selected regions. The program is committed to deploying cooperative Driving Safety Support Systems (DSSS) and promotes the use of onboard equipment by 2010. It will develop technologies for interactive communications systems for pedestrians, roads, and vehicles that will contribute to a drop in pedestrian fatalities. "Over 2,000 general users will evaluate the system through everyday life without being conscious of the test," details Fukushima. "We will monitor data such as speed, deceleration rates, braking, and stationary time at stop signs." The Japanese safety expert says that Nissan has already generated good quantitive results – such as safer driver behavior – and confirms that the company has already started selling cars with DSSS units on board.

Words of warning from Toyota

In April 2009, Toyota Motor Corporation (TMC) demonstrated its own CVHS – infrastructure-linked driving safety support systems – at a public display of ITS technologies, sponsored by the Universal Traffic Management Society of Japan (UTMS) in Toyota City.

The systems are aimed at helping drivers notice red lights, start promptly after stops, notice stop signs, avoid rear end collisions, and notice pedestrians crossing the street. Toyota says they help reduce the possibility of accidents by using infrastructure-vehicle communications to reach beyond the limits of a vehicle's autonomous safety systems (e.g. onboard radar devices and cameras). They also aim to improve traffic flow for environmental benefits.
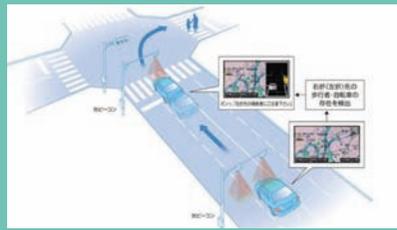
The systems were evaluated in public-road tests sponsored by UTMS Japan and carried out in Toyota City from December 2008 to March 2009, based on the new IT reform strategy outlined in January 2006 by the Japanese government's IT strategic headquarters. Those tests were part of the broader ITS-Safety 2010 intelligent transport systems testing program in Aichi Prefecture (sponsored by Japan's private-public ITS Promotion Council) aimed at achieving practical application of vehicle infrastructure cooperative systems in the year ending March 2011.

Based on its 'integrated safety management concept', in addition to developing onboard autonomous safety devices and systems, TMC is promoting development of infrastructure-respondent systems that allow V2V and V2I information exchanges using ITS technologies. TMC says that it is also participating in the creation of a safe traffic environment and is conducting traffic safety awareness activities "to help realize the complete elimination of traffic casualties".

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makes the first move: the car industry or the infrastructure provider? In this area, it is vitally important that all parties speak closely together."

Within his university group, Busch has 30 scientists conducting research into CVHS. "We are a big partner in the SAFESPOT project," he reveals. "Within that program we have full responsibility for the Intelligent Cooperative Intersection Safety System (IRIS). The research here looks into safer intersections by monitoring an online image of an intersection, and providing warnings in the form of pictures – from cars intending to turn right/left and where to put/give warnings, or where cars are violating the lights, putting other drivers in danger. We can gather information from radar detectors, which create a complete image every millisecond, and forecasts what possible safety issues there may be."

SAFETY AT THE CROSSROADS

Intersections are the focus of many efforts being made with CVHS, and there are two major projects running in Munich, involving Audi and BMW. Busch and his team are involved in Travolution with Audi, which looks vehicles communicating with traffic lights. "The traffic lights send a signal to the vehicle saying, for example, that they will turn red in 10 seconds, and the system calculates what speed the car should drive so that it doesn't have to stop, decelerate or accelerate," Busch explains. "If the car is waiting at a red light, it receives notice of how many seconds it will be until the lights turn green." Similar to Richard Harris's ideals, this system ticks the efficiency box as the engine can be switched off, and the driver is made aware of how long it will be until the traffic signal goes green.

One of the main motivations for the latest traffic management system from BMW is to improve mobility. With its EfficientDynamics in mind, efficiency also plays a role. In this particular research project, the traffic light system transmits data to cars, telling them if the red light will remain for more than five seconds. If this is the case, the engine will then cut out for maximum efficiency. The system will also give precedence to busier routes, therefore working on the assumption that to have seven car engines idling is worse for the environment than just one or two of them. As ancillary devices, such as the car's air-conditioning, can turn on the engine (in a stop-start scenario) the longer-term aim is for technologies installed at the junction to be able to communicate with these products specifically.

Busch has also been working on the Safe and Intelligent Mobility Test Germany (SimTD), involving 150 roadsign units in and around the city of Frankfurt. "This is a big field operation that won't give new functions, but will try to prove the effect of traffic efficiency with a large number of vehicles," he says. "It's a much bigger network than has ever been done before." ∎

A Daimler C2X system sends danger signals from vehicle to vehicle to enhance safety

BMW testing the concept of EfficientDynamics in a research vehicle in 2008

SEEING
MACHINES

Machine vision technologies are increasingly being used to facilitate the analysis of video images for traffic management purposes. **Louise Smyth** finds out that developments in the field will further improve the results these systems can offer

Illustration by Tim Ellis

With so many products in the ITS sector being plug and play and as such requiring very little in the way of systems integration, it's quite simple to forget about the behind-the-scenes components that are integral to their successful operation. In the field of ALPR cameras or traffic-counting devices, for example, traffic managers have the luxury of purchasing off-the-shelf solutions without giving much thought to the 'visioneering' that goes into their development.

Yet the vision sector is well worth considering for a moment. The technical developments that are occurring at a rapid rate are good news for ITS and over the coming years will shape the flow of new products tailored specifically for the market. First, though, let's get to grips with the basics. "There are two terminologies that

have been established in our market," explains Vlad Tucakov from Point Grey. "There is machine vision and then there is computer vision. Machine vision is for applications where the environment is well controlled and you know exactly what your task is – most often a 'yay or nay' job such as reading a barcode. Computer vision, on the other hand, is a broader term for tasks that tend to be less defined – 'put a camera out there and tell me what you see' types of application. ITS falls between the two.

"ALPR, for instance, aligns very well to machine vision because you're seeing a set of characters and you need to recognize them. It also maps well to computer vision because you really don't know how far away the vehicle may be, how fast it will pass and whether the plate is obscured in some way. So there's elements of both and that's what makes ITS challenging and interesting."

Point Grey manufactures digital cameras and their related components, which are sold into a number of different industries. Widely used by systems integrators and solution providers in the traffic market, the end-users may not even be aware that it's Point Grey technology driving the products they have purchased. Tucakov hints that more concerted efforts to showcase the company name will be made in the future, but he's more than happy with the current state of play: "Essentially, our job is to take a picture and put it in the memory of the PC. The point is that the images we produce are very well suited for ITS applications."

One of Point Grey's best-selling products is the Firefly MV. "It's a small, low-cost USB camera that can be paired with a standard PC to create an inexpensive yet feature-rich solution for ITS." In its current evolution, the Firefly MV is a complementary metal-

oxide-semiconductor (CMOS) sensor. "It was a FireWire interface but introducing it with USB as well has made a big difference. It's a wide VGA (Video Graphics Array) format that runs at 60fps and is used in limited field-of-view applications – such as at a toll booth or a parking lot. As it runs fast, it can be set to free-running mode; it doesn't need triggering."

This introduction of CMOS sensors is interesting as it's a fairly new area to try and bring to ITS. "The vast majority of our applications are CCD-based, but CMOS is becoming important," Tucakov says. "We are now using brand-new sensors from a company called CMOSIS, which we think are going to be very applicable for ITS. These CMOS sensors have a global shutter, with very high resolution and frame rates. The advantage of CMOS is that they are not susceptible to smear, so moving objects or shafts of sunlight pose no problem to capturing a usable image. They are featured in our Gazelle line of products, which we've just announced, and we think they'll be a serious competitor to CCDs – particularly for ITS – in the coming years."

CAMERA ACTION
A more than familiar name in vision solutions for the ITS market is Basler.
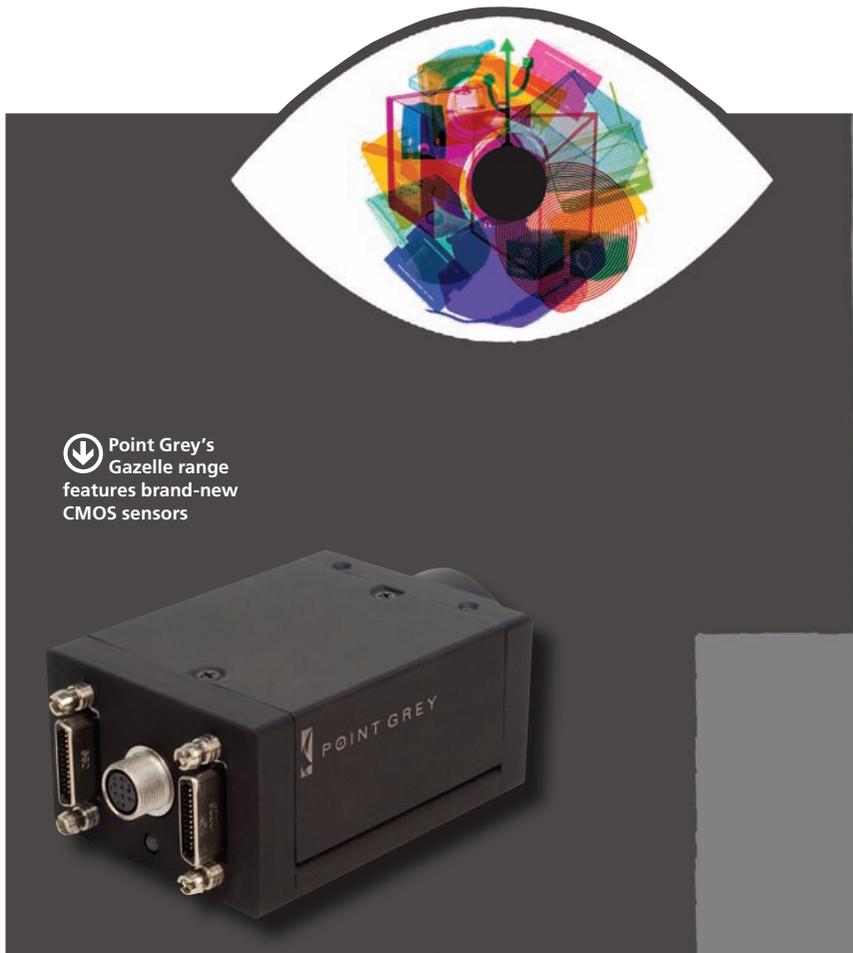
Point Grey's Gazelle range features brand-new CMOS sensors

"One of the benefits is that the traffic industry has high numbers of unit sales. But machine vision is also a very big industry and you can learn a lot from it"

Speaking to the head of product management, Henning Tiarks, just after Basler's participation in the Vision show in Stuttgart, he is understandably keen to share his latest news: "We have just launched a new camera family. The ace cameras use Gigabit Ethernet (GigE) technology for data transmission. GigE has the advantage of long cable length (up to 100m), which for ITS applications is very useful at toll bridges or traffic intersections, for instance."

Basler cameras are already widely used for traffic enforcement and toll road projects. "This is one of the biggest markets for us due to the fact that the cameras offer very good image quality. They are also very fast in capturing the images. When a radar or ultrasonic trigger is used, for instance, they react swiftly to get a shot of a vehicle regardless of how fast it is traveling."

Tiarks feels that bringing machine vision technologies to the traffic sector is a good business strategy for those that can do it effectively: "One of the benefits is that the traffic industry has high numbers of unit sales. But machine vision is also a very big industry and you can learn a lot from it. Cameras made for high-speed production processes are well suited for high-speed image detection in the outside world. We also see ITS as an adjacent market, so we develop features especially for it."

As Tiarks reveals, a number of recent projects illustrate the application of machine vision cameras in the ITS market: "We are working on a tolling project in Asia using our Pilot camera, which is also GigE and has

Imagine that…

Currently, the main focus for Matrox's Imaging division is the Iris GT. "This is a PC and camera in an all-in-one enclosure," explains Fabio Perelli, product manager for the vision specialist. "What sets it apart is that we were the first to use the Atom processor from Intel." The Iris GT is finding fans in the ITS sector as Matrox's ALPR package can be incorporated into the camera itself.

Perelli is also keen to highlight the company's MIL (Matrox Imaging Library). "These are the actual algorithms that run within a camera or inside a PC if you want to run them standalone," he says. "The library is 15 years in the making and is a hugely important image-processing tool. It has a module called String Reader that can be used for ALPR, then we also have other modules to conduct geometrical recognition of shapes – for instance, if you'd like to track a static shape throughout a scene."

ALPR is good business for Matrox and the company has recently provided

software to operate an access control system for a gated community in Italy. Matrox is also noting growing interest from traffic authorities wanting to deploy its smart cameras for enforcement. "One recent US project was for red light enforcement at a four-way intersection," Perelli says. "We are using four cameras that each monitor vehicles that cross the stop-line."

Although Matrox is looking into the use of CMOS sensors (all of its camera offerings are presently CCD-based), its main technical evolution right now is to add color sensors to its products. "The motivation for this is applications such as airport parking lots, where many cars are stolen," he reveals. "We want to go beyond users just receiving a parking ticket, even one detailing license plate data, and start providing code-specific identification information about the car."

An eye on ITS

JAI's megapixel cameras offer useful features to the ITS market, including ALC

One key player offering machine vision solutions for the ITS market is Stemmer Imaging, which is a distributor for many industrial vision brands, including Dalsa, AVT, JAI and Sony. "We also develop our own software, Common Vision Blox (CVB), which is a leading tool set for all areas of industrial imaging," explains the company's Steve Hearn. "At the recent Vision show in Stuttgart we showed our latest CVB tools, including the GigE Vision Server, which enables distributed processing for high-end systems."

Hearn regards ITS as a prime market for machine vision because the cameras provide the functionality that traffic systems need: "The challenge in traffic applications is dealing with variations in lighting and weather, but systems have been developed to cope with this."

What are the advantages of machine vision when compared to other solutions? "CCTV cameras can be appropriate for ITS applications but IP network cameras provide compressed images to the server, which takes away detail that software needs to make reliable decisions. Analog cameras again are fine for many traffic applications, but they are limited to CCIR or PAL formats so resolutions beyond 440k pixels are impossible. Machine vision cameras provide uncompressed images, so no loss of data. A key benefit of using machine vision cameras is the ability to trigger them so an image can be taken at an exact point in time. For measurement – speed enforcement, etc – it is essential that the time of the captured image is recorded accurately. This can be done with current machine vision cameras but the GigE vision standard will incorporate IEEE 1588 within 12 months, meaning that every device on the network will be synchronized to sub-microsecond accuracy. Smart cameras are also becoming commonplace in machine vision so decisions can be made in a small single unit rather than sending the data to a remote PC for analysis."

One prime contract that Stemmer currently has in the traffic arena is a partnership with a UK company for speed measurement systems, for which hundreds of Dalsa Genie cameras are being used.

a five megapixel resolution. The client benefits from this high resolution by using one camera to monitor three lanes – previously they needed three cameras. Another Asian contract is for mobile speed enforcement, using our Scout camera."

It is noteworthy that both projects are in Asia, because Basler makes a point of responding to geographic market needs: "Big growth areas are Asia, Eastern Europe and Mexico. People there want to benefit from our technology as much as our European customers do. So we include as many automatic functions as possible – for example, the camera adjusts itself to the outside light conditions – to help medium- and low-skilled users take full advantage of what machine vision can bring."

STABLE SOLUTIONS

Another player whose name is well established among users of all skillsets is JAI. The company is heavily involved in the traffic sector, working on everything from basic monitoring projects to sophisticated vehicle fingerprinting applications. Speaking from JAI's headquarters in

Basler's Scout range is widely used for ITS applications, including speed enforcement

Denmark, Tue Mørck explains why the products are so popular for ITS: "More than 15% of our standard machine vision camera business goes into ITS applications, because we can offer important features for this market. Robust cameras in terms of shock, vibration and temperature, long-term stability and high MTBF, coupled with high resolution and high image control are all attributes that make these cameras very suitable for ITS."

JAI's most popular products are its C3 series of megapixel cameras that have evolved to offer features such as ALC (automatic level control). "Triggering is a regular feature but we can combine that with ALC to prevent surrounding lighting conditions from adversely affecting images," Mørck explains. "These are basic machine vision features that we have incorporated and used in cameras for ITS."

JAI also announced a new range of cameras at Vision 2009 that it hopes will be adopted by the ITS market: "They are prism-based cameras that enable us to look at different spectrums. So we could expose an image of a car to look at the license plate with infrared light and then to look at the color of the car with normal lighting."

The use of color is becoming very popular in ITS, particularly in ALPR. And if a color sensor has been proved in a stringent environment such as medical processing, for instance, then it's not such a great leap expecting the system to accurately pick out colors on a license plate. The same holds true for the topic of robustness, as Mørck illustrates: "If you can place a camera on an industrial stamping machine where everything shakes and it works effectively, then of course it will also withstand vibrations from traffic."

But Mørck sees one overwhelming benefit of machine vision – the image quality itself. "The higher resolution and better light control is appealing for traffic and high-end surveillance applications. In the past they may have settled for simply seeing if anything was happening, but now want to see exactly what is happening. How to best control blooming, for instance, is something we've learned from machine vision that is also good for the traffic market."

Similar to Point Grey, JAI is also starting to offer CMOS sensors for traffic: "CCD and CMOS sensors each have advantages and disadvantages depending on what you are trying to achieve," he says. "Generally speaking, if you have a CCD and look right into the sun, it starts to bloom. CMOS sensors bloom a lot less but they can be susceptible to what's called 'shutter leakage' – some of the charge leaks out and you can get similar effects to blooming. It's going to take some time, but I think CMOS will become standard for the ITS market." ■

FATAL
DISTRACTION

Distraction is a big traffic safety problem around the world.
Nick Bradley learns its contribution as a factor in road
trauma is likely to increase as more distractions – both inside
and outside of the vehicle – compete for driver attention

Main photograph courtesy of Daimler AG
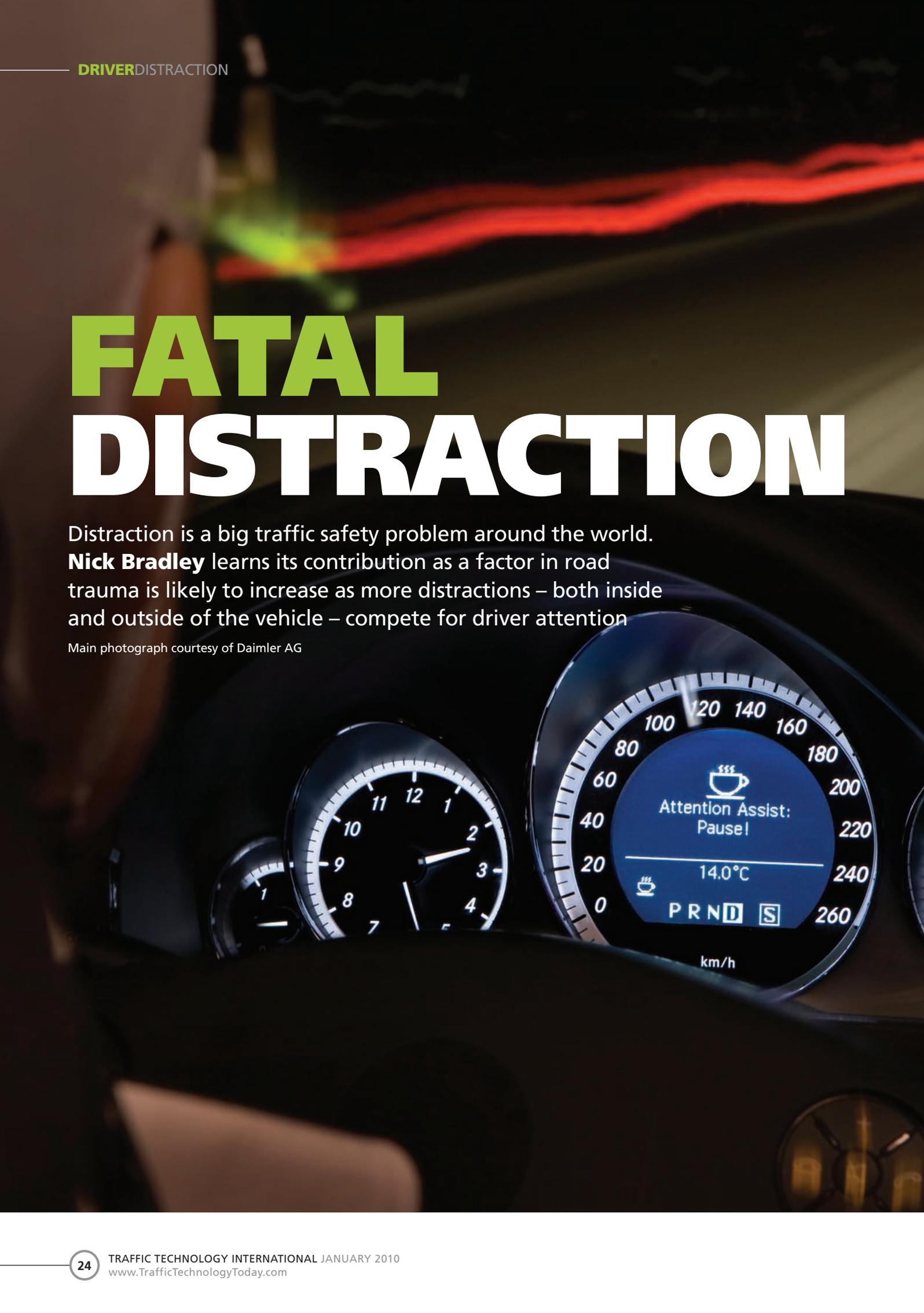
When US Transportation Secretary Ray LaHood hosted his Distracted Driving Summit in Washington recently, he added some high-profile weight to an issue that's been intensively researched for a number of years already. "Distracted driving is a menace to society, an epidemic – and it seems to be getting worse every year," he told the 300 or so delegates. The resultant mainstream press coverage propelled the issue to the masses, with many headlines rightly or wrongly billing it as the new drunk driving.

Sensational headlines aside, though, how big a problem is distracted driving? "It's significant," reports Michael Perel, former chief, human factors/engineering integration division, NHTSA. Now retired, Perel was the keynote speaker at the Driver Distraction and Inattention Conference 2009, held in Sweden in late September. "No one knows for certain how many crashes, injuries, and fatalities are associated with distracted drivers," he says. "Most of the national estimates of driver errors in the USA are based on police reports, or special in-depth investigations conducted after the crash." In this circumstance, Perel suggests, investigators have a difficult time finding out what drivers were doing or thinking, as they may either not recall or potentially even lie. Moreover, in about 45% of the cases, drivers involved in crashes listed their distraction in the crash report as 'unknown'.

The other factor preventing us from knowing the real size of the problem is that it is defined differently by different investigators. "Some only count cell phone and other multi-tasking distractions," Perel explains. "Others include mind-wandering, looked but didn't see, and drowsiness. These limitations have led to estimates of distraction contributing to anywhere from about 10% to 25% of crashes."

Figures quoted at the Distracted Driving Summit however, claim 5,870 people were killed and 515,000 injured in 2008 as a result of one or other form of distraction. Overall, driver distraction was involved in 16% of all fatal crashes.

THE NEED FOR ACTION
Although the actual figures are open to debate, there is certainly a consensus that something needs to be done, and as with drunk driving and seatbelt usage, education would seem to be key. "We must try to influence behavior at a basic level," says Claes Tingvall, director of traffic safety at the Swedish Road Administration. "We must minimize the need for drivers to attend to text messages and other things that we already know are problematic. I can recall a story of a truck driver a few years back making a phone call and not looking at the road ahead. He crashed into a car in front, which subsequently hit another car in front of that. Two people were killed as a result – all because of a phone call."

The example of a trucker is quite apt, because according to research they are 23 times more likely to be involved in a crash when texting. Richard Hanowski is director, Center for Truck & Bus Safety at the Virginia Tech Transportation Institute (VTTI), and was recently involved in a study that investigated driver distraction in commercial vehicle operations, analyzing naturalistic driving data collected by researchers at VTTI. In-service vehicles were instrumented with sensors and cameras to record real-world driving performance. "A key finding was that driver distraction is a prominent factor in trucking safety events," Hanowski reveals. "We found that, across all safety events – including crashes, near-crashes, and other performance errors – driver distraction played a role in 60% of these events." In addition, the study found that specific tasks or behaviors that required a high level of visual attention, such as texting, were associated with the highest levels of risk. "From a methodology standpoint, the study proved the notion that to really understand real-world behavior, you have to get outside the lab to conduct naturalistic research."

Something that particularly struck Hanowski during the study was the impact of work-related distractions – i.e. tasks that drivers were performing as part of their job duties while driving. "A good example of this was the use of dispatching/messaging systems," he details. "These are small keyboards that the driver interacts with while driving, presumably to communicate with their dispatcher. I don't know of many (if any) studies that have looked at the implications of non-driving job duties performed while driving and whether there is an expectation on the employer's part for drivers to perform such tasks while behind the wheel. Given the tragic crashes in various transportation work modalities in the USA – including texting-related crashes involving trolley operators and rail engineers – I think that a naturalistic study into work-related distractions is needed."

Perel concurs with the need for real-world studies. "The biggest challenge going forward is being able to predict the real-world consequences of different distractions and the effectiveness of the measures to minimize the crash risk," he says. What he's getting at here is that legislators, the public, and equipment designers want to know whether talking on a true hands-free phone (cognitive distraction) presents a serious safety risk and if so, under what circumstances does this increase the risk. "In the case of driver assistance systems, how much do they really help distracted drivers? These questions cannot be fully answered from crash investigations or driving simulator studies. Ongoing and future studies using instrumented cars to monitor a large sample of drivers and record their behaviors in the seconds leading up to crashes should provide the data needed to address this challenge."

Perel and Hanowski also agree that comparisons of distracted driving to drunk driving are not helpful. "Driver distraction involves the momentary shift of focus (attention) from the road, while drunk driving is pervasive," Hanowski says. The crash and fatality statistics would also underscore the fact that driver distraction is in no way comparable to drunk driving. "In the USA, approximately 40% of all fatal crashes are alcohol-related," he continues. "With the proliferation of distraction devices used behind the wheel – cell phones, for instance – crash and fatality rates would have exploded if the problem was comparable to drunk driving, but that just isn't the case. It's not a relevant comparison."

"I see absolutely no evidence that distraction – as represented by cell phone use – is anywhere near as severe a safety problem as drunk driving," Perel adds. "The media has frequently misrepresented this comparison based on the findings of certain research studies." These studies, he is keen to stress, were conducted on driving simulators and showed deterioration in various measures of driving task performance while using a cell phone compared to being impaired at 0.08 BAC, the legal limit in the USA – for example, when distracted or impaired drivers had slower reaction times and missed roadsigns. "I think it is extremely misleading to imply that the impairments found in simulator studies using volunteer participants mean that the safety hazard of phone use is as bad as that of alcohol impairment."

Perel explains that there are many factors that differentiate real-world behaviors leading to crashes from performance deterioration in a simulator-type study, not least the fact that drivers can put the phone down and stop talking. In contrast, the deleterious effects of alcohol cannot be 'turned off', last longer than typical phone conversations, and are more insidious as impaired drivers often do not realize that they are as impaired as they are. "Alcohol crashes are often associated with high speed and drowsiness, which is probably why

Transportation Secretary Ray LaHood has helped bring driver distraction to the fore

Although distraction due to cell phone use is not such a huge problem as drunk driving, more work is needed – both in laboratories and in the real world – to assess the extent of the problem

"Driver distraction has to be a design factor in the road system. We should try to minimize it, but at the same time we must understand that we cannot eliminate it"

Claes Tingvall, *director of Traffic Safety, Swedish Road Administration, Sweden*

they result in so many fatalities," Perel says. "The simulator findings for cell phone conversations should not be confused with the reality of the thousands of driving fatalities involving alcohol." In 2008, alcohol-impaired driving fatalities actually accounted for 32% of the total motor vehicle traffic fatalities in the USA.

SOLUTIONS

From the problem to the solution, what can be done to reduce the impact of driver distraction on traffic fatalities and injuries? Is it a technological solution, one of education, enforcement – or an amalgam of all three? "We [VTTI] provided recommendations based on our research findings to address driver distraction," Hanowski states. "These include a primary law banning the use of handheld wireless devices in a moving vehicle as well as regulation limiting functionality of visually-demanding in-vehicle devices in a moving vehicle. For the trucking industry, in a report we've published, we list a number of recommendations for fleets to institute with their drivers, which can be found on the Federal Motor Carrier Safety Administration website."

"Strategies for improving safety should focus on a combination of measures to change driver behaviors, simplify device designs, and assist distracted drivers," Perel notes, adding that most efforts to change driver behavior emphasize education as well as laws. "However, I am not aware of any evidence that measures are very effective, though they may help to reinforce the need to stay focused, especially for teen drivers."

Time and time again, surveys show that most drivers know that distracting activities are risky but still do them anyway. As far as device designs go, Perel feels there could be improvements in a number of ways, as recommended by various human factors guidelines. "Some speech-based interfaces, for example, can help to keep drivers' eyes on the road longer than those that require drivers to visually look at a device and operate controls manually," he explains. Perel also has high hopes for the continued development and deployment of advanced driver assistance systems that can detect imminent crashes and warn distracted drivers to take avoidance actions, or even apply the brakes if the driver does not respond in time.

Finally, Perel cites systems that employ image processing of the drivers' eyes and face and other indicators to monitor driver distraction in real time, which he thinks may provide helpful feedback to drivers to encourage them to stay more focused. "These systems," he says, "have the potential to help drivers distracted by any source – not just wireless communications – which appear to be a small part of the overall distraction problem."

"Driver distraction has to be a design factor in the road transport system," concludes the man widely acknowledged as the 'father' of Vision Zero, Claes Tingvall. "The consequence of that infrastructure design and vehicle design must be based on the fact that the user might be distracted. Of course, we should try to minimize distraction, but at the same time we must understand that we cannot eliminate it." ∎

LEAD THE WAY

Smart sign solutions are a flourishing area. **Louise Smyth** catches up on the latest product, contract and application news from some progressive players in the VMS market

Illustration by Brett Lamb

When speaking with suppliers in the variable message sign (VMS) sector, it is interesting to note how various geographic markets deploy these solutions. In North America, there is a growing trend for using these signs to go beyond providing only regular traveler information ('Delays for five miles', etc) and to utilize them as part of driver education campaigns, enforcement programs, and more. The European market, meanwhile, tends to focus more on standardizing the types of messages and pictograms that are displayed as well as how they are displayed – a less 'creative' approach, perhaps, but one that certainly benefits drivers on the road by working to ensure the signs do not prove to be more distracting than they are helpful.

"I think in the UK we have a little more discipline than some regions," says a forthright Roger Stainforth, VMS Limited's deputy chairman. "Some of the alerts that appear on portable VMS are not approved messages, for instance, and can be misleading to drivers. We've made portable VMS for the past 20 years, but when they are used on the British motorway and trunk road network they are governed by comprehensive guidance laid down by the UK's traffic authorities. However, elsewhere, you often see a scenario where the operator who gets his hands on the keyboard more or less sets whatever messages he wants."

So how are VMS Limited products being used in the UK? "We've been working extensively in conjunction with the Highways Agency on the implementation of the M42 Active Traffic Management scheme and other managed motorways schemes around the English network," Stainforth explains. "We're also pleased to
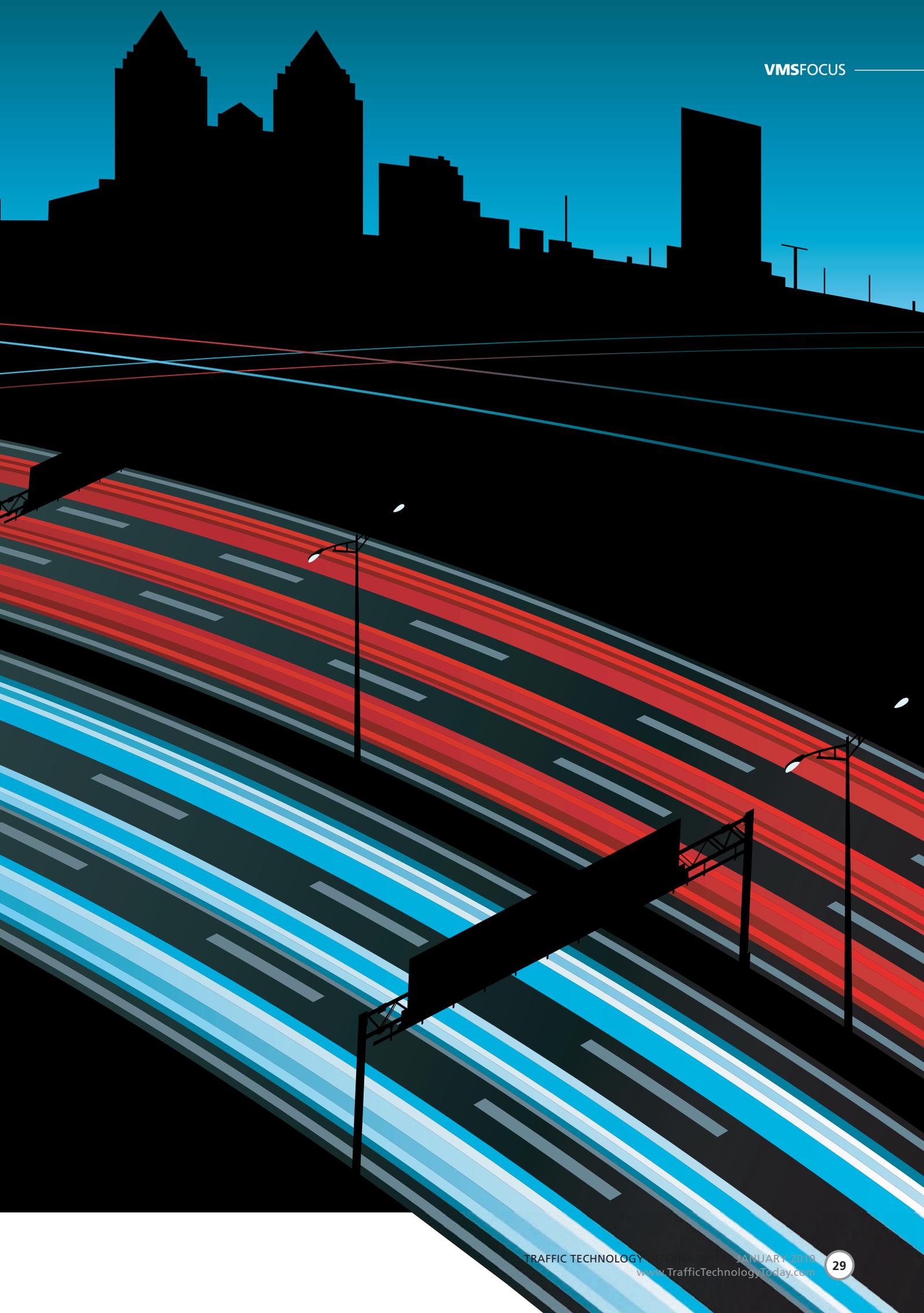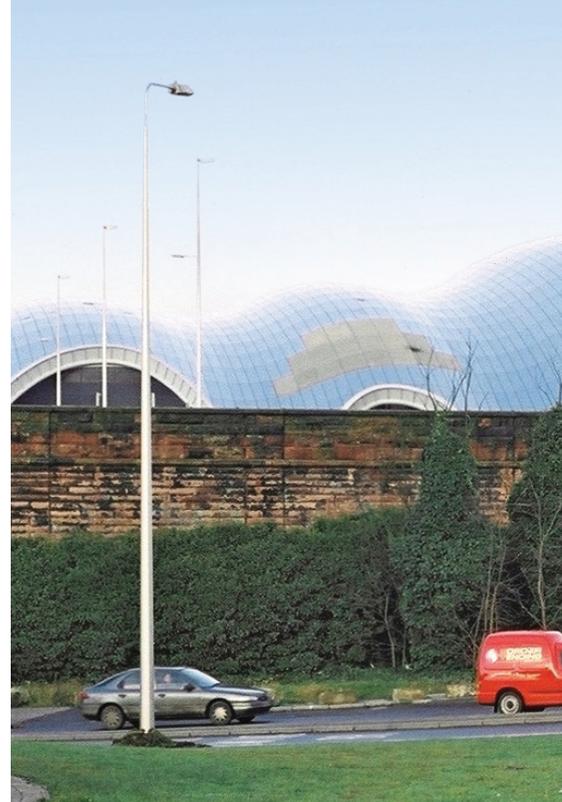
have recently been awarded the contract as a supplier of signs – both static and mobile – for the Welsh Assembly government. This will see our MS4 signs (high-resolution, dual color units for displaying text and pictograms) being rolled out across the Welsh road network in an ongoing four-year contract."

Although both of the abovementioned contracts are for traditional highway VMS, used to display traditional traffic information, this is not to say that Stainforth discourages more innovative deployments of this technology. "We're seeing a rising demand for other, non-motorway applications – in urban areas, for example," he says. "In 2009 we were awarded a five-year contract for several types of signs in the West Midlands, conducting tasks such as car park guidance and providing city center driver information."

VMS Limited is also becoming more involved in tunnel management, where its products are used for lane control, variable speed limits, tunnel message signs, and portal signs. The company is currently working on both the Hindhead and Hatfield tunnels in the south of England. The Hatfield tunnel will eventually have 36 VMS Limited signs of various types, while the Hindhead tunnel will have around 100.

MOBILE APPLICATION

One company that is working on a number of diverse applications – and that takes pride in its signs being used for less usual purposes – is the Pennsylvania-based All Traffic Solutions. The company was founded 10 years ago and has been working in the traffic market for the past seven years, concentrating primarily on mobile signage solutions. "We haven't focused on the conventional types of products, the massive VMS that are switched off for much of the time and have limited use," says one of the company's founders, Scott Johnson. The strategy is paying off, particularly in the current economic climate: "Right now, every tax dollar being spent has to work harder. If you're buying equipment you can only use 10% of the time, it's a false economy. With our product line you can mix and match the different signs – you make a VMS talk to a radar speed display, and put them both on a trailer together. Or you can split them apart and have one across town at the community fair, while the other one is calming traffic as the surge is coming into town. We offer something that's easier to use, so it gets used more often. This demand for greater usefulness from the same or less capital expenditures is helping drive our popularity domestically and internationally," he states.

One recent contract aptly illustrates the flexibility of All Traffic Solutions products. The company has sold 38 VMS trailer units to the state of Rhode Island. "They purchased the full suite of products – VMS on trailers, working with our radar speed

Signed and delivered

French company SES Securite & Signalisation is responding to demand for more flexible solutions and has recently announced a new product that utilizes solar power. "We already had some smaller signs powered by solar panels that were used to display a small graphic or pictogram or 'reduce speed' type warning, but now we are launching the first full-size, solar-powered DMS for use on main highways and motorways," says the company's product manager Audrey Mesmin.

Throughout its time manufacturing signs of all types, SES has noticed growing demand for smart signage from many regions – notably North Africa and the Middle East – that in the past may not have been very involved in ITS due to large parts of their road network being a long way away from any electrical supplies. "We had to find a solution for these clients to have VMS installed in areas without electricity," Mesmin says. "So we have developed the Optima energy-free DMS, which is now receiving its CE certification. Our clients in remote areas can now have the information they want to display to road users exactly where they need it."

It is not only clients in remote areas who will benefit from the Optima DMS. The use of solar power is also in line with another current trend. "In France especially, but also elsewhere in Europe and beyond, the pressure is on to come up with greener traffic solutions. Highways authorities are demanding more sustainable solutions and SES takes pride in responding to new requests."

In other company news, SES has been busy fulfilling a large contract in the UK. Meanwhile, its US subsidiary, SES America, has recently received its third contract from a DOT on the East Coast.
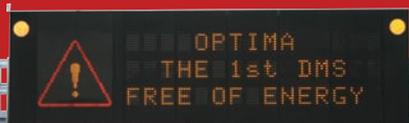
display," Johnson explains. "They are using them for a federally sponsored program that's being administered by the state, but rather than limiting the equipment to be used only toward the state's program for highway safety and driving under the influence (DUI) enforcement, they've deployed and granted the equipment to the individual municipalities in the state. These guys will be out there on the street with these signs all year long – so those tax dollars are at work the whole time."

The program to which he refers involves the signs being used to display messages alerting drivers to the state's crackdown on DUI, meaning the VMS are effectively used to advertise the fact that the state is taking this problem seriously. The radar speed signs also fit into this ethos of using traffic technology to educate and (it is hoped) influence driver behavior in a bid to improve road safety. "One of the reasons our radar speed displays are effective is because people sometimes just aren't aware that they're going so fast," Johnson says. "Awareness has a huge impact in programs such as this."

Moving beyond awareness and actually incorporating signs into enforcement is an area that interests Johnson: "We're extending our ongoing innovation not only in terms of the hard product – although we do have something in the pipeline – but also

⬅ **Rhode Island uses VMS in its anti-drunk driving efforts**

focusing on how people are using our equipment. There's an increasing interest in video complementing the speed data. Europe is years ahead of the USA in terms of utilizing imaging for enforcement but that is starting to gather pace here, so we're looking at better ways to take the information we're gathering with the radar speed displays and aligning it with an imaging product so that it becomes a more useful tool."

GETTING THE MESSAGE

Also heavily active in the North American market is the South Dakota-based company, Daktronics. The company is noting a surge of interest in its Vanguard VMS, which it believes offers an advantage to drivers on the road: "Full-color, graphical VMS technology such as the Vanguard can improve motorist reaction time by displaying high-resolution standard traffic symbols," explains Mike Weinberg, Daktronics Vanguard product manager. "We designed all Vanguard VMS to give customers a choice between amber and full color with high-resolution pixel pitches. This increasing demand from the industry is a leading indicator for the use of high-resolution, full-color signage to help improve traffic management."

In September 2009, West Virginia Division of Highways (WVDOH) installed three amber and 12 full-color Vanguard

⬆ **Daktronics signs are used to encourage safe driving behavior in motorists**

units to manage traffic applications. "The high-resolution 20mm pixel pitch allows them to create graphics to enhance AMBER Alert information – they can even display photos," Weinberg says. "WVDOH will also display logos and other graphics for event and incident management."

In April 2009, Michigan DOT activated 28 high-resolution, front-access Vanguard VMS to replace aging toll displays on Blue Water Bridge, connecting the USA and Canada in Port Huron, Michigan. Of the 28 units, five are full color and the rest are monochrome. MDOT is using the signs to display messages regarding payment types and lane management.

According to Weinberg, Daktronics is seeing a rising demand for full-color graphics on VMS that are used in mission-critical applications where legibility is crucial. "In October 2009, Caltrans District 6 installed four full-color Vanguard VMS on SR 99 in California's Central Valley to alert motorists of fast-encroaching Tule fog. The VMS use bright, attention-grabbing warning messages, and they are part of an integrated system that includes traffic sensors, visibility sensors, and CCTV cameras."

In addition to its large full-color projects, Daktronics launched a new product in 2009 called the Dedicated Dynamic Message Sign (DDMS), specifically for travel time and variable toll/congestion pricing applications. "The DDMS allows agencies to use a product that's both cost-effective and full-featured to display travel times and toll rates," Weinberg reveals. "We located its critical components on the ground for simple maintenance without bucket trucks and for easy installation of the lightweight sign panels. In the next few years, I think we're going to see more agencies adopt the DDMS as well as full-color VMS for applications such as individual lane management." ∎

DRIVE BY WIRE

Saul Wordsworth learns how the HAVEit project's long-term vision of highly automated driving could lead to the safe and intelligent mobility of both people and goods

Images courtesy of Contintental AG

We all know that human error plays a major part in road traffic accidents. Quite how much, though, is open to debate, although recent research suggests the figure is over 90%. This is why the European Commission is currently funding a project aimed at increasing road safety via driver state assessment and vehicle automation. HAVEit, the acronym for Highly Automated Vehicles for Intelligent Transport, began in late 2006. Initially established by a consortium of 20 OEMs, suppliers and research bodies – including Volvo, Volkswagen and Continental – in February 2008 this collective sought and received an EC funding grant of €17 million (US$25 million) as part of a total budget of €28 million (US$42 million). Reiner Höger is HAVEit project coordinator and head of innovation at one of the world's most respected Tier 1 suppliers, Continental: "We know that if we want to increase safety, we have to assist the driver," he says. "So many accidents are due to inattentiveness or misjudgment. At the moment, assistance functions only alert the driver if something is wrong. The problem arises when two or more of these systems warn the driver at the same time, which may result in them becoming overloaded and confused. We have to get to a scenario where the vehicle deals with most critical situations itself, leaving only situations to the driver that the system cannot handle."

HAVEit aims to improve road safety – as well as energy efficiency and comfort – via the development of a system that blends driver and technology in the form of an electronic co-pilot, leading to optimized vehicle control. To achieve this, HAVEit is working on developing the optimum automation level based on an assessment of environment, vehicle and driver attentiveness, leading to the application of different degrees of automation dependent upon the circumstances. This radical new approach means that instead of switching off an advanced driver assistant system (ADAS) in a potentially critical situation, a step-by-step-approach will transfer the driving task back to the driver.

"We are not striving to make the driver obsolete," Höger stresses, noting that the Vienna Convention states the driver must always be able to operate the car. "Today's technology cannot make decisions as well as humans. Nevertheless it is clear that drivers often need more assistance."

TECHNOLOGY

Under the HAVEit scheme, a scalable vehicle architecture is being developed to facilitate the migration from current vehicle architecture that can deal with existing ADAS to a powerful co-system representing the basis of highly automated vehicle applications. Laser and radar sensors along with camera technologies will be used

to achieve a perception area that is wide enough for all applications, and the driver state will be monitored by detecting eye blink rate and driving performance.

HAVEit integrates a number of different vehicle applications for passenger cars and commercial vehicles, all of which can be divided into three main areas: highly automated driving; green driving; and safety architecture applications. The first provides support when the driver is underloaded (bored/drowsy) or overloaded (critical situation pending), while the last presents a migration concept based on a drive-by-wire platform to pave the way for highly automated driving.

HIGHLY AUTOMATED DRIVING

Automated Queue Assistance, or AQuA, is aimed primarily at the HGV market, although it is also applicable to passenger cars. Developed by Volvo Technology, the AQuA system is designed to relieve drivers of the monotonous tasks associated with driving in congested areas, thereby lowering their workload and making them more alert for regular driving situations.

"When drivers are underloaded, often in a repetitive or tedious environment, they may start daydreaming or become sleepy," Höger details. "A common accident is the rear-end collision, in which the driver reacts too late. When in a jam, the repetition of accelerate, brake, accelerate, brake may be boring but still requires full alertness."

With AQuA, the vehicle is equipped with several sensors to provide a full view of the environment around the vehicle. The current state of the system is presented to the driver on a display. When the traffic situation is suitable, AQuA will be available to the driver who can choose to activate the
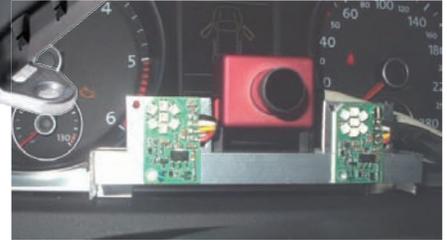
Driver monitoring equipment will detect driver state (above) and a short-range 24GHz radar

function, handing longitudinal and lateral control over to the system. The system will continuously support steering, accelerating and braking of the vehicle. When the congestion lifts, it will alert the driver to take control of the vehicle once more.

Automated Roadwork Assistance – currently being developed by Continental – supports drivers as they navigate their way through workzones. Key challenges for the system include narrow lanes and curves, ambiguous lane markings, variable speed limits and other vehicles driving close beside (see *Roadworks assistance* sidebar). "In workzones you have narrow lanes and many drivers feel uncomfortable driving through them," Höger says. "By taking lateral control of the vehicle automatically, we can relieve driving stress."

Temporary Autopilot by Volkswagen is being developed to integrate three different levels of functionality. These include pilot functionality or hands-off driving as in a traffic jam scenario, assisted driving (hands-on driving, with the driver in the loop), for instance when a traffic jam terminates, and lastly intervening safety functions, such as driver-initiated emergency braking. The temporary autopilot system includes the engagement of a laser scanner, a 77GHz radar and ultrasonic sensors all on the front of the vehicle, as well as mono cameras on the front and rear.

SAFETY ARCHITECTURE

HAVEit also features a number of safety architecture applications that present a migration concept based on a fail-operational drive-by-wire platform that will pave the way for a safe platform for the later development of a fully automated vehicle. These include the introduction of the self-enforcing electromechanical brake-by-wire system, being developed

The human factor

Subproject 3000, the development of a Joint System, is crucial to the HAVEit scheme. Such a solution allows the vehicle to drive at different automation levels, from manual to highly automated. Of particular interest to HAVEit is how the driver interacts with the system.

A recent joint study was undertaken by researchers at the German Aerospace Center (DLR) and the Würzburg Institute of Traffic Sciences (WIVW). Using the Institute's driving simulator, researchers attempted to understand how drivers react to transition requests of the automation and to unexpected events. Sixteen drivers negotiated a highway in the simulator and the results revealed that drivers didn't experience problems in reacting to required transition requests, from highly automated back to manual driving. More difficult was the reaction to sudden, unexpected obstacles that were not detected and therefore not managed by the automation system. In those situations, drivers reacted much later compared to manual driving.

"We are not striving to make the driver obsolete. Today's technology cannot make decisions as well as humans. But it is clear they often need more assistance"

Reiner Hoeger, *HAVEit project coordinator & director of Innovation, Continental*

Processing units, PCs + ECUs

Controller area network
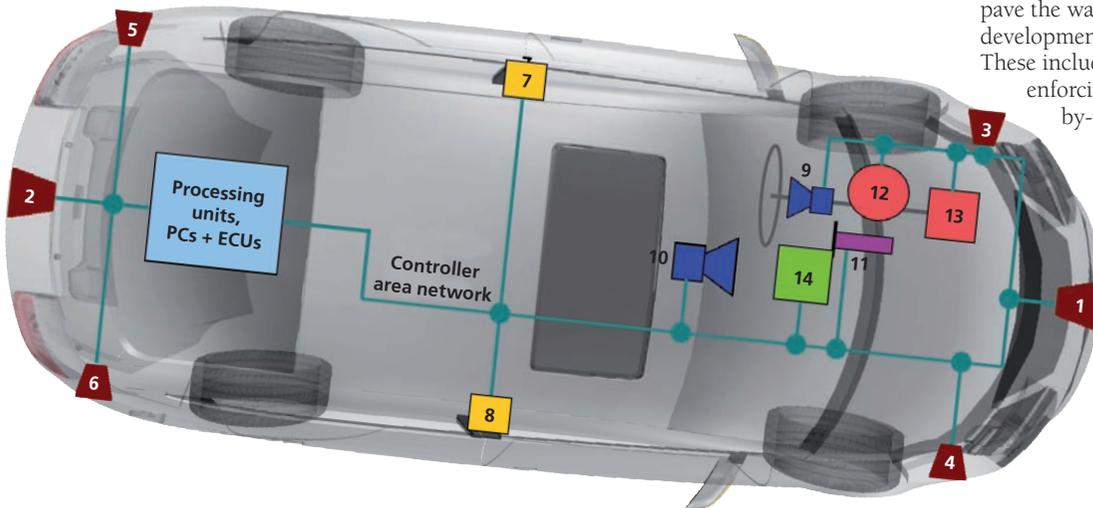
1+2: Long and mid-range radar
3-6: Short-range radars
7+8: Motorized Seat Belt (MSB)
9: Driver monitoring camera
10: Front camera
11: Force feedback pedal
12: Active brake booster
13: Active servo steering
14: Touch-screen monitor

Roadworks assistance

Driving through construction sites can be extremely stressful, especially in heavy traffic. With HAVEit's Automated Roadwork Assistance a sensor system will provide near-360° monitoring via six radars and a mono front camera. The camera will detect construction site signs and speed limits, adapting the vehicle's speed accordingly. Additionally, it will view lane markings, guardrails and other guiding objects.

Relative distances and velocities will be measured by short-, medium- and long-range radar sensors. The adapted car will also provide lane-keeping, stationary object detection and emergency brake functionalities, all while monitoring the driver using an NIR (near-infrared) camera.

⬆ Long- and mid-range radars can operate to the front, the rear and to the side, so allowing the integration of a variety of advanced driver assistance functions

by Haldex and integrated into a Volvo HGV, to reduce the stopping distance of such a vehicle by 15%. DLR, the German Aerospace Centre, is developing steer-by-wire components for passenger cars.

"By 2025, one-third of all drivers will be 60 or over," Höger says, "which is a very high number. The probability is that many of these drivers will have one kind of health problem or another, so any additional help we can provide will be welcome."

Despite the clear benefits of the HAVEit scheme, Höger is aware that there is a limit to what it can achieve and recognizes that Vision Zero is just that – a vision. "Our system relies on a reasonable and considerate driver," the German says. "We realize that there will always be people who drive when they are either intoxicated or too tired. We are not building a law enforcement system. If the driver is driving despite all the system warnings, then the system will not be able to help them."

CONCLUSION

"We have completed half of the project," Höger says on the progress thus far. "We are currently prototyping the vehicles. At the end of 2009, we should have had all the electronics running, so now we start the integration into the vehicles." In mid-2011, HAVEit will host a final event to demonstrate the project results to the public. The work will not end there, however. This groundbreaking scheme aims at the long-term vision of highly automated driving. "We are pushing the limits in terms of technology and aim to bring it onto the roads in the next four to eight years," Höger predicts. In the long term, he concludes that HAVEit should form the basis of integrating further generations of ADAS and drivetrain components, offering the next step to highly automated vehicles. "We believe that HAVEit will contribute significantly to higher traffic safety and efficiency for both passenger cars and trucks." ∎

STREET
SMART

A genuine revolution is achievable in the illumination of our roads – but will it happen? **Saul Wordsworth** explores the world of intelligent street lighting

Illustration by Magictorch

The good old streetlight. We'd feel lost without them – and rightly so. Yet in many ways they are an anachronism, a throwback to a bygone era of waste and innocence. Out of sync with the 21st century, they stand – on, off, on, off – dutiful, inflexible, and rigid. These familiar monoliths use around 40% of a city's annual energy budget and against a backdrop of global warming, shrinking resources and rising energy prices – on average 3% a year since 1999 – they are millstones around the necks of local governments. One 500W street lamp left burning throughout the night produces two tons of CO_2 emissions a year. But turn them off and people die…

Despite the proven safety benefits, one in five Local Authorities in the UK continues to shut them down late at night to save money. Leave them on and bills continue to soar. Faced with such an outlook, most cities feel that they are damned if they do and damned if they don't. This need not be the case. A revolution that is stealing up on the world of streetlighting looks set to haul the traditional roadside lamp into the modern era.

This revolution is twofold and based on the convergence of a number of mature technologies. The first, currently underway, is the introduction of LEDs as replacements for standard diffusion lamps (see sidebar, *A bright future for LEDs*). LEDs are not by definition 'intelligent' but are no less important for that. Directed, glare-reductive and producing more luminance per watt, LEDs are up to 50% more efficient than the current generation of lights and their phased introduction is certainly having considerable impact. Yet while this nascent technology may be big news for streetlighting in general – and city budgets – there is a different kind of revolution ongoing that complements LEDs and requires a sea change in our notion of how roads are illuminated.

DIM BUT BRIGHT

Telemanagement, or Intelligent Street Lighting (ISL), creates intercommunication between lamps as well as providing remote access, resulting in a total system that includes dimmable luminaries, advanced lighting control and individual monitoring. As Anders Axelsson, senior vice president for Echelon, succinctly puts it, "Networked streetlighting has been shown to reduce energy use by up to 40% while improving citizen safety, dramatically lowering

A bright future for LEDs

Lamp technology has been improving steadily in efficiency over the past 30 years. Moving from high-intensity discharge (HID) mercury vapor to sodium and metal halide, the typical diffusion lamp is now a highly efficient bulb. Yet in the past 12 months, the introduction of LED streetlighting technology has led to a seismic leap in energy efficiency, as well as improvements in direction radiation, light pollution and better color renderings. These current LED solutions offer energy savings of up to 52% over mercury vapor HID and 26% over sodium fixtures.

Martin Kortmoeller is LED Streetlights project leader for Hella – the first company to introduce LED headlights to the automobile industry: "The lifetime of an LED is 50,000 hours," he says. "With a lamp on full-time, that's 12 years minimum. Old-fashioned lamps average 12,000 hours and must be replaced every three years. This means there are fewer maintenance and

replacement costs. There is a lot of LED technology currently trying to enter the market because of the interest in cost reduction and environmental issues. LEDs reduce maintenance costs and – combined with the energy savings – mean that municipalities can recoup the costs of a basic non-networked LED-based streetlighting installation in four to six years. We predict that with an uptake of LED technology, the prices will be more or less the same as standard lights in four years' time."

maintenance costs, and providing to-the-minute confirmation about aspects such as lighting performance and availability."

ISL operates wirelessly or using existing power lines and requires every ballast to be fitted with a transceiver or Outdoor Lighting Controller (OLC), an interface that measures and controls the ballast. Through bi-directional data exchange, individual lights may be remotely dimmed and monitored, and can feed their own unique information back to a central server via segment controllers or GPRS gateways that control 100 or more lamps. An astronomical clock is located in the segment controller, beaming

a 24-hour dimming schedule decided by the central server to the lamps around it. The segment controller receives information from each light concerning temperature, power consumption, running hours, voltage and failure status, all of which are measured via the use of tiny internal sensors. The city's control center is meanwhile equipped with monitoring software to record this data, enabling it to carry out remote diagnostics and devise optimal maintenance schedules.

INTELLIGENT ADVANTAGE

The benefits of introducing ISL are manifold, the drawbacks almost nil. Although at

its most effective when complemented by the presence of energy-efficient LEDs, ISL technology can also be retrofitted to standard diffusion lamps, often at an add-on cost as little as US$5 a lamp. The built-in astronomical clocks, or in some cases light sensors, track the changes in sunlight levels, enabling dimming from late evening until dawn. This is possible because a reduction in illumination of up to 50% is not noticeable to the naked eye of a driver. The result is increased equipment longevity, reduced energy use and fewer CO_2 emissions. In the case of unmonitored street lamps, failed lights may remain in situ

LET THERE BE (SMART) LIGHTS

Turning off streetlights to cut power bills and fight climate change could result in a tripling of the number of fatal road crashes, each one costing society millions of dollars, according to a study published by Newcastle University in the UK. "Streetlighting reduces the number of crashes, including the number of injury crashes and crashes involving fatalities," states Fiona Beyer, the study author. So, in times of financial

hardship and supposed environmental awareness, maybe it's better that authorities opt for intelligent technology, rather than no technology at all?

In 2009, for instance, the Federal Ministry of Traffic in Germany completed a pilot installation of an LED streetlighting project at a service area in Walsleben East. One side of the A24 between Berlin and Hamburg shines brilliantly, while the opposite side features a muddy and shadowy light that drivers are used to. An advanced lighting system was sourced from Lumenova, part of the PSI Group, which develops, manufactures, and supplies the LED units, known as 'Lightengines'.

Specifically developed for lighting streets, large squares, pedestrian crossings, and bicycle paths, the LED light source,

optical distribution reflectors, and the electronic control system are all integrated into a sealed unit. According to Lumenova, one-third of Germany's existing streetlights will have to be exchanged in the coming years, as they are technically outdated, so the success of this particular project could be good news for LED lighting suppliers.

In a similar demonstration of the effectiveness of LED over traditional streetlights, BetaLED tested two forms of lighting control systems in Wisconsin, USA, featuring its LEDway streetlights – 11 LEDway units fitted with either a power line communication system or wireless radio frequency (RF) system were installed, both of which are designed to manage each fixture to cut operating and energy expenses.

Lighting Science's Prolific LED system, which delivers 80 lumens per watt

"If it is raining, the roads require less illumination so the lights will be dimmed. But if it snows, on account of the glare, you can pretty much turn off the lights"

Ken Leonard, *director, EMEA West, Echelon, UK*
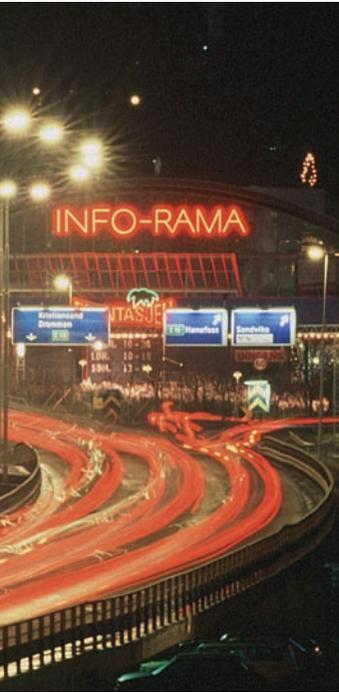
← **The city of Oslo wanted to lower streetlight operating costs, ensure driver and pedestrian safety, and allow remote monitoring and control with Echelon's solution**

for days or even weeks until a routine and expensive night patrol is undertaken, or a member of the public alerts the authorities. Through the deployment of ISL, a failed light will be flagged automatically, improving safety and public service standards. The end of a light's natural life can also be anticipated and intercepted.

Ken Leonard is director, EMEA West, for Echelon, developer of some of the world's first ISL projects. "Not only can each lamp be controlled remotely, they can monitor the weather conditions via aluminum sensors," Leonard explains. "If it is raining, the roads require less illumination so the lights will be

dimmed. But if it snows, on account of the glare, you can pretty much turn off the lights. There is little question that ISL is the technology of the future. Such a system generally takes seven years to pay for itself but networked streetlighting means immediate and sizeable savings. We know this from our long-standing project in Oslo."

NORWEGIAN DID
When a European regulation was published requiring all streetlighting to use electronic rather than mechanical ballasts by 2007, Norway's capital sought a solution that would satisfy this rule, as well as address European and worldwide directives to reduce energy use and carbon dioxide emissions. The city also wanted to minimize operating costs, improve driver safety, and allow remote monitoring and control. Since its inception back in 2003, the scheme has installed over 10,000 electric ballasts with ISL capabilities, with the potential for another 45,000. Echelon's LON 100 Internet Servers – which act as segment controllers – manage the streetlights and use the GSM network to communicate with Oslo's monitoring center, reporting on the overall status of each light as well as controlling their dimming times and light levels.

Eirik Bjelland of Hafslund ASA, Norway's largest electricity supplier, has

been thrilled with the success of the project. "This technology lets you remotely identify lamp failures and in many case fix them before residents even notice," he says. "Reducing lamp downtime can significantly affect driver safety. It also makes repair crews more efficient by proving predictive failure analyses based on a comparison of actual running hours versus expected lamp life."

In the six years since the first installation, the city has made a 68-72% saving in emissions, with the possibility of this rising to as high as 75-80% over time. "If you segment it down," continues Echelon's Leonard, "about one-third of this is as a result of the lights being networked, most of which is saved in maintenance costs, the rest in electricity. In combination with LEDs, optimized bulbing, and electrical ballasts, massive economies can be achieved."

The many live and pilot ISL schemes around the world are not just about cost-cutting, energy-savings and maintenance. Although there are indeed considerable savings to be made, there are also potential benefits to road users. In the event of an accident, Local Authorities may receive a message from emergency services stating that a particular street or zone requires illumination in order to help an ambulance locate the scene of an accident and aid their vision on arrival, as well as alerting other

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Milwaukee-based We Energies tested the remote access and monitoring capabilities of each system and calculated and compared reduced energy and maintenance costs. "The ultimate goal of the test was to determine if these technologies could be valuable tools in controlling costs and reducing unnecessary light," explains Chris Balliet, We Energies program manager.

The powerline system communicates over the same wires that deliver power to each fixture to monitor and control streetlights equipped with special hardware and software.

Alternatively, the RF control system uses a wireless mesh network to transmit information to a remote source. Data such as energy usage, operating hours, and traffic patterns are collected

from both systems and analyzed to identify specific streetlights that can be dimmed, reducing energy use and cost. Each individual fixture can be monitored and accessed from anywhere in the world by logging onto a secure website.

The demonstration also included an online visual display of the system that allows the users – through the use of pole-mounted cameras – to see the effects of any adjustments to the fixtures from any location around the world.

LEDway from BetaLED is engineered for energy efficiency and environmental sustainability

A further solution that highlights the differences between LED and traditional HID luminaires was recently unveiled by the US company Lighting Science Group Corporation (LSG). Designed with the environment in mind, the new Prolific Series is also claimed to offer benefits over other LED products, illuminating the roadway while reducing energy consumption and lowering the operating costs over the system lifespan.

They provide between 80 to 90 lumens per watt depending on the model – performance that was validated by an independent testing lab approved for LM-79 Testing by the US Department of Energy CALiPER program. At over

drivers to the incident. For authorities that have invested in ISL and LEDs combined, there is a further option – one that was showcased recently in San Francisco with Mayor Gavin Newsom controlling individual streetlights via an iPhone. Newsom was able to underline their benefit in unison via the strobing of the lamps on and off, a technique that could again be used to help emergency services locate the scene of an accident. Such a display can only be achieved through the use of LEDs, as it's the only lighting that can instigate immediate start-up. LEDs can also change color, adding further possibilities to any emergency situation.

In Hamburg, ISL is being used to safely direct traffic from one lane to another through the Elbe Tunnel via luminous lane markings. Requiring stringent safety standards, the project employs LEDs to safely guide up to 150,000 cars a day through the 3.2km tunnel. The system replaces the previous guidance system involving the manual shifting of concrete blocks and beacons, a time-consuming, expensive, and dangerous practice. The 650 electronically controlled LED surface lights that lead up to the tunnel are networked using power line communication technology, allowing them to communicate over existing lines. The LED lighting network is connected by servers to the tunnel's control center, helping staff make real-time decisions about traffic control and maintenance.

VEHICLE-TRIGGERED LIGHTING

There is another use of ISL that relies exclusively on the implementation of LEDs. Although such technology is increasingly deployed in parking lots to facilitate nighttime vehicle guidance, it has experienced only limited use on the open road. Gil

"Movement-triggered technology depends on the use of immediate-start LED lighting, and consists of radar-based sensors integrated into the luminaire"

Gil Soto Tolosa, *global product manager, ONS, Philips, the Netherlands*

Soto Tolosa is global product manager for outdoor network systems at Philips. "We at Philips believe systems will one day automatically provide the exact light where and when we need it, hence why we are working on movement-triggered systems, with a pilot scheme taking place in France. Such technology depends on the use of immediate-start LEDs, and consists of radar-based sensors integrated into the luminaire that we expect to be introduced initially for people and bicycles, and latterly cars."

The notion of sensor-based, vehicle-triggered lighting is an area of conjecture and debate within the streetlighting community. Despite a number of live pilot schemes, Paul Eidem, CEO of Luminext, pioneers in automated outdoor lighting solutions and provider of much of the Oslo

Echelon's LonWorks technology is being used to help move traffic safely through the Elbe Tunnel
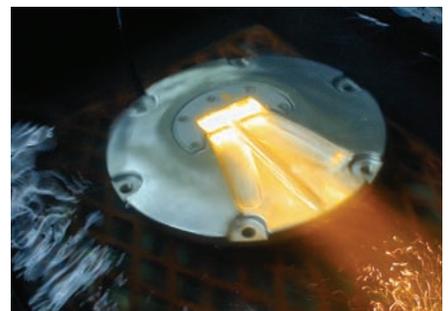
Over 650 electronically controlled LED surface lights lead up to the tunnel

80 lumens per watt, Prolific delivers greater performance than currently available LED-based streetlights, which offer only 50 to 60 lumens per watt. With over 40 million streetlights in the USA, the new products could dramatically expand the market for LED roadway lighting technology and change the way roads, streets, and highways are illuminated forever.

Of course, advanced technology doesn't only revolve around the light source itself. In 2009, Nivis and Cisco debuted an embedded wireless IP mesh technology using a 6LoWPAN solution for integrated management of devices such as streetlights. In one live demonstration, the companies

Energy savings from LEDway streetlights is generally 40-60% compared to HID products

showed a wireless mesh network of streetlights communicating with a parking meter. The meter communicates with a sensor ring in a parking space and the data is sent to a Cisco cell phone. As a result, it allows internet users to see if a parking space is available ahead of their arrival, or to learn if their meter has expired.

And if you ever wanted proof of the savings that many of these suppliers claim in their marketing literature, look no further than the city of Mobile in Alabama, USA. "We were using 150W incandescent bulbs," explains Bill Metzger, the city's traffic engineering director, who spent US$911,000 in Federal Economic Stimulus money to replace all its incandescent traffic signal lights with new, more efficient LED lights. "These new LED ones are about 12W. They are actually

brighter, and they last so much longer," he explains. "The lower wattage means a real saving in power bills. Each replaced red light, for example, will save the city about US$29 a year in electricity. What we're doing is using Stimulus money, and then we are turning around and getting money back on it. Rather than using the money once, we are also getting the power savings. Plus, these things will last about 10 years before they start dimming out; the old incandescent bulbs were replaced every two years, by comparison. We are doing the pedestrian signals to try and make it a little clearer to people when they are supposed to cross the street. With the countdown, it's a little more obvious when they can go and how long they have to cross the street."

Cunning cat's eyes

Retroreflective road studs, or cat's eyes, were developed during the London blackouts of the Second World War to complement shuttered headlights, and have probably done more to save lives on the road than anything developed since.

This brilliant yet simple technology has recently been improved upon by Luna Road through the incorporation of solar power into the design. Crafted in polycrystalline, these road markings – charged for eight hours during the day – can glow for a full 12 hours afterward. By capturing solar energy, Luna Road has found a way to improve road safety in a clean, green way. The studs no longer require the light from car headlights to illuminate them, and as such can serve as a warning indicator to drivers from a far

greater distance, providing them with more visual information and thus enabling greater time to make night-time decisions. The 30 ton per tire load studs – available in a variety of colors – have recently been installed at a number of locations, including roads around Mexico's Olympic Stadium and Costa Rica's Tunnel Zurqui ('The Tunnel of Death') – one the country's most perilous mountain roads.

project architecture, is less certain: "There have been initiatives to control streetlights based on a car driving down the street and I am not sure it can be done," Eidem says. "Even with the use of LEDs, they need more time to come on. If you turn them on and off too quickly you are going to kill the light source – the one thing you don't want."

Regardless of the feasibility of vehicle-triggered lighting, another possibility is the

benchmark for future road lighting with a high-concept energy-efficient solution that is able to harness renewable energy sources. During the daytime, 'Light Blossom' will harness the sun's energy by opening its solar-celled 'petals' and, similar to a sunflower, follow the sun while it moves east to west. In windy weather, the lamp will even move its petals to an upward half-open position. The petals will then progressively rotate,

Light Blossom is more concept than product, yet promises to shape the environmentally driven streetlight of the future.

INTO THE FUTURE
The market for ISL is huge, the basic technology proven, and the cries for a greener planet louder than ever. Today, over half the world lives in cities, and as urban areas expand, the demand for streetlighting becomes greater. E-Street, a European body constituting 13 organizations from 12 countries dedicated to increasing the market for ISL, states that Europe can make an annual saving of 38TWh (Terawatt-hours) of electricity – a 64% reduction on present annual energy consumption for streetlights – by introducing or retrofitting old installations with ISL. But the technology is not catching on as fast as it should. Both LED and ISL are still young and expensive. The main problem seems to be in the mind: most municipalities would rather stay with the same streetlights for the next 12 months than invest in the future with a system that takes time to pay for itself, especially in the middle of a financial crisis.

"The per-unit investment cost for networked streetlighting is of vital importance for the decision-makers," says Bjoern Sandtveit, central coordinator for E-Street. "The only way to battle this is by increasing the number of units installed annually." Lasse Hersel, technical director for Luminext, sees a different kind of resistance in place. "Streetlight technology hasn't really changed in the past 25 years," he says. "People who work in the streetlight business are very conservative and not used to changes of any kind. It takes a while to alter that. We are talking about a lot of lamps and a lot of investment."

Daniel Svensson, environmental consultant for WSP Group, goes one step further, suggesting that, "people who have the power to buy streetlights are not well educated in economics so they buy what they know. Here in Sweden most of them are 60-year-olds, so hopefully soon they will retire and be replaced by young people who have economics skills!"

But progress is being made. New standards from CIE, the International Commission on Illumination, recommend intelligent lighting. The savings potential remains huge, and a strong will within the EC helps. In the UK, almost three million streetlights have exceeded their 25-year life and need replacing – and they have to be replaced with something. Echelon's Ken Leonard is hopeful that "in 10 years' time, every new streetlight installed will be intelligent because there is so much benefit."

All that is required is a handful of brave decision-makers who – through choosing to invest in ISL and LED technology – will help this movement reach a critical mass, driving down unit prices, and creating an unstoppable tipping point for a technology that can only benefit mankind. ∎

> ## "People who work in the streetlight business are very conservative and not used to changes of any kind"
>
> **Lasse Hersel,** *technical director, Luminext, Norway*

notion of real-time traffic data from existing traffic sensors being fed into control center servers to determine streetlight dimming, which could override the use of astronomical clock data, as such data doesn't account for unusually busy out-of-hour roads.

LEDs have arrived, albeit in limited numbers and the same is true for ISL. Triggered lighting may yet follow. What about in 10 years' time? Philips has set the

transferring the movement to the built-in wind rotor that converts this movement into energy. At night, the lamp will close its petals and transform itself into a precision street lamp, minimizing light pollution, lighting the way for cars and pedestrians, and saving electricity and emissions by drawing nothing from the grid, instead being entirely self-reliant, possibly even returning energy. Demonstrated for the first time in late 2008,

← **Cities that create managed streetlight networks can not only offer additional services, but also save energy and reduce their maintenance budgets**

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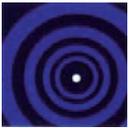
CELEBRATING ITS 20TH EDITION, INTERTRAFFIC 2010 IN AMSTERDAM IS GOING TO BE FULL OF SURPRISES, AS **ERIK DIJKSHOORN** EXPLAINS

Interviewed by Lloyd Fuller

Although still some four months away from opening its doors, a great deal of the planning for Intertraffic 2010 in Amsterdam has been set in stone for a long time already – and with good reason. The organizing team at Amsterdam RAI have a few surprises up their sleeves for this very special occasion. "As this is the 20th edition of Intertraffic Amsterdam, visitors and exhibitors will find this event in particular will have a celebratory feel," suggests Erik Dijkshoorn from Intertraffic Worldwide Events. "We feel extremely proud that not only has Intertraffic been in existence for such a long time, since 1972, but it continues to grow with every edition we stage," he says. "In 2010, we are all set to have more than 800 exhibitors from more than 40 countries around the world – this isn't a Dutch exhibition or a European exhibition, it's a global exhibition for suppliers in the industry to showcase

their expertise." This international appeal is backed up by some of the figures released concerning the 2008 event. "We had over 23,000 visitors two years ago," Dijkshoorn recalls. "There isn't another show in the ITS or traffic management industry that even comes close to matching that," he says. "Also, the number of people who visited from outside of the Netherlands rose by something like 60%, which wasn't a surprise given that nearly 80% of the exhibitors were from outside of the Netherlands."

ATTRACTIONS

So why do so many people visit Intertraffic? "Amsterdam's a beautiful city," Dijkshoorn says, smiling. "Seriously I think we stage a really good show – we work really hard to ensure we get everything right for our visitors and also our exhibitors. I would also say that our exhibitors do a very good job at promoting their own presence at Intertraffic – it's a very successful give-

and-take relationship, and I think they are pleased to be a part of it. Also, Amsterdam is very easy to get to from many international destinations, and obviously there's good transport in Amsterdam itself. We put lot of resources into promoting the event: I have lost count of the different countries I have been to myself as part of the campaign."

So what will Intertraffic 2010 have to offer? "Firstly we have some new additions to our usual segments of infrastructure, ITS/ traffic management, safety, and parking," he reveals. "The thing that intrigues me when walking around events – and not just our own show – is that they encapsulate industry trends at that particular time. I noticed a strong focus on sustainable mobility in our 2008 show. It's clearly an important issue, so we have given those exhibitors their own platform with an Environment area. We all know that vehicle emissions are one of the major sources of air pollution, and even with the

advent of cleaner burning fuels, enhanced engine technologies, and even upcoming hybrid and electric vehicles, the traffic sector is quite rightly accepting part of the responsibility. Such vehicle technologies don't hit the roads overnight, so in the meantime whatever solutions ITS can offer to help traffic run more smoothly, economically, and cleanly all helps."

DEMAND MANAGEMENT

In this regard, Dijkshoorn is watching developments in his own country in relation to the Dutch nationwide road pricing scheme with huge personal interest. "The Transport Minister, Camiel Eurlings seems to be very much in favor of a new way of thinking regarding not just transport financing, but the environment, reducing traffic, etc," Dijkshoorn says. "Just last week, there was a big debate in the lower house about the introduction of road pricing, *Anders Betalen voor Mobilteit*, or alternative charging regimes for mobility. The Minister actually said that he would cancel the scheme if there wasn't enough support for it, but from what I read, a majority of the MPs are in favor. Of course, the opposition party is attacking the idea, as you would expect from an opposition party, claiming that Dutch motorists will face higher costs, but Eurlings is convinced the scheme will lead straightaway to 15% fewer cars on the roads, meaning reduced traffic delays and emissions, which benefits everyone who drives to work as well as business in general."

Wearing a driver's hat, though, does Dijkshoorn believe such a scheme to be fair? "It's going to take some getting used to for Dutch drivers," he admits. It is proposed that the charge will work on a sliding scale, depending on how much pollution the vehicle emits, the time of day, and certain stretches of road. "Someone who drives along the main roads into Amsterdam to work, for instance, will pay more than an old person who drives to her local shops in Heemskerk. We've never had tolling on any of our roads, so to all of a sudden be paying a fee per kilometer that we drive will take some adjustment. But in concept, it seems a fair way to do things. People who drive less, pay less. People who drive more, pollute more, etc, pay more. It's worked in Stockholm, albeit the schemes are slightly different. I was there for the World Congress on ITS and the general feeling was that congestion charging, or demand management, has worked. It's also worked in Singapore and in London, so I don't see why it wouldn't work in the Netherlands."

INTELLIGENT PROGRESSION

In addition to the Environment segment of Intertraffic 2010, there is also a new Cooperative Systems area, with the theme 'connecting smart vehicles with intelligent infrastucture'. "This is another piece in our jigsaw," Dijkshoorn continues, "but

> "In concept, it seems a fair way to do things. People who drive less, pay less. People who drive more, pollute more, etc, pay more"

sort of joins everything together, because there will be a focus on how cooperative systems enhance the environment, safety, and mobility. It's all linked. As well as an exhibition showing the technologies that are being used and will be required to develop these cooperative and intelligent networks, called i&CDrive (Connecting Vehicles with Infrastructure), there is also a conference and a demonstration of the final results of the EU-funded projects CVIS, SAFESPOT, and COOPERS. We've been working with the European Commission, the Dutch Ministry of Transport, as well as with project teams at CVIS, SAFESPOT, and COOPERS on this whole new event. The idea is that people will learn about and importantly experience for themselves the latest developments in the field of V2V and V2I communications."

Obviously, there have been many demonstrations of such technologies over the past few years, so why will this one be any different? "These are the results of some major projects," Dijkshoorn says. "These projects have been four years in the making and the experts involved will all be present to discuss things such as development, testing, and validation. Alongside these demonstrations, there will be a three-day technology forum about the promise of cooperative systems and aspects such as challenges. I think it will be more comprehensive than anything we've seen before." Dijkshoorn is, however, reserving his excitement for the demonstrations. "You read about these projects, you hear about them at various events, but to actually see

them in action – and three such high-profile programs – it's going to be highly valuable. We've planned a track around the RAI grounds as well as out on nearby motorways and city roads, all of which is designed to highlight the positive impacts that cooperative systems can have in terms of the environment, safety, as well as for the individual traveler."

Alongside these extra features for the 2010 exhibition, regulars to Intertraffic may also notice some changes to the venue itself. "There's a brand-new extended hall," Dijkshoorn says. "The new Elicium building will be the main hall and will be the central hub," he says. "It's really spectacular architecture and will just add to the whole experience for visitors and exhibitors alike."

READING BETWEEN THE LINES

And any interview with Intertraffic's top man couldn't conclude without a mention for its latest venture into the world of multimedia. "We're really happy to add a print component to the Intertraffic brand," he says of the recently launched *Intertraffic World* magazine – a collaboration with the publisher of *Traffic Technology International*. "We think the magazine offers the industry a great opportunity to communicate a marketing message direct to a target audience and we look forward to the next edition in time for Intertraffic China."

Within the covers of *Intertraffic World*, readers will find technology insights covering road infrastructure, parking, road safety, and advanced traffic management – basically everything you'll find at Intertraffic's hugely successful events, but in a magazine format. "What started as a national event in 1972 has evolved into the leading traffic show in the world, with trade fairs in Istanbul and Beijing as well as the Intertraffic.com website. *Intertraffic World* magazine offers extra exposure to traffic professionals around the globe." ∎

Intertraffic Amsterdam takes place at the RAI from March 23-26, 2010. Log on to www.intertraffic. com for further information. Log on to www. intertrafficworld.com for subscription information about Intertraffic World

GREEK ROADS ARE BEING REINVENTED, WITH MANY POSITIVE CHANGES AFOOT, AS BILL HALKIAS EXPLAINS

Interviewed by Louise Smyth/Photography courtesy of Attikes Diadromes

When considering the so-called pioneering nations deploying ITS, Greece might not be the first country that springs to mind. Terrifying driving and excessive use of the horn? Maybe. Advanced traffic management? Maybe not. But things have changed a great deal over the past decade, with one project in particular heralded as such a success story that many other countries are looking on with interest. That project is the Attica Tollway in Athens and the man behind it is Bill Halkias.

When Halkias joined the initial concession in 1996 to run this envisioned tollway, the team consisted of the financial director, an accountant, a company secretary and himself as technical director. Today, though, Attikes Diadromes – the company created to operate and maintain the road – employs around 1,200 people. Halkias, who has been CEO of the operator since it was established in 1999, is the first to admit he couldn't have predicted what would unfold: "When we started the concession, nobody

knew if it would actually be developed," he recalls. "The initial plan was just not bankable; we had to make many changes and we learned everything the hard way."

It was little wonder there were so many hurdles to overcome. This was the first project in Greece to introduce technology to allow motorway users fast and easy travel through toll plazas, with each toll station configured for both manual and electronic ETC. Although not particularly controversial or revolutionary in itself, nothing like it had ever been seen before on Greek roads. As well as the legal and political intricacies involved in setting up a scheme that allows for ETC (Greek law is not exactly welcoming of change), funding was also a huge challenge: "There is no denying it was an expensive venture," Halkias acknowledges. "After a lot of discussions with banks, we finally managed to get the project funded through PPP financing. That was the first major achievement."

The next major challenge was setting up the operations technology for when the

project went live in 2002. The custom-made ETC system uses 5.8GHz DSRC technology. There are currently more than 350,000 of the e-PASS tags on the road, and at peak times as much as 65% of traffic is using the electronic system. The tags are also now compatible with three other interurban toll road systems in Greece, representing the first steps on the road to true interoperability. But, as Halkias details further, going to all-electronic toll collection is not currently a priority for the Attica Tollway: "It would be difficult," he says. "If the law was there to accommodate violation enforcement, then perhaps we could get to that point within three years. But as a result of the private financing, the financial institutions must feel secure about revenue streams, and the toll barriers we have at every plaza provide this for them. There are also issues to be worked out with the data protection authorities."

ON THE OPEN ROAD...

Given that AETC doesn't appear to be on the cards, it's probably safe to assume the same

for tolling with GNSS. As Halkias reveals, Greece differs to many other countries in that the desire for open-road tolling (ORT) is just not that fervent, although he is keeping an open mind. "When the need to gain additional capacity becomes more urgent, we could lead the way in free-flow ORT, either with DSRC or through satellite tolling," he says. Likewise, although the technology exists to implement ideas such as variable pricing, these types of demand management strategies won't be rolled out until the road becomes too congested. For now, the Attica Tollway is still functioning within capacity with no excessive queuing at plazas, or traffic congestion.

"Of course we are following closely developments in the satellite tolling arena and have looked at congestion pricing schemes similar to London's, but making that switch is difficult," the 52-year-old says. "We have already been very pioneering in our own right. It takes time for the government in Greece to pluck up the political courage to introduce new laws that will allow the integration of new technology into our tolling systems. I remember when we first tried to explain to the taxman how electronic tolling worked, he was actually demanding that we issued paper receipts!"

INFORMATION INTEGRATION

Despite the apparent reticence on the part of the government, the Attica Tollway is nevertheless a technology-rich infrastructure, especially in its use of Geographical Information Systems (GIS). Such is the extent and diversity of the GIS applications in use, the Tollway recently claimed a 'Special Achievement in GIS' from ESRI, the software's developer. The GIS incorporates static and dynamic information. The static information includes data from the motorway network as well as the surrounding roads, orthophoto maps for base mapping, satellite images and positions of all fixed assets, such as utility boxes and signage. Dynamic information, meanwhile, encompasses incidents, traffic counts, and the geocoding used to monitor both ETC users and Tollway personnel. Plans are afoot to further expand the use of GIS, as Halkias outlines: "The integration of mobile GIS devices is under development, which means that when maintenance groups go out and fix a pothole or a lightbulb they will have handheld portable devices that feed the maintenance action directly into the GIS, so we'll know exactly what actions have been taken, where and when."

The vast amount of data from GIS applications and various other sources (such as the 100% CCTV coverage on the road) is fed into a central control room and also another TMC that is situated 50km away from the road, which is dedicated purely to emergency management and data back-up. And there is no doubt that the data is used proactively: "Our traffic incident management system ensures that we have

> "It takes time for the government in Greece to pluck up the political courage to introduce laws that will allow the integration of new technology into our tolling systems"

an average response time of five minutes – in some instances we respond within two minutes," Halkias proudly asserts. Such statistics help to explain why a ride on the Tollway not only offers a smoother journey for travelers, it's also a much safer one.

On that subject, Attica Tollway is internationally recognized for its safety efforts and has been awarded prizes by the likes of the International Road Federation. A number of elements promote safe operations, including an integrated traffic management and incident management strategy that aims to get broken-down vehicles off the hard shoulder as quickly as possible. Vehicles are towed off the road free of charge so drivers are not stuck attempting to fix their cars at the roadside. Custom patrols (at least 12 vehicles during the day and six at night) drive more than 150 times the length of the road on a daily basis to be able respond swiftly to incidents, but also to encourage safer driving as a result of such a visible presence. Indeed, when discussing the road's safety virtues, Halkias takes great pride in describing it as a 'managed infrastructure' rather than just managed lanes, explaining that as drivers cannot actually get on the Tollway without passing through a toll plaza, the whole road is effectively access-controlled.

A number of innovative safety-oriented marketing campaigns have also contributed in terms of promoting improved driver behavior. As Greek tax law dictates that data

such as home address is required for each user (there is no anonymous ETC as yet), mailshots are sent out to a fairly captive audience of e-PASS users. The Tollway also collaborates with other organizations: "We've participated in anti-drink driving days, where our staff visit nightclubs and drive home anyone who feels they've had too much to drink. We also target tomorrow's road users, by staging educational plays in schools. Extensive campaigning on traffic safety is just something that's never been done here before," says the Greek.

Such efforts are being widely lauded by the global tolling industry, and 2009 saw yet another accolade in the form of one of the IBTTA's Toll Excellence Awards. "Of course it is good for morale but we're not patting ourselves on the back. Tomorrow, nobody will remember that Bill Halkias won this or that award – they'll remember that the Attica Tollway won it. It is a recognition of what you do and who you compete with – and there was no competition in Greece! But we set standards very high. This was first toll road concession here and its success led the Greek government to fully sanction the use of PPPs on toll roads and motorways."

Halkias does himself a disservice with such modesty, and there is no doubting he will be remembered for his forward-thinking approach for many years to come. He is highly regarded among the many toll industry associations. He is an active member of the TRB's Freeway Operations Committee and was instrumental in establishing the first triannual International Symposium on Freeway and Tolling Operations, held in Athens in 2006. The Tollway is also a member of the IBTTA and Halkias is the first Greek elected to its board of directors. He helped develop an MOU for the cooperation of the TRB and the IBTTA and was honored to be asked to take on a new role as liaison between them. "But don't ask me what a Greek is going to do with two American organizations both based in Washington DC that don't talk to each other! It's strange, but sometimes I feel like a modern Columbus, discovering what can be achieved when we all work together." ∎

GBS BINDRA IS A MAN WITH A NUMBER OF PLANS FOR LONG-TERM RESULTS IN THE SUSTAINABLE TRANSPORTATION FIELD

Interviewed by Louise Smyth/Photography by Craig Marshall

The role of 'global director of innovation' may sound like something more suited to Disney or Starbucks than to an IT services company, but don't let the corporate-sounding name fool you. GBS Bindra is not a man who converses in business speak (he doesn't refer to that dreadful term 'blue-sky thinking' once) and he's also not working from a little bubble far away from his employees or clients. Taking a hands-on approach to all facets of his role at Logica, he has worked from the ground up: "I have around 24 years of experience," he says, "largely in setting up and running Indian subsidiaries of Silicon Valley companies. Naturally, this required the use of a great deal of innovative thinking."

He joined Logica in a different division several years ago and assumed responsibility for worldwide innovation 18 months ago – something he describes as innovative in itself: "I run innovation for Logica, which is primarily a European company, from India. It is interesting to discover that you can do numerous things for customers who are largely in developed markets from a country such as India and do them successfully – it's working out well so far."

Bindra works closely with Logica's executive committee on creating strategies related to internal innovation – inspiring the company's 40,000-strong workforce to "work on solutions to create a better tomorrow" – and doing the same for its customers as well. The third part of his role involves trawling the globe to discover up-and-coming organizations that Logica could partner with. "There are lots of smart companies with neat ideas that could add value to our customers, yet who would struggle to even get a meeting with decision-makers who could help them. Logica has a rich history in working with these customers and they trust us, so when we partner with those smaller companies, people listen."

Hoping to use the weight behind the Logica name to further one of his personal passions, Bindra is currently working tirelessly on developing, promoting and achieving sustainable solutions for transportation. Notable among such solutions is a newly developed system, called Logica EMO, for encouraging drivers to be environmentally aware when they are behind the wheel. "It's a breakthrough technology we've created that can fit into every car produced after 1996," he says.

"It connects to the engine control unit and records how the engine is being used, which not only depends on the engine quality and condition of the car, but also to a large extent on how the car is being driven. This information is then transmitted over the regular GSM wireless network that we use for cell phones, where the data is then analyzed by back-end systems.

"Once that information is there, you could open up many business models," he continues. "The one we've chosen to implement first is that we are linking driving behavior directly to the price at which the fuel gets sold to the driver." Obviously, the aim is to encourage 'greener' driving by offering cheaper fuel to those who drive more responsibly – not accelerating or braking heavily, not traveling at illegally high speeds, and so on. The prices individual motorists receive at the pumps are calculated by algorithms in the back-office IT system and then the plan is to display these prices on an LCD screen retrofitted to the pump.

On first impressions, one would be inclined to think that such a system – and the potential cost-savings it could generate by positively influencing driver behavior – would appeal more to fleet managers than individual motorists, a point that Bindra disputes: "It's as much for individual drivers like you and I – it can make an enormous difference to our driving," he suggests. "The model behind this is that we need to make it cheaper for people to go green than not go green. Although everyone is talking about Copenhagen, emissions cuts and carbon taxes, Logica believes that a lot can be achieved just by changing behavior. And if we can link financial incentives to behavior, then change starts happening. Even if you have all the money in world, if you go to a fuel pump and realize that the car in front is getting the same amount of fuel for a cheaper price, you won't just ignore that.

"Many regulators are looking at changing the current tax methodology to make a far more progressive modern tax system, and want to get away from having higher taxes on high-end cars at the time of purchase. Bringing in differential fuel pricing in a manner that changes behavior is preferable to making an already premium car even more premium by taxing it more."

Logica EMO is currently being trialed in a number of pilot projects across the world and Bindra reports 'phenomenal' feedback from governments, regulators and

> "Even if you have all the money in the world, if you go to a fuel pump and see the car in front getting the same amount of fuel cheaper, you won't ignore that"

oil companies alike. Looking to the future, he predicts the first region likely to adopt such a system would be Europe: "It's far ahead of other parts of the world in terms of citizens and governments wanting to make a difference on environmental matters. The lead is coming from Europe so I think that's the market that will favor new innovations."

IN THE RED
An equally innovative but perhaps less controversial system that Logica is also working on is a pay as you drive (PAYD) insurance concept called Crimson. "It's very similar technology wise," he says. "The same system that's used for Logica EMO can be upgraded and Crimson can sit on top of it. If a country decides not to change the tax system to bring in Logica EMO, Crimson can also be deployed independently. It is another in-car solution that offers drivers more flexibility in what they spend on journeys.

"Instead of paying insurance as a lump sum, it works just like Pay As You Go cell phones, and your insurance fees are debited from your account as you drive. It can be set

up to do this automatically, or drivers can choose when to top up their accounts."

As with Logica EMO, the aim is to alter behavior by bringing about a greater consciousness of the true costs of driving and the affect that drivers' behavior can have on their mobility. Again, there are environmental benefits and financial incentives to those able to make changes – such as walking instead of driving for shorter journeys. Bindra says that all drivers can benefit from this new system, including those with no choice as to how many miles they drive: "Today, drivers who cover lower mileages each year subsidize those who drive more – both pay similar insurance costs. With Crimson, low mileage drivers pay a lot less. There is also a capped upper limit, so there is virtually no risk to a driver that if he chooses this insurance model, he'll pay more than with a standard model."

REALIZING REVENUE RESPONSE

Great news for motorists, then, but how on earth do you sell a system that's designed to generate less revenue to the insurance

companies themselves? Bindra chuckles, "When we started selling to them, they'd say 'why are you trying to cannibalize our revenue?' But of course they quickly realized the benefits of this approach. Their aim is to improve the quality of revenue, meaning the amount of money collected from premiums minus the money to process claims. With Crimson, the number of claims – both genuine and false – drops. For one thing, if a car is stolen, a tracking device can be activated to locate it, leading to fewer claims for stolen cars. There's also a human behavioral element: studies show that if a driver is aware of a black box device in his car monitoring his behavior, he tends to respond by driving more responsibly – which we'd hope would lead to fewer accidents. So, yes, drivers are paying less for their premiums, but they're also claiming less, leading to better quality of revenues."

A debate on any form of PAYD charging must consider those drivers that, for whatever reason, do not wish to switch to a new system. Bindra bats away the old privacy argument by stating that Crimson

doesn't record data on driver behavior (it continually re-writes over previous data) and that the only time the tracking component would be deployed is if the car is reported as stolen. For those still not convinced, talk turns to 'added-value features'.

"We are working with insurers to see what added value we can bring to the device to encourage drivers to switch. One of the things we are considering – applicable to both EMO and Crimson – is to use the device to provide audio feedback (beeps of different frequencies) to indicate when a car is being driven irresponsibly. This all relates to the ethos of encouraging good behavior. Many people don't even realize when they are driving to poor standards, either in terms of fuel efficiency or general safety, and they respond well to this extra guidance."

Crimson is being used in advanced pilots and Bindra says that virtually every large insurance company in the world is trialing it. Logica's innovation expert certainly has high hopes for this new system: "In my view, in a few years' time, this is the only way that motor insurance will be sold." ◼

Net-centric control

This large-scale visualization solution harnesses the power of the network for real-time access to vital information for proactive decision-making and collaboration, meaning traffic can be effectively managed, congestion reduced, and incidents cleared quickly

by Theresa Myers, Activu, USA

The central nervous system of many ITS networks is the operations center, within which some major technological advances have evolved recently that are taking traffic management to a whole new level. This is aptly demonstrated at the recently opened New Jersey Traffic Management Center (TMC) at Woodbridge, New Jersey. There, the New Jersey Turnpike, Garden State Parkway, the New Jersey State DOT and State Police have come together physically and figuratively in a state-of-the-art facility that may prove to be a model for future TMCs.

The centerpiece of the new US$29 million facility is a two-story operations hub with an 18ft x 50ft wall display driven by net-centric Activu software to monitor and control traffic operations, upon which the TMC can monitor real-time roadway situations via the 150 Turnpike and 300 DOT traffic cameras throughout the state. "What it allows is an integrated view of incidents statewide, enabling operational personnel to make better and more informed decisions regarding potential traffic impact on the roadways," advises Paul Noble, CEO of Activu, the company responsible for the intelligence behind the wall display – a network-based software solution for large-scale visualization and collaborative decision-making running on the center's data walls and desktops. Additionally, Activu designed and built the entire visualization system, including the large wall display comprised of 48 Mitsubishi 67in rear-projection cubes, as well as another smaller wall display in the executive briefing room.

⬆ **The new Woodbridge TMC provides a level of inter-agency traffic and data sharing that was previously impossible**

In such mission-critical environments, organizations invest in a wide range of systems that produce information vital to conducting operations. But to gain the maximum benefit, Noble believes the key is to turn that information into knowledge, which can subsequently be made transparent across an organization. "A dynamic visualization system is an essential tool for making information readily available from the control room to the conference room and into the field," he confirms.

◄ **Activu allows situational awareness of what is happening on New Jersey's transport network**

Brian Gorman is the director of IT and Administration at the new TMC. Despite welcoming the fact that Activu offers him visibility of legacy applications, new applications, as well as the video information displayed on the wall, he suggests it provides something probably far more important – a virtual disaster recovery strategy. "We can literally take a laptop and go anywhere on our network. We are fortunate that when we did the E-ZPass deployment, we put fiber in the ground – around 440 miles of it, spanning throughout the state. There are around 120 areas where we have access nodes – all the toll plazas and service areas – so we can go to any one of those locations with a laptop, plug in and connect, meaning we can operate the center remotely."

SMART IDEAS, SMART PEOPLE

"The whole idea behind Activu – which we first developed over 10 years ago – was that visualization could be better handled by network-based software," Noble continues. "Our whole philosophy was to take a standard consumer server, such as an HP, Dell or IBM, and do what had previously been done with audio-visual proprietary devices. There is now a tremendous movement in the marketplace

toward IT solutions for the sharing of visual information versus AV solutions. We're now seeing IT professionals taking more decision-making roles that may have previously been fulfilled by AV professionals – and these guys welcome the concept of open software-based solutions running on standard IT hardware. There's a generation of very smart, savvy IT-focused people that are employing the latest IT technology, and I think Brian Gorman is a case in point. He realizes the enormous power of distributed information visualization across the WAN and into the homes of key executives, who might find themselves at home in the middle of the night when a situation arises. And this is easily achieved with Activu."

Activu advances the visualization paradigm by creating a visual layer in the network that puts people at the center of the information ecosystem, enabling the dynamic aggregation of visual information from anywhere within the network and its visual integration on display walls, flat-panels, workstations and even laptops and Windows-based handheld devices. "Consolidated visual information can be assimilated, analyzed and shared person-to-person, team-to-team, display-to-display and site-to-site to create a fluid and dynamic collaborative environment," Noble explains.

Integrated within a network, Activu enables organizations to leverage their existing IP network infrastructure, creating what Noble describes as "a borderless information ecosystem in which users and operators, devices, sources and displays are seamlessly connected", regardless of location and distance. Deployed on commercial-off-the-shelf (COTS) server and display hardware, it provides a cost-effective platform. Furthermore, as a scalable system, it is quite easy to add new operators, displays, information sources and locations, simply by connecting them to the network. "This gives organizations the flexibility to evolve with changing demands, while avoiding the expense, operational inconvenience and functional constraints of hard-wired 'stove-piped' systems."

Such an open-architecture approach enables a broad range of sources to be

aggregated, displayed, controlled and shared. Additionally, analog sources can also be displayed and shared. "This open and dynamic visual layer helps sustain accurate situational awareness and a complete operating picture," Noble adds. "Aggregated real-time information can be instantly reconfigured to adjust to rapidly evolving situational requirements. There is also no restriction on the number of sources that can be simultaneously viewed in a single display, while users can also activate and operate devices such as video cameras, etc."

BOTTOM-UP APPROACH
Although Activu's technology has played a big part in operational improvements at Woodbridge, Noble feels much credit should go to Gorman's unique approach. Collaboration, he feels, is designed into the facility from the ground up. "It is tailored specifically to our needs," Gorman confirms. "Rather than have architects come in and design something, with us trying to fit into the space, we did the reverse. The aim was to create an environment that improves the flow of information and the quality of decisions that we make at the facility."

So, how has this collaborative process improved life for New Jersey's travelers? For

starters, the mean-time to remove incidents from the roadways has been reduced. "What's really meaningful about that – and what most people don't recognize – is the real impact on traffic," Gorman says. "During peak travel times, we use a pretty standard metric: for every minute there's no mitigation on an incident, a mile of traffic will back up. That mile of traffic actually takes 12 to 15 minutes to clear. Extrapolate that to four miles and motorists are facing up to an hour of delay. Minimizing the mean-time to clear incidents off the roadway has dramatic effects."

Although Woodbridge features all the bells and whistles you would expect for a near US$30 million outlay, Noble stresses that as a result of the Activu software-based approach, you can do a lot more for less. "In a cash-strapped industry, you can add intelligence to what you have for a fraction of what it would cost to start from scratch. TMCs can install a very robust, net-centric solution that allows them to collaborate, but it doesn't have to be a huge wall such as at Woodbridge. With Activu, you can have the same kind of control on a variety of platforms, even in the palm of your hand." ■

For more information, contact Activu by phone at +1 973 366 5550, email info@activu.com, or log on to www.activu.com/traffic

Through the use of integrated technology, information is presented to a cross-agency team to aid in solving regional transportation incidents more quickly and effectively

The network's nucleus

Dubai's congestion problems are the stuff of folklore. But the continuing integration of intelligent traffic management systems – under the guise of the FALCON project – is increasing safety, as well as ensuring smoother and more reliable journeys for all

by Kate Huber, Optelecom-NKF, the Netherlands

Dubai is incontestably one of the most financially pivotal cities in the Gulf region, but sitting in a traffic jam in the sweltering desert heat is, as any businessman will testify, certainly not what makes the city a success. Yet, as Dubai absorbs a good deal of the interchange between international companies, this worldly city has inevitably been confronted with growing rates in traffic accidents and congestion.

The Dubai Roads and Transport Authority (RTA) has definitely not stood still while cars pile up in its coastal city. Rather, it took direct action to reduce mishaps and bottlenecks by introducing an advanced intelligent traffic system, which has been instrumental in decreasing traffic collisions as well as improving traffic flow.

RTA contracted Scientechnic – a leading project engineering and system installation company – to undertake the implementation of the system throughout Dubai's traffic infrastructure. Known as the Freeway and Local Coordinated Operations Network (FALCON), the project entailed designing a system capable of transmitting large amounts of real-time data from various sources, such as sensors and cameras, over an IP fiber-optic network. Ultimately, it has come to include a number of cutting-edge traffic technologies, including automatic incident detection (AID) and centralized traffic management.

AN INTELLIGENT INFRASTRUCTURE
Tasked with the construction of a robust traffic management system, Scientechnic designed a fully integrated network, incorporating the existing infrastructure, such as arterial and expressway traffic signals, as well as a plethora of new technologies into the ITS. In order to realize these plans, an IP network had to replace the existing point-to-point analog system. This required technology that could both cleverly connect the enormous number of video streams involved as well as handle the extreme temperatures of the region's climate.

What was self-evident was that a smart and sturdy switch was vital to the project's success.

In general, switches are the nucleus of a network. They receive and analyze data packets in order to appropriately dispatch the information to the relevant locations. A good switch is capable of both ensuring quality network performance and conserving bandwidth. Yet with the vast and varied data packets being sent over Dubai's ITS network – coupled with the need for a switch that could function in such high temperatures – finding just the right hardware to carry out the task at hand was a project all on its own. Ultimately, the solution was made possible

through Optelecom-NKF, a leading global supplier of advanced video surveillance solutions, which provided the FALCON project with its Siqura XSNet 2800 SW switches (pictured above left).

"The Siqura switches fit seamlessly into our entire project, and the local support from Optelecom-NKF provided a key resource in designing this architecture," explains Scientechnic's Brijesh Moothat. "The XSNet 2800 SW switch was selected as a result of its capability to perform in high operating temperatures. The Gulf countries – being some of the hottest places during summer – require that all field equipment can endure an extended

temperature range. Siqura XSNet switches have an operating temperature of up to 75°C, which makes them suitable for operation in the Middle East."

DIRECTING TRAFFIC IN DUBAI

Once united by Siqura switches, Dubai's ITS revolves around servers, field devices, system applications, and management and viewing software, each part helping to make traffic flow safer and more efficient.

Populating the streets of Dubai are a number of sensors and cameras, connected to a CCTV system and servers. Although on the one hand these devices allow operators in a control room to monitor the overall

traffic situation, dedicated servers also apply incident detection algorithms to the video. These algorithms enable the system to detect an array of events, from pedestrians, stopped vehicles, wrong-way drivers, and lost cargo to queuing, speed drops, and even the presence of smoke. Detected incidents can then trigger alarms to alert operators as necessary.

From centralized control rooms, operators can then instantly evaluate the severity of a situation and respond quickly and confidently. This may entail adjusting lane control signs, variable speed signs, or dynamic message signs (DMS) as well as informing authorities, such as the police, fire department, or emergency medical services.

The Dubai ITS also includes an option for traffic authorities to define and customize emergency protocols for specified events, such as a fire in a tunnel. Equipped with such precise and prepared response plans, operators can competently and consistently initiate just the right reaction to possible occurrences. By doing this, traffic in Dubai can continue more smoothly and safely, despite obstructions or mishaps.

Motorists themselves benefit twofold from this intelligent and integrated traffic management system. First, as traffic is

directed effectively through DMS and variable lane and speed signs, bottlenecks in Dubai are less of a burden. Additionally, up-to-date traffic information is made available to drivers via a graphical user interface on the internet, in information kiosks, or text messaging services. As a result, travelers can plan their route so as to literally steer clear of any congestion.

RELIABLE ROADS

As business and commerce in the Middle East expand at astonishing rates, roads are jamming up almost as soon as they open. Worldwide, gridlock and traffic jams continue to detrimentally impact people's lives as well as the economy. Yet drivers hitting the highways in Dubai today can now depend on the ITS – implemented by Scientechnic and connected through Siqura switches – to make it easy to get to where they're going. The ease with which authorities, operators, and travelers alike can plan and react to traffic situations reveals once more just how helpful innovative traffic technologies can be. ∎

To find out more information, please contact Optelecom-NKF by telephoning +31 182 592 470, emailing khuber@optelecom-nkf.com, or visit the company's website at www.optelecom-nkf.com

That personal touch

How you view your RWIS data is just as important as the way you collect it. Although there are many ways that this can be achieved, this new software package provides users with more control over how they view it, even allowing for personalization

by Rose Mooney, Quixote Transportation Technologies Inc, USA

The effects of inclement weather threaten transportation across the USA, impacting roadway safety, mobility, and productivity. Figures reveal approximately 1.5 million adverse weather-related crashes a year resulting in 7,400 fatalities and over 800,000 injuries. Overall, the injuries, loss of life, and property damage caused by these weather-related crashes cost an average of US$42 billion. [1]

Every year, DOTs spend millions in salt and chemicals for anti-icing and snow/ ice removal on pavements, but they're always looking at ways to limit the use of these chemicals due to the cost as well as the adverse impact they have on the environment. Chemicals affect watersheds, air quality, and road infrastructure.

Although the safety of motorists is a top concern for monitoring the road conditions, the cost of traveling delays is another – said to be US$9.5 billion a year for 85 major urban areas in the USA. Weather causes account for 25% of non-recurrent delays on highways and there are an estimated 554 million vehicle-hours of delay per year from snow, ice and fog, and other weather-related conditions. Roadway weather delays have a large economic impact as they add US$3.4 billion to freight costs annually. [2]

In an effort to provide safe roadways, reduce associated costs related to winter maintenance, and reduce economic monetary loss due to weather-related road delays, agencies have been using road weather information systems (RWIS) to gain additional information for surface transportation applications. An RWIS can be explained as a combination of technologies and decision-making techniques that use detailed, historical and real-time road and weather information to improve the efficiency of highway maintenance operations and distribute effective real-time information to travelers. [3]

An RWIS station generally consists of pavement sensors that can provide pavement temperature, condition and freeze point. They might also feature atmospheric devices for information such as wind speed/ direction, precipitation rate/type, visibility, relative humidity, and a camera for visual road and traffic conditions. Other optional sensors provide information on conditions such as traffic flow, barometric pressure, snow depth, subsurface temperature, and air quality. An RWIS station is typically deployed close to the roadway and gathers the information provided by the various environmental sensors, and processes it in the field, before sending the collected data to a central processing unit (CPU). Once the data is collected, it is displayed within a user's interface software within which information can be viewed and analyzed.

IMPORTANT CHARACTERISTICS

Although it is important to have RWIS stations and the correct suite of sensors deployed gathering various data, the software interface is as much – if not more – of an important factor. Without effective software to display and analyze all the pavement and atmospheric data being collected from the field stations, crucial and timely decisions suffer. The software interface allows transportation managers to easily obtain and understand the full picture of current weather and roadway conditions, information that assists in allowing them to efficiently manage resources, more effectively maintain their roadways, and give credible and precise travel advice. Road and weather information is used to make a number of critical decisions, such as when and where to treat the roads for snow or ice, when roads should be closed due to drifting snow, high winds, low visibility, or even flooding. It is also valuable in helping managers decide when to post travel advisories.


Significant investments in winter maintenance research have been made in the USA and other countries, reflecting the importance of the subject and its huge economic and safety implications

Navigator software allows users to customize data views and set up alarming and alerting notifications based on specific weather parameters

The problem with many high-tech systems today is that the software can be complicated and tedious to view, and as such can slow acceptance of the technology – or worse, prevent users from adopting the technology at all. Before purchasing an RWIS software interface, the quality and usability of the software should be evaluated, as it is critical to have the right user interface to fulfill your agency's needs. Even with the best deployment and utilization of RWIS stations, problems will arise when the software interface does not present the RWIS data in an organized, easy-to-use and understandable fashion. With an inefficient user interface, the data collected from the various field sensors could be improperly interpreted, which in turn will impact important decisions, or the data collected may not be usable or reliable altogether. Many people are resistant to change and if the new way is too complicated or requires a tremendous amount of effort, it is easy to revert back to the previous, simpler, and more comfortable way of doing things.

The best software interface designs are simple and easy to learn and use. Having a clear and understandable interface helps prevent errors and makes important information obvious. Every visual element that appears on the screen should grab attention and contribute to understanding the information presented. The software should provide clear and concise displays in a wide range of formats, from summary overviews to detailed site-level displays. Depending upon user preferences, summaries and detailed site levels should be able to be viewed in either a user-chosen map or table format. It is also important that the software menu provides easy access to all pages. In addition, embedded links throughout the page views would offer additional and easy navigation capabilities.

Another important feature for RWIS software is the capability to view camera images by station, along with streaming video for those sites configured for this application. These would give users a good visual of conditions as well as validate the gathered data. Further, the availability of historical data is valuable as it provides
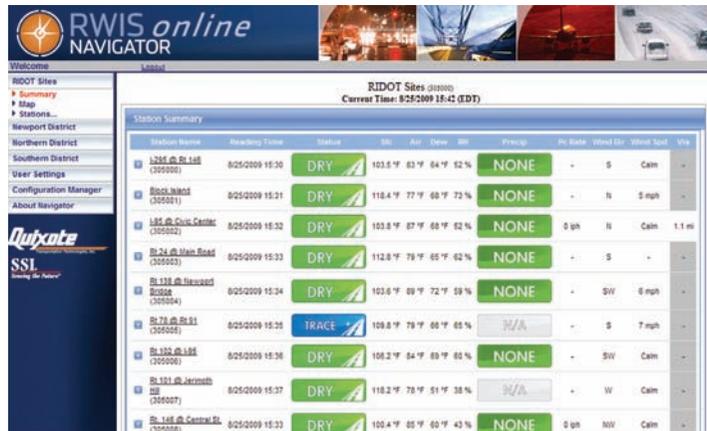
The average annual cost of floods in the USA has been calculated at US$2.41 billion

important information about past trends, storms and events, which can offer insight into future decisions and strategies.

A user's software interface that has a fully integrated alarming and alerting application capable of monitoring data for critical, user-specified conditions may be the most valuable tool. The capability to send warning notifications as defined by the user allows time for deployment of snowplows, road treatment, and public advisories.

A common feature requested by RWIS users is for the interface software to have an easy-to-use built-in configuration manager. Everyone has their own preferences about how things should look and feel, and they like to view data in a certain order. Giving the user the power to configure each webpage and display the data that matters most will ensure the best usage of the software. Having the flexibility to configure the software – such as supplying your own

map images (regional and station level) – gives an agency a unique and powerful system customized to meet their needs.

NEW CHAPTER IN RWIS SOFTWARE

A longstanding perception is that an RWIS user interface had to reside on a user-owned server, with the agency being responsible for all server administration and users either dialed in or accessed data via the internet with a browser. This was an acceptable and fairly easy way to view RWIS data before tighter security and firewalls became highly important. However, in the past few years, there has been an alternative method introduced to view RWIS data known as a hosted server option. Now it is a question of server-based versus the RWIS vendor owning the server and hosting the data. Although there are many agencies that still prefer to own their own RWIS server and be responsible for the data collection and administration duties, others are migrating to the RWIS vendor-hosted option. With the hosted version, all of the same RWIS data is gathered and can be viewed – however, it eliminates the requirement of the customer to purchase their own server. The hosted option removes the administration issues and security barriers encountered by some agencies. The data is viewed on a password-protected website and can be accessed by any computer capable of running a web browser. This makes viewing the data at any time of day or night simpler and hassle-free. Also, with the hosted data option, it opens the door to data-sharing among the RWIS fraternity. All who participate in the hosted environment can share data and in turn have viewing capabilities of the other agencies participating in the program. A hosted
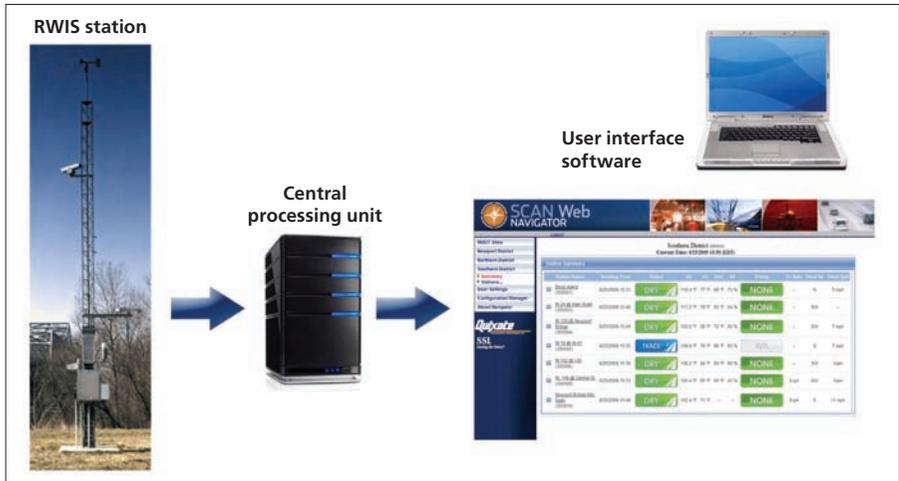
RWIS station

Central processing unit

User interface software

solution is a good alternative without losing any software capabilities or features.

SHARING YOUR WEATHER DATA

The idea of solely relying on your own pavement and weather condition information being enough to make critical time-saving, money-saving, and most importantly life-saving decisions, is declining. When RWIS stations were first deployed 35 years ago, they were not developed with the concept of sharing data. Data was collected from the various deployed weather stations – typically within a particular region or district – and brought back to a central server for only that district, region or DOT to view. Not much thought was given to the value of sharing this information with others. In time, with the deployment of more RWIS stations, agencies soon created their own 'RWIS islands'. The system in place provided pavement and weather data within that agency's parameters, but as we all know, weather does not stop when crossing a district, region, county, city, or state line.

As more RWIS stations were deployed, it became apparent that a full weather and pavement condition picture was essential to transportation managers, weather providers, and the public when making weather- and road-related decisions. The facts show that insufficient or poor quality road weather information can become costly in economic and human terms. In 2004, the USDOT's FHWA – in conjunction with the ITS Joint Program Office – established the Clarus Initiative. This research and development program was formed to reduce the impact of adverse weather conditions for surface transportation users and provide a more accurate and complete weather picture

RWIS data is easily viewed with clear, user-friendly displays for quick review of site conditions

to transportation managers and weather providers. Currently, Clarus collects weather observations from both weather and transportation sources at a central electronic location and then turns them into valuable road information available for everyone to view. Types of data collected include atmospheric data, pavement data, and water-level data. The vision is for the nationwide participation of all transportation agencies. As of December 31, 2008, 33 states were connected and 10 were pending connection. The number of Environmental Sensing Stations (ESS) or RWIS totaled 1,700, with 34,260 sensors providing data.[5] The impact and importance of data-sharing is clear.

THE HAPPY ENDING

With nearly four decades of experience in providing RWIS globally, Quixote Transportation Technologies Inc (QTT) not only knows the importance of providing quality data-collecting systems but also the importance of viewing the data on a reliable, well-designed RWIS user interface software.

Navigator is the newest web-based RWIS user interface from QTT. There are two product offerings for Navigator software. The first is RWIS online Navigator, where QTT hosts the collected RWIS data on a password-protected website. RWIS online Navigator offers a data-sharing option, which will enable the user to view other agencies' RWIS data, including camera images, if they are also data-sharing participants.

The second product offering is SCAN Web Navigator for those who prefer to collect and host data on their own server. Both product offerings have the same high level of software features, including interactive maps that update automatically, and the ability to supply, create and configure your own regional and station-level maps. Users can configure each web page to display the data that matters most, and in the format they desire. The built-in configuration manager provides administrative-level access to manage user accounts, application permissions, station groups, stations, and data content. Other features – such as alarming and alerting, historical data table and graphs, and PDA applications – add to the list of benefits. Future plans of integrating Clarus and mobile weather data into this interface will make it an even more effective tool. With the industry and public need for more precise, relevant and timely weather information, it is no longer just about collecting the data, it is also about how the data is presented, analyzed, and shared to assist those making critical decisions, and to help ensure the well-being of our economy and the traveling public. ■

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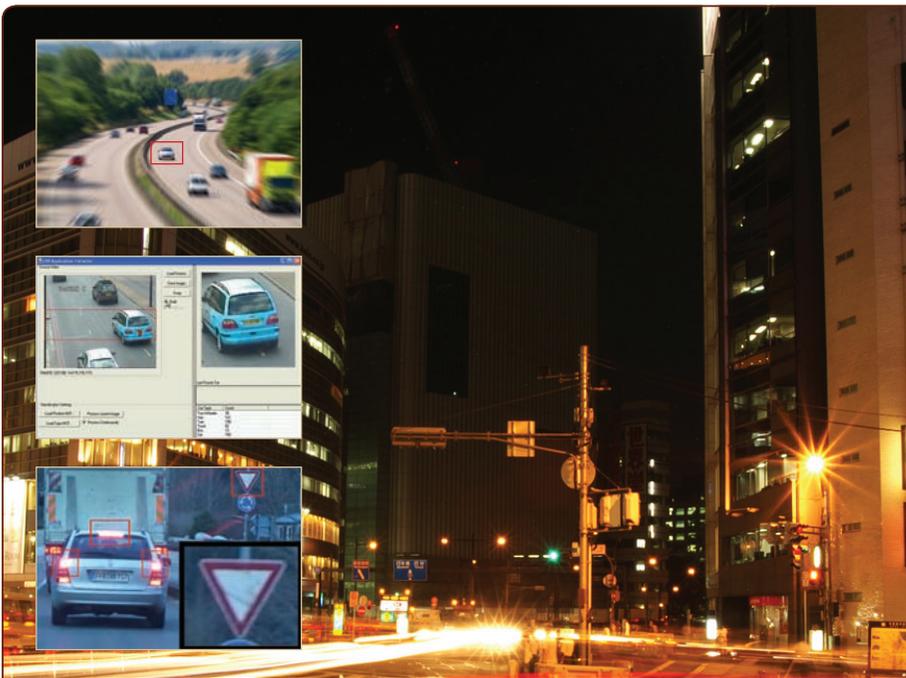
Something in the air

A number of developments in emissions modeling software from a notable player in the sector are helping transport planners to meet the ever more stringent legislation that affects traffic traveling through their cities and towns

by Peter Vortisch, PTV, Germany

Traffic planners do not have an easy life these days. Reducing traffic emissions, in particular, is an especially complex field. The trend toward low emission zones in cities and the introduction of pollution-busting legislation means they're faced with all kinds of dilemmas, more so when up against the need to make journeys quicker while all the time trying to reduce congestion. But the quickest, most straightforward route through a town may not be the most efficient in terms of emissions. And as whole sections of networks become 'no go' areas for vehicles as a result of high pollution levels, the problems that traffic planners face rapidly multiply.

Historically, reducing emissions on the roads was targeted toward the vehicle OEMs. The introduction of catalytic converters for instance, has led to modern vehicles emitting very low levels of pollutants, such as carbon monoxide – so much so that in some areas, what comes out of your tailpipe may be cleaner than the outside air you breathe.

Without doubt, modern cars are far cleaner than they were even five years ago, but challenges nevertheless remain. Cold starts, for instance, are a huge conundrum: the first few miles before an engine and catalytic converter reach optimum operating temperature are of particular focus. Fifteen years ago, these first few miles were not as important as emissions were high overall – they were just part of the problem. Today, though, the relative importance of several

miles of higher emissions in what's normally a very low polluting vehicle should not be underestimated. And if you're only using the car for a three-mile journey, the issue is further exacerbated. A number of countries have launched campaigns to encourage motorists to leave their cars at home for short journeys – and if reducing CO_2 isn't enough of an incentive, they're being asked to focus on the cost of the fuel that they are consuming for those journeys that could be undertaken on foot or by bicycle.

So, with vehicle manufacturers and drivers themselves seemingly on the case,

With the new software, planners could see how changes to traffic signal timings or other measures could affect not only traffic flows but emissions at intersections or other critical points

traffic planners also have a vested interest in assessing fuel consumption and emissions in relation to their roles. As with transport planning/engineering and traffic simulation in general, there is always a need to consider issues either on an aggregated (macroscopic) level, or on an individual (microscopic) level, depending upon individual desires.

UNDER THE MICROSCOPE

A car that drives along a road, stops at a traffic signal and then continues will consume a certain amount of fuel, which is not used at a constant rate. Stopping at the signal results in more emissions as the car accelerates away from a standstill and all stops will increase overall emissions. The microscopic level involves looking at that individual vehicle. Planners are finding that emissions modeling tools are increasingly valuable to their day-to-day work. A signal control setting that is optimal for travel times may not be optimal for emissions levels, for example, so simulation will help find a balance between potential solutions.

Working at the microscopic level means more than just defining an individual car. The emissions generated differ hugely between a small VW and a large Mercedes, for instance. To simulate emissions on a second-by-second basis requires detailed

PTV, TNO and Vialis have joined forces to combine VISSIM and VERSIT+ to create EnViver. This new emissions modeling tool combines TNO's emissions data with VISSIM's simulated traffic behavior of individual vehicles

information about different vehicles and how much fuel they consume in various driving situations. Very few organizations have such data (for instance, VW may have it, but only for its own vehicles). One institution that does have the data is the Dutch research organization TNO, which has partnered with PTV and another Dutch expert, Vialis, to develop a microscopic emissions package that can be integrated into PTV's VISSIM traffic modeling tool. TNO's existing emissions modeling tool was called VERSIT+ and was based on the emissions of around 2,800 cars measured in various conditions. By combining VISSIM and VERSIT+, a new product, EnViver, has been created.

Linking the emissions data of the TNO model with the simulated traffic behavior of individual vehicles in VISSIM has created a software add-on that can incorporate any kind of traffic situation – introducing a new roundabout or traffic signal, for instance – so the exact level of harmful emissions produced can be determined.

THE BIGGER PICTURE
When it comes to transport planning that regards things from a more aggregated level, this is where macroscopic modeling is useful. In layman's terms, macroscopic modeling allows planners to consider the effects of various strategies on whole chunks of the network. So, typical information available would consist of things such as how many vehicles per hour there are on a link. The main difference between this approach and the microscopic equivalent is that at the macroscopic level, there is no individual vehicle data – beyond classifying between cars and trucks. Strategic transport demand models such as PTV's VISUM calculate information on volumes per hour and how different traffic conditions impact emissions. These models yield traffic volumes either as totals or disaggregated by vehicle type (e.g. cars, light trucks, heavy trucks). The volumes are then multiplied by emissions factors, which represent combinations of several factors. Speed, link type (such as motorway versus city street), engine type, gradient, and even temperature all have a considerable impact.

The functional relationship is determined through a vast amount of empirical work, measuring actual emissions in the field and in the lab, taking a variety of driving patterns into consideration.

There is also a link between VISUM and the newly revised *Handbuch Emissionsfaktoren* (HBEFA) 3.1 – a comprehensive database of emissions factors that now encompasses data from a number of European countries. How does the VISUM-HBEFA 3.1 link simplify life for the transportation planner? The first step is mapping the vehicle types used in the demand model to those used in HBEFA. Demand models typically distinguish only a very small number of vehicle types, known as transportation systems (often only cars and trucks), which is much too aggregated for successful calculations. In fact, each transportation system represents a mix of many vehicle types that behave similarly in terms of demand modeling yet have very different emission factors. The providers of HBEFA offer ready-made mixed fleets for different countries and years as part of the

Governments can use hard environmental figures to tackle traffic flow, especially with an eye toward the environmental lobby

database. For a national model of a region in Austria, for instance, the planner might map the VISUM transportation system 'car' to the HBEFA standard fleet-mix 'car Austria 2015', composed of dozens of specific vehicle types. Different traffic situations (e.g. stop-and-go versus free-flow traffic) can also be defined. With these two mappings in place, emissions calculation becomes an easy post-processing of an assignment result from the demand model. For each network link, VISUM breaks down the volume to the HBEFA fleet mix, looks up the traffic situation and its emission factor, corrects for gradient, and multiplies the result.

Modern software packages such as VISUM store the full trajectory for each assigned trip, so by inverting this data it is possible to tell which fraction of the volume on a given network link corresponds to vehicles within the first few hundred meters of their trip, so accounting for cold starts. After adjusting for cordoning effects near the model boundary, this data can be used to make a calculation, derived from the model, rather than being a pure guesstimate of cold-start emissions. Such a capability may alter the total emissions distribution considerably.

With the new models on offer (the VISUM-HBEFA 3.1 link and the EnViver tool) PTV is in a position to exactly compute emissions. Whether a transport planner is tasked with assessing signal control with VISSIM or assessing the whole network with VISUM, they now have additional, accurate emissions data at their fingertips. ■

To find out more contact PTV by calling +49 721 9651 0, emailing thomas.friderich@ptv.de, or log on to the company's website at www.ptvag.com

Detection innovation

The trend toward LEDs has been noticeable across many sectors, with many applications in the traffic management industry. The latest advance, though, combining illumination with detection, is opening up new horizons for ITS

by Dave Gilbert, LeddarTech, Canada

With the continued development of LED-based illumination, the lighting market has brought about huge changes for many industries. The transportation sector was one of the earliest adopters of the technology, with the introduction of LED-based traffic signals and pedestrian indicators. Clear benefits have also been identified for replacing streetlamps with LED illumination.

Notwithstanding the benefits of LEDs, there is another compelling argument for the LED currently in development at the Canadian organization LeddarTech. The company has leveraged a major technological benefit of the LED by using it not only for a primary function of illumination, but also a secondary function of detection and ranging. The technology, named LEDDAR (Light Emitting Diode Detection And Ranging), provides multiple object detection using either visible or non-visible illumination provided by the LED. Similar to the lidar principle, LEDDAR is a time-of-flight-based 3D sensor providing detection and ranging information from the scene.

As opposed to lidar devices, this new technology benefits from the use of the illumination provided by the LED source, thereby enabling ease of installation and alignment. In addition, as a result of advances in digital signal processing, it provides the robustness needed for detecting objects in adverse weather conditions regardless of the time of day.

Various detection technologies for traffic management systems exist today, but none offer the 3D perspective that the LEDDAR technology does. Here, objects are continuously tracked regardless of whether they are moving or not, making the system ideal for stop-bar vehicle detection as well as pedestrian/bicycle detection. Another important feature is that the non-intrusive LEDDAR units can be mounted practically at any height at the intersection as – unlike traditional camera systems – they are not influenced by the horizon. As the technology is always measuring range information the sensor is able to provide equivalent or better detection performance compared to inductive loops. It also provides direction
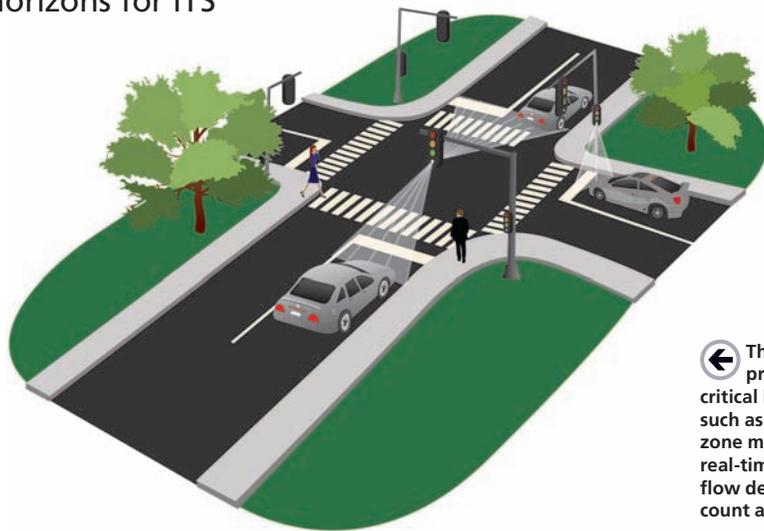
The sensing unit provides added critical information, such as continuous zone monitoring, real-time traffic-flow density, vehicle count and speed

of travel, which is critical in avoiding false calls for traffic intersection management. In addition, wireless capability is achieved as all the data is processed within the sensor itself, in doing so avoiding complex connectivity and post-processing CPUs at a secondary location. Basic features aside, the sensor can also provide valuable analytical data related to count and vehicle speed.

FROM PROTOTYPE TO PRODUCT

During the development of the first prototypes, LeddarTech focused on ensuring a user-friendly installation process as well as providing flexibility in configuring the number of detection lanes. Two prototype
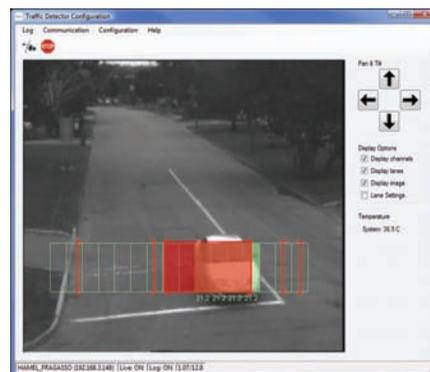
The LEDDAR sensing unit has been successfully field-tested in traffic intersection applications

versions for traffic management applications have now been developed, which have been field-tested to compare the detection performance to that of inductive loops, which still represent 80% of installed traffic detection systems. The proof-of-concept experimentations were critical in order to validate the technology's maturity in meeting transportation requirements. Not only was the performance very similar to that of inductive loops, ease of configuration and installation was also highly impressive.

LeddarTech is currently finalizing the development of the product version intended for vehicle detection for intersection traffic management, which will be launched in Q2 2010. This first version of the sensor will have an independent LED source as emitter with a corresponding receiver. The sensor will be located within a separate enclosure capable of being mounted at any location. It will have multiple detection zones that are fully configurable by the user and compatible with current traffic controller interfaces.

LeddarTech is also studying other smart lighting concepts, notably the advent of LED street lights and LED parking luminaires in which the LEDDAR technology can conveniently be integrated and can leverage the value of the lighting function with advanced detection applications. ∎

To find out more, please contact LeddarTech by calling +1 418 653 9000, emailing dave.gilbert@leddartech.com, or alternatively visit the company's website at www.leddartech.com

Glare necessities

Reducing dangerous glare from roadway luminaires has been a longstanding challenge for those in the lighting industry. Could the use of low-power, lighting-grade LEDs address this issue while also making energy savings?

by Eric Anderson, Philips Hadco, USA

When traveling at night, most drivers have experienced the nuisance of discomfort glare originating from roadway luminaires. Meant to provide illumination for safe driving during dark hours, roadway lighting can sometimes be more of a distraction than a service to the traveler. In fact, in extreme cases, the glare coming from street lighting can actually be disabling and dangerous, causing a temporary reduction in visibility rather than an improvement.

Glare can be a result of many factors, including luminaire design, mounting height, mounting angle, or lamp source. According to the Lighting Research Center in Troy, New York, glare can be thought of as objectionable brightness. "It can be disabling or discomforting. There are several kinds of glare, the worst of which is disability glare, as it causes a loss of visibility from stray light being scattered within the eye. Discomfort glare is the sensation of annoyance or even pain induced by overly bright sources. Think of driving along a dark road when an oncoming car with bright headlights suddenly appears. The sudden bright light can be uncomfortable and make it difficult

to see. Discomfort and even disability glare can also be caused by streetlights, parking lot lights, floodlights, signs, sports field lighting, and decorative and landscape lights."

Although an energy-saving solution, luminaires equipped with LED light sources can be a major contributor to discomfort and disability glare on the roadway, if not designed properly. As a result of the inherent directionality of the source, LED luminaires can be very bright and harsh to look at from a street level. An ideal luminaire design will offer sufficient illumination levels on the ground while creating the effect of minimal light at the luminaire. One way to accomplish this is by spreading the light source over as large of an area as possible, so there isn't one specific point where the light is originating from. High-powered LED sources have offered luminaire designers the ability to accomplish this to a degree by spreading out the LEDs over the surface area of the luminaire. However, the directionality and brightness of each LED source can still be overpowering if not addressed properly with optic design. Unfortunately, redirecting the light from the LED through a secondary optic can cause some undesirable loss in efficiency and light output.

ILLUMINATED THINKING

Philips Hadco has taken the high-powered LED approach a step further by incorporating thousands of low-power, lighting-grade LED devices in its Evolaire street and area luminaire, instead of only tens or hundreds of high-power LEDs, as

is common practice with other lighting manufacturers. In fact, the WL100X model uses 1,440 LEDs and the WL150X model uses 2,160. These two luminaires can achieve the same level of illumination as 250W and 350W high-intensity discharge (HID) luminaires respectively, while consuming less than half of the energy of the HID equivalents.

The combination of a high quantity of low-power, lighting-grade LED devices and the fact that each device is individually aimed and does not utilize a secondary optic allows the Evolaire to provide a very high level of illumination on the road surface, while being surprisingly glare-free and easy to look at directly. The angle of the LED panels can be easily adjusted for pole height and spacing, further reducing glare. In fact, out of 12 LED luminaire manufacturers recently tested in a pilot program in Houston, Texas, the Evolaire was considered to be the easiest to look at with regard to glare, and was also considered to have great uniformity and house-side shielding qualities. In another report from a separate pilot program undertaken in August 2009, its uniformity was praised by the town of Purcellville, Virginia: "Average horizontal roadway lighting levels achieved using the LED luminaires essentially provide the same level of illuminance as the mercury vapor HID luminaires that were replaced, with a discernable improvement in light uniformity on the roadway." ∎

Contact Philips Hadco, Philips Professional Luminaires North America (PLNA) by calling +1 717 359 7131, emailing e.anderson@philips.com, or visit www.hadco.com or www.hadcoLED.com

Direct approach

A new solution for interfacing Ethernet-based traffic signal control equipment to existing twisted copper pair circuits is proving particularly valuable in these challenging economic times, where investing in brand-new systems may no longer be an option

by Bruce M. Berman, ComNet, USA

Many system owners that want to upgrade the capabilities of their closed-loop traffic signalization systems – or even completely rebuild their current ITS communications infrastructure – are finding budget constraints are prohibiting them from doing so.

For many years, a large number of signalization systems were deployed utilizing analog-based frequency shift keying (FSK), with the communications media being conventional twisted copper pair circuits. Other systems were RF-based, but employed the use of wider-bandwidth coaxial cable in lieu of the more widely used balanced 600Ω copper transmission circuit. As a result of the inherent bandwidth limitations of these circuits – particularly the twisted pair variant – the data rate capability is very low, but was adequate when baud rates in the order of 1,200 or 2,400bps were common.

Most ITS-specific hardware is now available with an Ethernet electrical interface, allowing the equipment to be easily integrated onto virtually any Ethernet-based network platform. Ethernet data rates are in the order of 10/100 or 1,000Mbps, and the communications equipment that supports these rates is now commonplace within the ITS industry. To this end, a user with an installed base of copper media desiring to upgrade their existing signalization system with a latest-generation traffic signal controller faces a major dilemma regarding how to effectively interface the two successfully, as twisted copper pair or coaxial cable are not directly usable with Ethernet.

The limiting factor with any Ethernet-over-copper network is the distributed capacitance inherent in either the twisted pair or coaxial cable. This creates a low-pass response relative to the applied data and effectively reduces the transmission distance versus data rate, known as distance/bandwidth limitation. As the data rate increases, the maximum usable length of the copper circuit must decrease, or serious data errors will result, hence why the Ethernet standard of 100m maximum transmission distance through CAT-5E copper exists.

One solution is to build a new infrastructure (e.g. a fiber-optic cable plant),
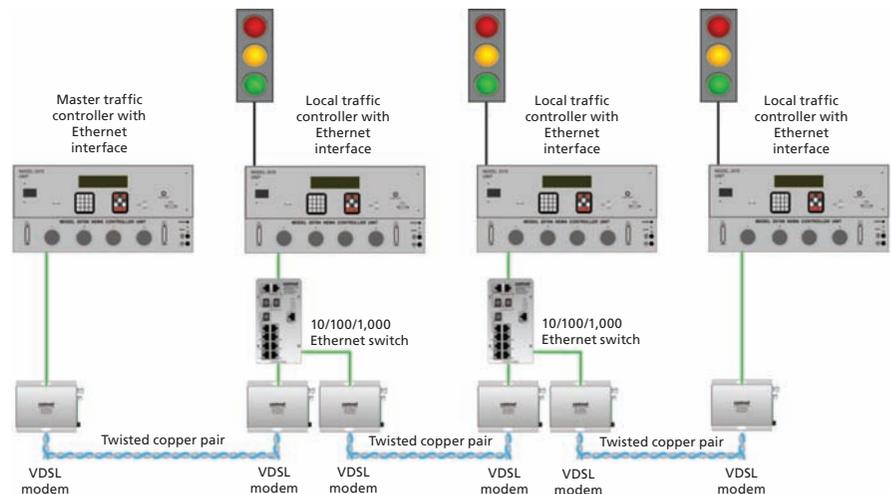
Upgrade of earlier generation system to Ethernet with existing twisted copper pair

although this is too costly for most ITS authorities. Recently, several innovative technologies have been developed to extend the useful transmission distance through copper. However, the majority of these devices are designed for deployment in benign, conditioned operating environments, and not the typical unconditioned roadside/out-of-plant environments encountered within ITS. Additionally, they are designed for use with CAT-5E copper wire and not the twisted pair found in early ITS systems.

NEW TOOLS FOR THE BOX

ComNet has introduced a product line that addresses these issues head-on and allows the user to retain existing copper-based infrastructure. These modems use the latest

in VDSL (Very high-speed Digital Subscriber Line) technology. One is a modem unit that allows the use of Ethernet over a conventional copper twisted pair circuit, up to a maximum of 3km (9,800ft) between modems, making it ideal for Ethernet-based signalization systems. The other is a modem unit that allows the use of Ethernet over conventional 75Ω coaxial cable, up to 2.6km (8,500ft).

These devices allow the latest-generation Ethernet traffic signal controllers to connect directly to the system owner's existing copper communication infrastructure. Point-to-point or the more commonly used point-to-multipoint network architectures are fully supported. The VDSL modem that can be used with 75Ω coaxial cable is designed for connecting IP-based CCTV cameras to an installed base of coax, for intersection monitoring or video detection systems.

Capable of running at a maximum Ethernet data rate of 100Mbps – and fully compliant with the NEMA TS-1/TS-2 standards for traffic signal control equipment – these small form factor units may be easily deployed within virtually any controller field cabinet. Installation is essentially plug-and-play and MTBF exceeds 100,000 hours, making the units extremely reliable. ∎

Please contact ComNet by calling +1 203 796 5300, emailing info@comnet.net, or visit www.comnet.net

Raised awareness

The successful combination of an innovative camera lowering device with pure Ethernet/IP communications for freeway and arterial roadway ITS devices is likely to see a more widespread rollout across Idaho's freeways and beyond

by Jim Larsen, Ada County Highway District, USA

The Ada County Highway District (ACHD) in the USA's state of Idaho has been using camera lowering systems on the I-84 and I-184 freeway network in the Boise region for the past seven years. The ease of maintenance and resulting time and cost savings made shifting to the lowering system concept from a standard 50ft (15.24m) pole with homemade camera bracket an easy decision. In partnership with the Idaho Transportation Department (ITD), ACHD now has approximately 20 lowering systems in place on the local freeway network, with plans to expand the number as funding permits. In anticipation of more deployments statewide, ITD recently awarded a multi-year contract to [MG]², Inc, the system's supplier.

PREPARED FOR ETHERNET/IP

In 2009 ACHD took the decision to start shifting its ITS communications network to an all-Ethernet/IP-based system. Many systems today utilize Ethernet by way of encoders and decoders located in a pole- or ground-mounted traffic cabinet. What's meant by an 'all-Ethernet-based system' – and what is specifically different with such a system – is the insertion of an IP-based CCTV camera. Running the Ethernet straight out of the camera eliminates the need for costly encoder/decoders. Most of the CCTV providers now have an IP dome-type camera. After a great deal of review and field testing, ACHD selected the Bosch

↑ Cameras can be installed at any height to provide a greater field of view as height is not limited to the reach of large bucket trucks

Series 500 IP camera to be installed on all new ITS projects.

In anticipation of the eventual (albeit likely to be slow) move toward a pure Ethernet deployment – where IP is run straight from the CCTV – the Alabama-based [MG]² had already begun development of a complementary lowering device, and in particular a contact connector, designed

← The IP-based video cameras deliver crystal clear MPEG-4 video of conditions out on the Idaho highways

→ The camera and its housing can be detached from its position atop a pole and lowered on a stainless steel wire aircraft cable

specifically for interfacing with the new Ethernet/IP CCTV cameras. The timing was perfect for ACHD to utilize this new Ethernet connector. The systems came prewired for IP/Ethernet connections using CAT 6 100 Base TX wire. Each connector included eight gold-plated contacts for the CAT 6 Cable, four additional gold-plated contacts that may be used for power or alarms, and a gold-plated ground contact.

The new IP connectors were made out of a molded synthetic rubber to ensure the greatest durability in extreme cold or extreme heat environments. Once again, the lowering device enabled quick and easy access to the CCTV cameras. Meanwhile, the MPEG-4 video from the camera is crystal clear on the TMC's videowall and the agency is not experiencing any latency in the pan-tilt-zoom (PTZ) control. ACHD is very pleased with both of these innovative technologies and certainly foresees them becoming standard – and not just in Idaho, but in other states and even other countries too. Overall, the shift to an all Ethernet/IP network has been a success in the Boise region, so much so that the Idaho Transportation Department has selected the Bosch Ethernet/IP cameras and [MG]² lowering systems to be used statewide on various freeway projects. ∎

For more information on [MG]² products, please call +1 205 823 6688, email information@mgsquared. com or alternatively log on to www.mgsquared.com

In a roundabout way

501 The UK's Transport Research Laboratory (TRL) and Savoy Computing Services have joined forces to develop a new system for designing traffic circles. The system links TRL's ARCADY and Savoy's AutoTrack to reduce the time taken for design.

ARCADY is a long-established traffic circle flow/capacity analysis system, which assesses traffic circle performance, taking into account the geometry and placement of features such as pedestrian crossings. It predicts flow rates, queue times and various performance criteria. The recently released Version 7 incorporates numerous improvements to the original user interface and has been tested on Windows 7.

AutoTrack Junctions also allows engineers to design roundabout geometry interactively to selected UK or US standards. Users can model traffic circles with up to eight arms and it caters for splitter islands, pedestrian crossings, rumble strips and traffic controls. Additional options let the user analyze driver and pedestrian sightlines, stopping distances and fastest line speed.
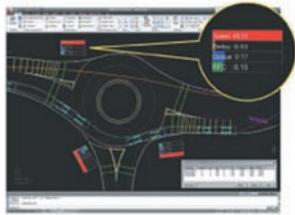
CONTACT

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Under surveillance

502 Optelecom-NKF Inc has released its new H 264 Siqura HD6x PTZ IP camera series. The high-speed dome (HD) camera line comprises three pan-tilt-zoom (PTZ) IP cameras, the indoor HD60 and the outdoor HD62 and HD66 WDR. All of the HD6x cameras support open streaming architecture (OSA) for easy integration with video management systems.

The cameras can move to predefined preset positions at speeds of up to 400° per second and PTZ coordinate positions can be queried or set through the OSA application programming interface. The range is equipped with a 26x or 35x autofocus zoom lens with 12x digital zoom.

As surveillance conditions can vary widely, the series also includes day/night (IR-cut filter) and backlight compensation, which can be applied manually or automatically. The HD66 WDR has a built-in image stabilizer to prevent vibrations from disrupting camera view or footage, such as those caused by heavy traffic.

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> "Driver distraction has to be a design factor in the road system. We should try to minimize it, but at the same time we must understand that we cannot eliminate it"
>
> see page 24

Camera action

503 Stemmer Imaging – one of Europe's leading imaging technology providers – has introduced new JAI mini CameraLink (MCL) cameras, adding them to JAI's C3 Compact camera range.

When developing an image-processing system it is often necessary to use different cameras to find the optimum solution for the task in question. The C3 concept allows the system designers and OEMs to easily switch between different camera models and technologies. The new CM-141 MCL (monochrome) and CB-141 MCL (color) cameras offer a 1.45 megapixel (1,392 x 1,040) resolution, while the CM-040 MCL (monochrome) and CB-040 MCL (color) cameras offer 776 x 582 pixel resolution.

The JAI CM-141 MCL and CB-141 MCL are based on Sony's popular ICX-285 2/3in progressive scan CCD. This sensor uses its 6.45µm pixel size and improved microlens technology to provide higher overall sensitivity (as low as 0.2lux) with low smear characteristics. The cameras deliver up to 30 full frames per second and use the popular mini CameraLink interface but are also available in power-over-mini-CameraLink versions.

The CM-040 MCL and CB-040 MCL utilize the Sony ICX415 1/2in monochrome CCD and outputs 61fps with full resolution. Higher frame rates can be achieved by using the partial scan or vertical binning modes. An auto iris lens video output function is also available to support dynamic lighting conditions.

The use of a mini CameraLink interface allows compact housing dimensions of only 44mm x 29mm x 5mm (width x height x depth) for the CM-141 MCL and CB-141 MCL and 44mm x 29mm x 66mm for the CM-040 MCL and CB-040 MCL. Each camera also only needs a single connection cable with power coming from the frame grabber.

The new models are ideally suited to imaging applications in machine vision, including the monitoring of fast-moving vehicles in enforcement and surveillance.

CONTACT

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www.stemmer-imaging.co.uk

Radar not required

504 The high-tech company Imagsa – a specialist in developing artificial vision cameras for outdoor environments – has unveiled its latest innovation in the field of ALPR. Atalaya Compact is an autonomous (no trigger needed) ALPR unit with a 1,280 x 1,024 megapixel high-speed sensor (250fps) and an embedded image processor based on FPGA electronics that detects license plates in real-time. Imagsa ensures a highly reliable detection and recognition rate of cars, trucks, motorcycles, four-wheeled vehicles and dangerous goods trucks in a full 4m road width. There are no false detections from vehicles on adjacent lanes, and the camera provides accurate results under challenging environmental and traffic conditions.

In addition to delivering accurate license plate recognition rates, Atalaya Compact integrates some specific image-processing algorithms to deliver spot speed of vehicles (90% accuracy up to 150km/h) without requiring any external devices such as radar or loops. Therefore, relevant traffic statistics are delivered to transport departments and speed alert projects can be deployed in a lower cost of ownership.

"Imagsa is engaged in a continuous innovation process, to develop high-performance and versatile products in the field of ALPR smart-cameras," explains Dr Ferran Lisa-Mingo, Imagsa's CEO. "We are aiming to expand in Europe and other world regions, supporting local partners that want to deploy successful road traffic applications."

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Q

This issue's question is how can the ITS industry benefit from the technology and experience found within the machine vision industry?

A "Machine vision techniques have been used in indoor environments where the illumination can be controlled by different means for years. Outdoor machine vision has some different challenges. In road traffic, vehicles move at high speed: every vehicle and license plate is different and the illumination conditions constantly change. Obviously, the experience of indoor machine vision is useful for ITS. But to achieve good results in the road, new techniques must be built. We have developed technology and products specifically for ITS, which overcome the challenging environmental and traffic conditions by processing hundreds of images per second in real time with FPGA devices. We are seeing great results in the ITS sector."

Ivo Paton
international sales manager, Imagsa, Spain

A "Requirements for the ITS industry are actually very similar to machine vision.
In machine vision, we need to read codes on silicon wafers, for instance. For ITS, we need to read license plates. The technology is similar (although the lighting and optics is not) and the underlying aim is pretty much a carbon copy. When you're looking at wafers with CPU chips that cost potentially millions of dollars, mislabeling one is a very expensive mistake. We can take all the technology that is proven in demanding environments and bring it over to reading a car – if it goes through a red light or if it's parked in the wrong place, for instance."

Fabio Perelli
product manager, Matrox,
Canada

A "A typical machine vision system provides most of the functionality that a traffic system needs, for instance, capturing an image of an event in a timely manner for analysis. So taking it from one demanding environment to another is not such a huge leap. The key challenge in traffic applications was how to deal with variations in lighting and weather conditions, but systems have now been developed to cope with this. Machine vision solutions are advancing quickly: higher resolution images are now available and software to gather more information from a scene is becoming commonplace."

Steve Hearn
head of UK sales,
Stemmer Imaging, UK

A "The main similarity in both industries is the importance of lighting conditions.
In machine vision it's more about ensuring you have enough light, but in ITS it tends to be about ensuring you don't have too much. Either way, you need a good image quality to provide what's called the 'dynamic' of the image. This means that if there's a shadow or very bright sunlight in the image, you are still able to detect the details you require, which is a conjunction between a good sensor and good electronics in the unit. Camera speed is also a benefit from machine vision: the ability to do 30fps, for example, is absolutely crucial in order to capture a car that's driving at 150km/h (93mph)."

Henning Tiarks
product manager, Basler,
Germany

A "The images that are being produced by a traffic security camera are often meant for visualization applications. So they might look fine but may not be well suited for interpretation by a computer. Machine vision can take an image that may even be really difficult for a human to look at and crunch through it to get exactly the results you want. That is what machine vision and its components and software can bring to intelligent transportation systems. Another advantage is the overall reliability and the way the products are built – they are designed to last for a long time in demanding environments. Machine vision camera vendors such as Point Grey have to produce a product that will perform exactly the same for the next five or 10 years. If you want to be doing processing and getting the same types of results over and over again, you do need to make sure that the components are durable and well built."

Vlad Tucakov
director of sales and marketing,
Point Grey, Canada

A "The short summary is that the robustness (in terms of both extremes in temperature and withstanding vibrations) and very high image quality of machine vision solutions is what the ITS industry can benefit from. The difference between a consumer and an industrial camera is that the industrial one has been designed to run 24 hours a day without stopping. For machine vision applications, as with traffic applications, the cameras need to operate perfectly under very demanding environmental conditions in situations where mistakes can cost money. Therefore, a high MTBF is important."

Tue Mørck
vice president, product marketing, JAI, Denmark

TTi **READERS ARE INVITED TO ANSWER THE BURNING QUESTION FOR THE FEBRUARY/MARCH 2010 ISSUE:**

What do the technological advances occurring in intelligent road studs mean for traffic engineers and for end-users of the roads?

email answers to traffic@ukintpress.com

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