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October/November 2011

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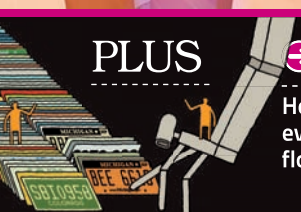

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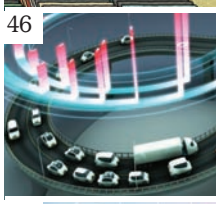

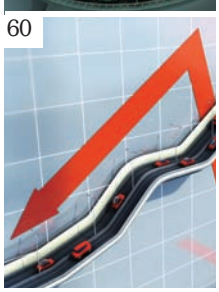

In **This** Issue

Technology Profiles

Foreword

A general rule of thumb when writing forewords is that editors impart some of the facts they've learned during the preparation of an issue to subtly introduce various features. Perhaps we'll link it to a newsworthy item or some recent scientific research to give the impression that we're on the pulse of current affairs and academia. Sometimes they write themselves; other times you sit staring blankly at the screen, sporting an expression you'd expect to see on a guppy fish at feeding time. At 136 pages, though, this issue has so much in it that I couldn't resist the temptation to regale you with my recent diving trip to Mauritius instead. In a roundabout sort of way…

Between the airport and our resort, I counted no less than seven billboards advertising the UN's Decade of Action for Road Safety. They highlighted the usual dangers: cell phone use, drunk-driving, and speeding. My taxi driver, Herroo, was a fountain of knowledge and fortunately wasn't driving to the taxi stereotype. I asked him if it was standard practice for other drivers to take up all the lanes. He explained that when Mauritius was a French territory they drove on the right. When it became a British Colony, they started driving on the left. So following independence in 1968 they now just drive in the middle. I think it was tongue in cheek.

I probed Herroo further about road safety generally and by pure coincidence it was a topic debated in a newspaper report the day before, which he duly translated. Last year was a bad one for Mauritius, with 160 fatalities in a total of 152 fatal accidents (up from 140 in 129 in 2009) – and 3,677 serious injuries (up from 3,661 the year before). Seemingly this is a blip, as the island state has made huge strides in safety over the past few decades. The article quoted 'road safety guru' Ben Buntapilly, a name that was familiar to me – why, though, didn't become clear until I returned home to write the interview with TRL's Goff Jacobs (*p*83).

Jacobs, a safety guru himself, cites Mauritius as a real success story. Seconded there many years ago, he recalls a young policeman who was determined to make a difference. Buntapilly rose through the ranks, becoming Chief of Police and establishing the Special Road Safety Unit. Today he's a special advisor to the prime minister on road safety issues. Jacobs is now retired, but looking back over his career, he's proud he's inspired others to follow in his footsteps.

Forewords, as I said, sometimes just write themselves. And not a mention of my wet suit!

Nick Bradley,
Editor, Traffic Technology International

Who's **Who**

Editor
Nick Bradley
nickbradley@ukipme.com
Deputy editor
Louise Smyth
l.smyth@ukipme.com
Proofreaders
Aubrey Jacobs-Tyson, Frank Millard

Art director
James Sutcliffe
Art editor
Ben White
Design team
Louise Adams, Andy Bass, Anna Davie, Andrew Locke, Craig Marshall, Nicola Turner, Julie Welby

Head of production and logistics
Ian Donovan
Production team
Carole Doran, Lewis Hopkins, Cassie Inns, Robyn Skalsky
Circulation
Adam Frost

Publication director
Mike Robinson
m.robinson@ukipme.com
Publication manager
Franco Crismann
f.crismann@ukipme.com
Australasia business manager
Chris Richardson
c.richardson@ukipme.com
+61 4207 64110

CEO
Tony Robinson
Managing director
Graham Johnson
Editorial director
Anthony James
Finance director
Rob Kirke

Traffic Technology International
UKIP Media & Events Ltd,
Abinger House, Church Street,
Dorking, Surrey RH4 1DF, UK
Tel: +44 1306 743744
Main fax: +44 1306 742525
Email: traffic@ukintpress.com
www.ukipme.com

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Red-hot debate

Following the publication of a recent Texas Transportation Institute study about the effectiveness of red light enforcement, **Timothy Compston** speaks with the author, the proponents, opponents and satisfied end-users

Photographs courtesy of FHWA & Tunart

The extent of the threat posed to road users at signalized intersections is underlined by the fact that in the USA during 2009 there were 676 people killed and an estimated 113,000 injured because somebody didn't stop on red. The problem has got so bad in some places that many communities have turned their attention to red light cameras as an active deterrent to alter driver behavior. A particular concern is right-angle collisions which, by their very nature, are more than likely to lead to severe injury and potentially death to not only innocent road users who find themselves caught up in a collision but even red light runners themselves.

Texas study

The Texas Transportation Institute recently issued a new report entitled *Evaluation of Photographic Traffic Signal Enforcement Systems in Texas*. Funding for the study came from the Texas DOT through the state legislature. According to its author Troy D. Walden, the catalyst for the report was the need to investigate the effectiveness of red light cameras on intersection accident frequency and severity at a community and state level across Texas.

"The published study is a three-year evaluation, part of which is intended to be a multi-year effort," Walden says. "What we found when we considered all types of crashes – red light- and non-red light-related – is an overall, statewide reduction of about 11% at intersections that were being monitored. Alongside this, looking at crashes with a red light connection – i.e. somebody violating a red signal – we saw an even larger crash reduction of about 25%."

For right-angle crashes – which Walden notes are the most dangerous and most frequent to happen at intersections – it was discovered that there was a fall in crashes of about 32%. "Overall we see a considerable drop in the number of collisions happening at intersections," he continues. "Interestingly, though, when we looked at the reduction in red light crashes at one-year camera sites it was 23%, for two-year sites the reduction was 27%, and at three-year sites it was 21%." For the analysis, Walden looked at crash rates an equal amount of time prior to – and after – camera installation.

Defining intersection crashes

When questioned about the definition of an intersection crash, Walden explains: "We went back to the crash reports and looked to see if an incident actually happened within the intersection boundary. In some instances, although the state system may have recorded an event as an intersection crash, in reality it did not necessarily meet our criteria. Out of 15,000 individual records, we ended up refining the number down to around 11,000."

Turning to the issue of rear-end collisions, Walden admits, "It is true that some studies

Cameras in Peoria, Texas will be switched off after the city learned crashes at monitored intersections actually increased during the three-year pilot

The right angle

The human side of red light running is brought into sharp focus by the fact that, according to the FHWA, "95% of drivers in the USA feel that other drivers running red lights are a major safety threat and one in three people claim to know someone injured or killed in a red-light running crash". The Administration stresses that this method of enforcement should only be considered when the research shows that the right-angle type of crash can be decreased through the deployment of red light cameras.

Both the FHWA and the Texas Transportation Institute highlight what they see as the typical trends that result from installing a red light camera system, namely that right-angle crashes – the targeted type of crash – decrease while rear-end crashes increase. Putting this into context, an analysis of data at 132 intersections in a study by the FHWA (*Safety Evaluation of Red Light Cameras*, April 2005) found a 25% decline in total right-angle crashes and a 16% drop in injury resulting from right-angle crashes. At the same time, however, it was reported that there was a 15% increase in the total of rear-end crashes and a 24% increase in injury associated with rear-end crashes.

> We found strong support for cameras: two-thirds of drivers said they approved of this type of enforcement

have reported an increase and we did see this to a certain extent in our study. However, what we discovered is that such crashes only represent a small proportion of those happening at the intersection. In our research, only 2-3% of red light crashes were actually rear-end."

An insurance perspective

The Insurance Institute for Highway Safety (IIHS) published a landmark report this year considering the effects of red light enforcement on fatal crashes in large US cities. This was followed by a study of attitudes toward the camera programs in the same communities as well as Houston, Texas, where cameras had been removed as a result of a vote in November 2010.

Dr Anne T. McCartt, one of the authors of the reports, is a senior vice president for research at the IIHS and sees the recent study as being distinct from previous investigations in the USA as it has a national focus: "Most studies have been done in a specific community or several communities that have used cameras and haven't really looked at fatal crashes. The reality is that most communities don't have enough crashes in order to conduct a decent study, so we took a look at several (14 counties/large cities) that had long-standing red light camera programs and then we compared those with a large set of cities that did not have cameras.

"Essentially what we found was that the cities with red light cameras had significantly lower rates per population of fatal crashes occurring at signal light intersections and reductions in fatal crashes attributed to drivers jumping red lights."

McCartt believes the IIHS research and other studies underline the ability of cameras to reduce crashes, particularly the more serious ones: "I would single out right-angle crashes as a crash type that red light cameras can address."

When looking at attitudes toward the red light cameras in the cities, all of whom had long-term programs, McCartt and her colleagues were interested in what drivers on the ground actually thought: "We found strong support – overall, in fact, two-thirds of drivers in the cities said they approved," she reports. "We also interviewed drivers from cities that had voted their red light cameras out. Interestingly, a majority of drivers in Houston still supported the cameras. The one major difference we did find compared with the other 14 cities was a larger proportion of drivers really opposed to cameras, which didn't surprise us given the strong views of the opponents and the low voter turnout when the decision was taken to remove them."

Dallas stops on red

For its part, the city of Dallas in Texas is reporting positive results from cameras at key intersections. "We implemented our program with the express intention of increasing public safety and decreasing accidents, fatalities, and reducing red light running," explains Sylvia Littleton, PHR program manager, Dallas Stops on Red, Dallas Police Department.

Prior to red light cameras being brought in, figures for 2006 showed that more than 28% of accidents at traffic signals in the city were related to red light running. Subsequently, a contract for camera systems was awarded at the end of 2006 with 60 cameras installed across Dallas throughout 2007.

Littleton has witnessed first-hand how these safety tools at controlled intersections can bring tangible benefits: "From the cameras being installed, in January 2007 through to July 2007, comparing the three years before-and-after results for the first 60 cameras at 49 intersections, our figures show that there was on average a 61% reduction in red light-related accidents on intersection approaches with red light cameras. Intersection accidents of all types fell on average by 25%. Significantly, it was found that 86% of intersections demonstrated real reductions in red light running accidents."

Following the red light cameras being switched off in Los Angeles, the city is now studying the merits of extending the yellow signal timing

Much research has established that red light cameras deter would-be violators and reduce crashes at signalized intersections

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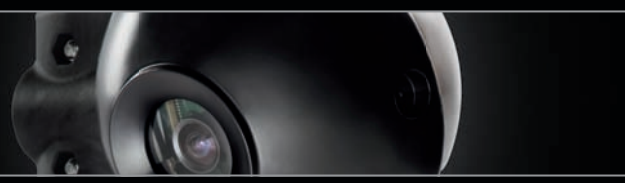

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View from Toronto

Mike Brady, manager of traffic safety for the City of Toronto, believes that there is only one reason for having red light cameras: "The sole purpose of this tool is to reduce right-angle collisions and the severity of injuries resulting from right-angle collisions," he says. "You can read several evaluation reports that talk about change in all collision types but to me that is not the objective."

Turning to quantitative data derived from Toronto's experience of red light cameras, Brady outlines some of the most recent figures: "Taking five years of 'before and after' data in Toronto for angled collisions that led to injury and fatality, this was down by over 60%," he reports. "In terms of rear-end collisions there was a minor increase until 2002, with a peak then and the figures have been coming down steadily at red light camera sites." His conclusion from the results is that although there are many studies out there that claim the cameras increase rear-end collisions, based on his experience in Toronto, he would suggest the effect is very short-lived.

"Although today there are many reports and studies written on red light cameras and system guidelines, before rolling out any cameras, my advice would be to actually go and visit a jurisdiction that you think is successful at operating these systems."

In the USA in 2009, red light running killed 676 people and injured an estimated 113,000. Two-thirds of the deaths were people other than the red light running driver – occupants of other vehicles, passengers, bicyclists, or pedestrians

According to Littleton, there was no evidence – contrary to what some critics may say – of a trend toward increased rear-end accidents associated with red light cameras. In addition, she says that misconceptions regarding privacy can be readily addressed: "The fact is we only ever take pictures of the rear license plate, not the front of the vehicle, so drivers cannot be seen or identified directly from any photos or video."

Safety first in Edmonton

Gerry Shimko, executive director of the Office of Traffic Safety in Edmonton, Canada, is a strong advocate of red light cameras as part of what he calls a speed management continuum: "This is based on the four 'Es' of traffic safety – namely education, enforcement, engineering and a very comprehensive evaluation-based process."

Shimko stresses that for his city, the initial impetus with regard to red light cameras came from the fact that Edmonton had a very high number of collisions, potentially even the most across all of Canada: "Faced with this situation, in the late 1990s, police brought in the cameras to deal with the fatalities and serious injuries that were occurring at intersections. Things have evolved since then and we have gone through several iterations in terms of the technology."

The 50 red light cameras currently in operation across Edmonton are dual technology – that is to say they cover both red light running and speed through the intersection. This type of camera was introduced in late 2009.

"What we can say, quite comfortably, is that we use a rigorous approach to select sites for the cameras, based on crash rates and crashes at intersections, and our experience continues to show that we are getting a net reduction in fatalities, injuries and property damage. We also do not seem to be having the experience reported in some studies of an increase in rear-end collisions."

Shimko addresses the question of the revenue generated: "The city has agreed that this should flow back to traffic safety initiatives," he reveals. "In Edmonton we have what is probably the only Municipal Office of Traffic Safety in the world and through the University of Alberta's Faculty of Engineering have created an Urban Traffic Safety Research Chair."

Ban the cams

Red light cameras are, of course, not without their critics and one of the most fervent is Henry Bentley, founder of BanTheCams. He points to numerous studies that he says show that rear-end collisions are on the rise where red light cameras are adopted. Looking specifically at the recent TTI report, he believes it falls down in a number of areas: "One of the things that I know is not in there is a comparison of accident rates between intersections where red light cameras are installed with signals that do not have the cameras. The reason that I raise this is over the past 10 years numerous reports have shown that accidents at red lights have been going down without the presence of any enforcement."

Another comment Bentley makes regarding the report is that the study, in his opinion, only goes to 30ft past the red light, which he believes is far too short a distance. Bentley also questions the way that the report "threw out something like 2,000 crashes that police officers considered to be at the intersection".

When pushed about whether he could ever see any case for the operation of red light cameras, Bentley can only envisage a role for accident documentation – although he feels even this is unrealistic, given the potential for authorities to, in his words, abuse the cameras.

More widely, Bentley believes a solution to intersection safety that does not require red light cameras would be to lengthen the yellow signal phase by one second: "They did that in Georgia and the camera companies went away," he concludes. "Another option might be to introduce a countdown for the red and yellow phases."

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Value for money?

A new study has shed some very valuable – and extremely positive – light on the size of the North American ITS market. **Tori Read** presents a selection of the report's findings

Images courtesy of istock photo and ITSA

The US industry association, ITS America (ITSA), has recently completed a two-phase study commissioned by the US Department of Transportation Research and Innovative Technology Administration (RITA). In August 2011, a 136-page report was published. Its full title is *Sizing the US and North American intelligent transportation systems market: market data analysis of ITS revenues and employment*.

The aim was to provide comprehensive estimates of the breadth and size of these markets – a task that had not previously been attempted before. The report states that the study was commissioned to "better understand the scope, scale, and growth projections within the private sector, where service offerings, scale, visibility, and use by consumers and public agencies – particularly state and local government agencies – is growing."

ITSA partnered with HIS Global Insight to conduct the study, which was based on a private sector survey of companies coupled with econometric modeling.

The results make for interesting reading. On the financial side, the document estimates that in 2009, US ITS company revenues were US$48 billion for end-use ITS manufacturing products (US$26.1 billion) and end-use ITS services (US$21.9 billion). The rest of North America also contributes an additional US$4 billion in revenue. To put this into a broader perspective, these figures show that ITS market revenues exceed those for electronic computers, motion picture and video products, direct mail advertising, or internet advertising.

In terms of how many people are working in the sector, there are nearly 180,000 private sector jobs in the end-use market alone, with 445,000 jobs in the total industry value chain. Those ITS jobs represent 0.3% of the 138 million total jobs in the USA. The report says, "The ITS end-use market contributes more jobs to the US economy than the motion picture/video production or electronic computer markets." The survey also suggests that ITS jobs pay well, with average ITS salaries being well above the national average by more than US$32,000. Interestingly, just three occupations (software developer, hardware developer, and other engineering) account for 32% of the ITS jobs.

The ITS market is currently estimated to be worth US$48 billion

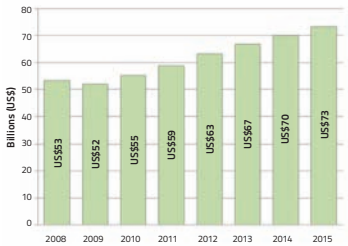
(Above) **The ITS market in North America could be worth US$73 billion a year by 2015** (Left) **Scott Belcher, ITSA president**

Both revenues and personnel are set to increase in coming years. Predictions are that by 2015 end-use revenue will increase on the 2009 figures by almost 41% and private sector employment will total more than 205,000. Total industry employment is projected to exceed 500,000.

US patent statistics also throw some light on how innovative the ITS sector is – naturally this is also a positive sign for future growth. ITS-based patent applications rose 17% from 2007 to 2008, when overall patent applications were static.

ITSA's president Scott Belcher wrote in his foreword to the study: "I firmly believe that with this effort we have a solid foundation for a fact-based understanding of the economic impact of the diverse and expanding ITS industry and its potential to improve transportation safety and the livability and sustainability of our communities."

From an initial list of 15,000, the report identified and validated 3,000 US companies that are currently operating in the US ITS sector



Key analysis

The analysis used a four-stage process. Stage 1 focused on understanding and defining private sector products and services in the ITS arena. Stage 2 identified North American companies active in ITS using internal industry databases, international listings of ITS companies, ITS exhibitor listings, and extensive internet and report research to compile a database of more than 15,000 potential ITS-related companies. Researchers cut down the list by eliminating duplicates, subsidiaries, and those not in the ITS market, to identify the 3,000 companies on which the data is based.

Stage 3 sought primary data from identified ITS companies via an electronic survey. More than 10% (295) of the companies responded and provided sensitive information about ITS revenues, private sector employment, and industry sector identification.

Stage 4 developed an econometric model, informed by the critical private sector industry survey data, tested the statistical model, and used the model to generate ITS industry estimates.

> 73% of US ITS revenues are attributable to companies with fewer than 500 employees

Build the lot

So what does it take to build a solar parking lot? Brusaw will install the solar panels for his own personal lot outside his electronics lab near Sandpoint, Idaho. Each of the 3.6m² (12ft) panels will produce about 7.6kW hours of electricity daily. Four of the panels would supply a typical household's electrical needs.

The aim is for Solar Roadways to create its own parking lot first so that it can effectively monitor it and see how it bears up under different kinds of load tests. As parking lots generally have lightweight vehicle traffic that is usually slow-moving, they make a good testing ground for the solar technology.

A shining light

After securing a follow-up research contract from the FHWA, the future looks bright for Solar Roadways. **Louise Smyth** speaks with founder **Scott Brusaw** to find out what's next for this smart-thinking organization

Images courtesy of Solar Roadways

After successful completion of a Phase I SBIR (Small Business Innovative Research) contract in August 2011, Solar Roadways was awarded a follow-up US$750,000 Phase II SBIR contract by the Federal Highway Administration (FHWA). The company has spent five and a half years working on the concept of an 'intelligent pavement' that generates electricity, acts like a power grid, and even has the ability to melt snow and ice. In 2009, the FHWA awarded the company a US$100,000 contract to build the first solar panel prototypes. This latest cash injection will enable those prototypes to be advanced to the point where Solar Roadways will start attracting investors for commercial production.

The funding is also enabling founder Scott Brusaw and his team to create a real showcase for his innovative technology: "Our Phase II funding will allow us to build the first solar parking lot right here at our facility," he explains. "This will allow us to show potential investors/customers what a solar parking lot can do. We hope to have a commercial product ready in approximately two years."

Cost-benefit analysis

Of course anyone serious about investing in commercial versions of the technology is going to want to know about costs and return on investment. If a parking lot managers decide to take the plunge and invest in a solar lot, does Brusaw have any projections for them on this aspect? "Greatly reduced electricity bills would be immediate. We're still too early in development to give an accurate estimate on the cost, but we anticipate being two to three times more expensive than asphalt," he says. "But that would be comparing apples to oranges: asphalt has no ROI and solar road panels begin paying themselves off the moment they're installed."

As well as parking lots, Brusaw also envisions the solar panels in driveways, patios, playgrounds and residential streets. Ultimately, though, the goal is to roll out the technology on the USA's highways, although Brusaw is keen to point out that this aim is still a long way down the line.

"The FHWA has already told us that they're not going to let us just start covering the nation's highways. They want us to start off in parking lots to learn our lessons and perfect our technology first. Being a new product, we anticipate some problems at first. Better to work on the fixes in a parking lot than on a highway!"

And what is Brusaw working on at the moment? "Getting the initial prototype parking lot installed in the spring, after the snow melts," he reveals. "Between now and then, we're working on perfecting the glass surface's traction and transmissivity in addition to the structural support for the panels."

The ability to melt snow and ice could be a huge selling point for getting this solar technology-based intelligent pavement onto the USA's roads

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> The FHWA wants us to perfect our technology in parking lots before it hits the nation's roads

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Human behavior

On the issue of improving driver behavior, the report focused on education, suggesting that changes to the Highway Code could be placed more clearly on the DVLA website when motorists renewed a driving license as well as be included in a leaflet with tax disc or license renewal letters. A free Highway Code cell phone app is another way standards could be improved.

Although noble ideas, they are somewhat simplistic and low-tech. Perhaps a study about technology's role within this field would be more worthwhile. The impact of both vehicle-based systems (particularly those that alert the driver to potentially dangerous behavior) and ITS technologies and their role in affecting how drivers behave are arguably just as critical as education in tackling the issues that lead to congestion.

Jam-packed report

The latest findings from the UK's Parliamentary Transport Committee are out. **Tori Read** explains how they show that congestion and the economy are intrinsically linked – and sadly not in a good way

Images courtesy of ESP Imaging

The UK's Parliamentary Transport Committee has launched its latest report, which among other things recommends a tougher driving test, greater use of ITS and real-time information systems, as well as better coordination between road management authorities. The report, *Out of the Jam: reducing congestion on our roads*, examined options for curbing congestion without road building or road pricing. "Congestion costs the economy billions of pounds each year," committee chair Louise Ellman said after launching the report. "Improving the way we manage road space so that the network runs more smoothly is vital to the prosperity of the nation. Pursuing this challenge should form a key plank of central government transport policy."

The committee set out a series of recommendations to government about how it could curb congestion and get more out of the existing road network, including monitoring cost and safety issues of the Managed Motorway scheme, particularly where the use of the hard shoulder could prevent emergency vehicles from reaching accidents. It also includes a requirement that all highway authorities publish traffic management performance measurements no later than the beginning of 2013. In addition, it recommends working more closely with highway authorities to identify the latest forms of intelligent traffic management systems and to renew funding for the ITS Toolkit. It also suggests development of a strategy for the delivery of real-time travel information to motorists that identifies clearly what is to be provided by local authorities, the Highways Agency or the private sector. Finally, it recommends independent evaluation of permitting schemes for highway authority and utility street works, as well as lane-rental schemes where utility companies pay to close road space for street works.

The UK government has recently given the go-ahead to 20 major transport schemes with £1.2 billion of funding for local transport improvements

> "Improving the way we manage road space so that the network runs more smoothly is vital to the prosperity of the nation

Spiraling cost of congestion

The committee's previous inquiry, *Transport and the Economy*, cited evidence that showed that the rising cost of congestion would cost the UK economy an extra £22 billion by 2025. One option for reducing road congestion – road pricing – has been ruled out already. Extensive investment on new roads is also unlikely given the current economic climate. Due to these factors, the inquiry looked at other ways in which road congestion could be reduced.

Without the option of road pricing, what are the best methods of reducing congestion on UK roads?

The report cites a number of strategies that ought to be tackled. These include maximizing capacity, minimizing disruption, and better links between agencies and authorities with responsibility for various sections of the road network. The sharing of best practice was also advised, as was providing more reliable information for travelers, and improved driver behavior based on better understanding of and adherence to the Highway Code.

Indeed, driver behavior was a particularly prominent part of the report. It states: "The overwhelming view from the evidence we received was that aspects of poor road user behavior led to increased congestion. Firstly, by directly causing incidents and secondly by inappropriate road use – which is not necessarily unsafe – but which adversely affects the flow."

Commenting on the publication of the report, roads minister Mike Penning said: "We are committed to tackling congestion and improving transport across the country. That is why, despite the economic climate, we have given the green light to more than 20 major transport schemes and made available a further £1.2 billion for local transport improvements. We are also focusing on making better use of the road network ... improving accident clear-up times, providing better information for motorists and tackling disruption. We will consider the report carefully and respond in full in due course."

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Support network

An increasing number of agencies are embracing MDSS for cost, efficiency and environmental improvements. But **Nick Bradley** finds that advances on the horizon in meteorology and connected vehicles could take the maintenance tool to a whole new level

Illustration courtesy of Magictorch

Considering that DOTs in the USA's snow-belt states spend more than US$2 billion a year on winter operations – or roughly 25% of their entire maintenance budgets – even minor improvements in road weather operations have the potential to deliver major savings. That's why any advances in meteorological instruments that enhance the decision-making process are greeted with open arms by the transportation community.

Substantial savings

For the evidence of what can be achieved, look no further than Indiana DOT (INDOT), which implemented a maintenance decision support system (MDSS) back in 2008-2009 as part of a three-year trial under the auspices of the MDSS Pooled Fund Study. Courtesy of the now Iteris-owned Meridian Environmental Technology, the MDSS tool helped INDOT save US$12 million in year one alone by reducing salt use by 40.9%, or 228,470 tons, while saving a further US$1.4 million by reducing overtime payments to staff by 25.7%. Perhaps best known for its pioneering work in 511 and advanced traveler information systems, Meridian's standing in road weather management is also revered. The Grand Forks company was founded by three researchers

from the University of North Dakota following a technology transfer to commercialize the fruits of their academic efforts. Although this was only 15 years ago, in 1996, their knowledge of road weather stretches back much further. "One of the problems with the Road Weather Information Systems (RWIS) program of the 1980s and 1990s was that it challenged maintenance folks to use it effectively," explains Meridian's Robert D. Hart, manager, Surface Transportation Weather. "It was more information – and more scientific information – than they were used to dealing with. If RWIS was ever going to be really productive, an expanded tool was necessary to ensure it worked more effectively."

The Federal Highway Administration (FHWA) laid the foundations for the development of MDSS back in 1999. "Working with five national laboratories, with the National Center for Atmospheric Research (NCAR) as the lead, we developed the MDSS Federal Prototype," recalls Paul Pisano, team leader of the FHWA's Road Weather Management Program. "This was based on significant requirements documentation effort with the state maintenance managers, which subsequently formed the basis of the prototype."

Hart, however, says there was a general consensus that the approach adopted by the FHWA at the time was not quite adequate enough to provide the type of guidance that states felt they really required. "The Pooled Fund Study then took it to the next level," Pisano continues, "putting the prototype into real-world environments with Meridian as the private sector lead."

"We wanted to create a decision-support system that ticked all of the boxes – something that could augment existing winter operation techniques with weather information and provide a single source for decision makers regarding snow and ice," Hart says. "MDSS was the result of many months of discussions and essentially looks at the process that a maintenance supervisor would have to go through in order to take action, then takes all of the inputs that the decision maker would typically make before simulating what the 'best practice' would be to resolve the problems they're having to contend with."

> The difficulty with MDSS and assessing its value is that there's a lot of resistance to employing new solutions to problems. As scientists, we often believe there are better ways to do things…
>
> **Robert D. Hart, Meridian Environmental Technology Inc, USA**

Meridian provides a suite of custom MDSS services to permit an agency to best meet local needs

Experiential debate

Until recently, one of Hart's Meridian colleagues, Tony McClellan, senior transportation engineer, was working at INDOT so he has first-hand experience of the impact that MDSS has at an operations level. "In the past, the removal of winter-based materials was always an experience-based decision but what MDSS helped us to do was take experience and combine it with science – and come up with a better, more efficient solution as a result. It also helps folks who don't have a lot of experience get there faster."

According to Hart, there's a lot of inherent experience in maintenance operations. "But the people doing the work are not necessarily the ones concerned with costs," he insists. "The difficulty with MDSS and assessing its success or value is that there's a lot of resistance to employing new solutions to problems. As scientists, we often believe there is a better way, but the ops guys are often very happy with the way they do things currently.

"Something else DOTs are finding today is that their workforces are now younger and more inexperienced than they used to be, so using MDSS as a secondary tool to transform all of this weather, materials, chemistry, and physics information into a single recommendation might be pretty attractive to managers."

For McClellan, one of the unexpected benefits of MDSS at INDOT was that it "tied management to the boots on the ground". He explains: "Everybody knew what everybody else was doing, which helped give us a much more consistent product while also influencing accountability – as Bob [Hart] said, sometimes the guys

Staying ahead of the weather

Jeremy Duensing reveals how Massachusetts DOT is utilizing a comprehensive weather and RWIS solution to anticipate and prepare for the north-eastern state's winter weather

With more than 15,000 lane-miles to maintain, the Massachusetts DOT (MassDOT) is faced with the formidable challenge of keeping roads safe during the harsh winters that afflict the northeastern USA. Managing both the high-volume, high-speed traffic of the densely populated coastal region and the hilly western part of the state requires multiple winter maintenance strategies. With a budget of US$70 million for roadway snow removal, including labor, materials, and equipment, effective cost management is of particular concern to the agency, which contracts 90% of its winter maintenance work to private firms.

"We want to call in our contractors no more than two hours before snow is scheduled to begin," reveals Paul Brown, MassDOT's director of snow and ice operations. "If our forecast information is not correct, we might end up paying a significant amount of money for inactive contractors waiting for snow."

To better manage this cost factor, MassDOT relies on weather information provided by Telvent DTN, with a subscription to multiple services that are customized to the agency's individual needs. The solution integrates highly accurate weather forecasts and current conditions with real-time roadway operations data. Although many DOTs still rely on multiple contracts for software applications, including RWIS data management and road weather forecasting, MassDOT has chosen an integrated platform that delivers information via a single interface. With the combination of two dynamic information management systems, MassDOT staffers can now import all of the critical data as layers into a high-resolution map of their service area.

In Massachusetts, RWIS data is now collected and managed by Telvent's Total View OASys SCADA system, which includes real-time network sensor status and reporting, camera views, current traffic data, and roadway surface conditions in addition to the status of the RWIS network health. The open architecture of the OASys SCADA system accommodates any hardware vendor and maintenance provider, allowing agencies to accommodate current and future systems and regulatory changes.

MassDOT receives hourly forecasts for a 72-hour outlook and daily forecasts for a 15-day outlook, which are updated every 60 minutes. These can be customized to the specific requirements of the DOT, issuing custom alerts whenever conditions move within close range of preset parameters.

As weather conditions vary considerably across the Commonwealth, the DOT subscribed to customized forecasts for each of its 19 operations areas. These forecasts are updated at least four times a day under normal conditions, and more often when severe weather is looming. In this case, the DOT reverts to conference calls with a team of Telvent DTN meteorologists, where they can query the timing of the storm and its severity, including the amount of expected snowfall, windspeeds, temperatures and other maintenance-critical information.

> "Staffing schedules are optimized, road accidents are reduced, and managers are better able to deploy 4,000 pieces of equipment

MassDOT's RWIS data is visualized in Telvent's MxVision Weather Sentry Online Pavement edition. Here, high-resolution weather maps and advanced temperature and precipitation forecasts are added to the RWIS information to provide a single and comprehensive interface, reducing the number of platforms needed and eliminating duplicate provider fees.

Another essential aspect of the service is the delivery of hourly updates on the pavement temperature in the DOT's service

Users can overlay Telvent's top-rated forecasting technology with color-coded traffic speeds, live cameras, and their own custom layers

Nor'easters are often unpredictable and difficult for meteorologists to forecast when it will start, how long it will last, how hard it will be, and exactly where it will fall

area, which helps staff schedule crews and determine when to start pre-treatment. These updates take into account the pavement makeup, atmospheric temperatures, precipitation, and cloud cover, and are made even more accurate through a proprietary correction algorithm based on model accuracy. In addition to roadway temperature, bridge deck temperature, and frost potential are also displayed, along with anti-icing recommendations based on FHWA guidelines or user-defined methods of practice. MassDOT uses this information to proactively apply frost treatments only when frost is forecasted and to select the most suitable chemical according to the temperature, in doing so eliminating unnecessary and ineffective treatments.

As MxVision WeatherSentry Online can be accessed on any computer screen or mobile device, DOT staff can access the software in their office, on the road or at home. A vital feature is the ability to consult a Telvent DTN meteorologist at any time, allowing staff to ask time-sensitive questions and receive answers within minutes. Through the online consultation interface, they can also see what issues are of concern to their colleagues in other states. "This interaction allows us to get ahead of the storm," says Brown. "It actually costs us less in the long run."

With this new weather solution, MassDOT and its contractors are now better equipped to make critical decisions during the winter season. Staffing schedules are optimized, road accidents are reduced, and managers are better able to deploy the DOT's 4,000 pieces of equipment efficiently. "Having this accurate weather information allows us to proactively treat streets, saving costs for the state, and keeping roads safer for our citizens," concludes Brown.

making the decisions are not the same ones writing the checks!"

Hart cites Colorado as another state that has warmed to MDSS. "They decided they were going to follow the recommendations to the letter, even if they did so with some trepidation," he reveals. "What they found was that it got the job done more effectively than perhaps in the past, which maybe surprised them somewhat. But costs are not always the only consideration – the rate at which you get the roads back to the desired level of service can also be as big a benefit as any cost reductions."

Ben Hershey, Meridian's director, Road Weather Services, feels the one-stop shop for information that MDSS offers shouldn't be underestimated either. "In the past, a lot of people have had to go to different interfaces or locations to get their individual RWIS, to obtain their weather forecasts, etc. Not only does MDSS provide them with a weather

> Everybody knew what everybody else was doing, which helped give us a much more consistent product while also influencing accountability
>
> **Tony McClellan, Meridian Environmental Technology Inc, USA**

Flash flooding is the leading cause of weather-related deaths in the USA, with around 200 deaths annually

forecast, there are also camera images to see what's going on out on the roadway. From a users' perspective, if they can view everything they need in one location, that has enormous time-saving and efficiency benefits." McClellan, who has that DOT experience, offers yet another example of how MDSS is paying dividends. "In New Hampshire they're definitely at the bleeding edge of environmental issues, and they've been using MDSS to curtail their salt usage," he adds. On this note, a cost-benefit study conducted following the Granite State's trial of MDSS in 2006-2007 showed the DOT was

The liability issue of RWIS

The data sourced via RWIS – and shared through initiatives such as Clarus – supports maintenance decisions and has a direct impact on public safety, mobility, and productivity. RWIS maintains traffic safety and is deemed as valuable for reducing exposure to certain liabilities, but as with any technology, liability concerns are an issue that require a certain level of consideration.

But what are these concerns – and what can be done to address them? These were questions asked by Jaime Rall when producing the 120-page *Weather or not? State Liability and Road Weather Information Systems* report, commissioned by the FHWA's Road Weather Management Program. "I think the FHWA's main goal was to clarify to states what is and isn't a concern," she reveals.

Rall, a policy researcher at the National Conference of State Legislatures, reports most of the states surveyed didn't have any concerns at all, but of the few that did, these fell into four categories. "The first two were about sharing information with the public, either directly or indirectly, such as through online weather providers," she says. "It could be that they gave false, untimely or misleading information due to a system malfunction. Another concern related to DOTs' duties to respond to RWIS information that gives notice of weather-related roadway hazards; if they have this additional information but insufficient resources to deal with the problem, could that lead to liability? The fourth concern related to liabilities for not using RWIS in situations when they might be expected or indicated – in essence, does RWIS raise the bar for what a DOT is supposed to be doing?"

Rall then surveyed the states as to how they would address these issues to produce a tool for appropriate responses. No doubt the FHWA was pleased to hear that, ultimately, RWIS helps reduce liability, not least by assisting DOTs to better meet their duties to the public. "The other way RWIS reduces liability is by providing evidence that a DOT did what it was supposed to do," Rall says. "This was highlighted by a case in New Hampshire last year in which the RWIS proved salt had been applied when they said it had, which absolved NHDOT from any liability resulting from an accident during a snowstorm."

able to deliver the same level of service with materials savings of 23% less effort, overall representing a benefit-cost ratio of 8:1.

Cool, calm, and connected

So that's MDSS in the present – but what of MDSS in the future, when mobile sources could proliferate and the number of data points feeding into the system could increase exponentially? Dr Sheldon Drobot is the scientific program manager at the NCAR in Colorado, and has been researching the potential of mobile weather probes for a few years now. NCAR worked under the direction and funding of USDOT on an initiative to create a system whereby vehicles wirelessly transmit data to a central network. Drobot built what USDOT refers to as a Vehicle Data Translator (VDT), the role of which was to take data from the network (of vehicles) and determine the driving conditions for different segments of road, in effect creating a real-time weather report that could be disseminated to maintenance personnel and even back to vehicles on the road.

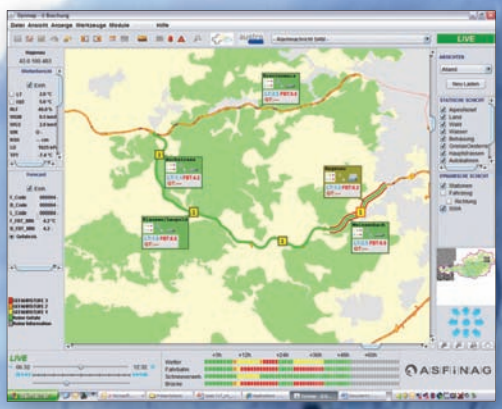
The system was put to the test rather successfully in Detroit last year, so now Drobot and his NCAR colleagues are going to be working with DOTs in Nevada and Minnesota to conduct similar tests using snow plows and other DOT maintenance vehicles. It's all exciting stuff, but what do these connected developments mean for MDSS? "I actually see the two becoming somewhat synonymous in the next couple of years," Drobot predicts. "In relation to Nevada and Minnesota, there are three real benefits the maintenance teams will realize, the first of which is an administrative one. Snow plow operators have to complete a report after each run and list where they put down material, how much was applied, etc, and a lot of this is based on memory. This could now be transmitted accurately and in real-time. The drivers I've spoken with seem keen about that! But that type of information also helps maintenance engineers, as they know precisely how long it's been since the vehicle's been out in a specific area – and that's the kind of accurate data we need for inputting into MDSS. The last benefit is situational awareness – getting information about roadway conditions to better know what spot treatments are needed."

Trucks in the Nevada DOT maintenance fleet are to be fitted with mobile probes to fill in the blanks in the fixed RWIS network

The Federal view

Both Drobot and the likes of Bob Hart at Meridian are certain these mobile technologies will become increasingly influential in the years ahead – and they're not the only ones. "We don't expect mobile to usurp fixed sensors because you're still going to need the fixed data to quality-check the data coming from the connected vehicles," states Pisano from the FHWA, which funded NCAR's VDT research. Equally, though, the FHWA man feels the information you can obtain from a network of connected vehicles will be invaluable, particularly in terms of filling in the blanks that currently exist between fixed RWIS sites. "I was at the recent meeting of the American Meteorological Society in

The Boschung roadmap



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Weather on the web

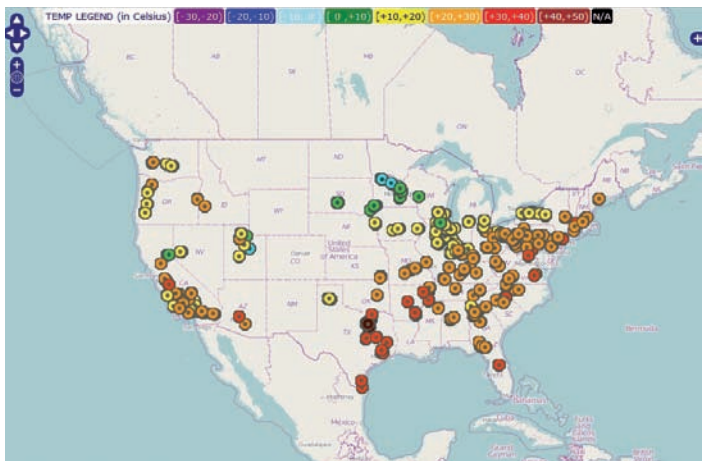
Aurora's Chris Albrecht is pretty animated about a 'knowledge base' website he and his colleagues at the Clear Roads program are developing devoted to the winter road maintenance and road weather sectors. "We don't want to just regurgitate existing information, or good research reports that you can already access through sources like TRB," he says. "It's going to be a place to share and discuss new ideas and experiments – there might be a snow plow operator in southern Minnesota who created a new modification of a snow plow blade that has shown to work really well for ice removal, for example. That operator may never write and submit an academic peer-reviewed research paper, but he might want to share what he's working on with others in the snow-ice field on the website. It could be a bit of best practice: 'We calibrate our spreader differently and it seems to work better' or 'We slow down to this speed in this condition and it seems to work well'. These are all things that traditional academic researchers may never appreciate as they're not out in the field. These guys who do the work every day, they might not have a PhD, but they sure know their stuff."

Albrecht is keen to ensure that the new portal doesn't simply become a marketing tool for private sector vendors to advertise this new equipment or that software or that chloride product. "We want the content to be very valuable, objective information for the road weather and winter maintenance practitioners," he insists. "We'll have different levels of users in order to better manage the site. All of the board members and myself and the managers at the Clear Roads program will be able to edit content, while some folks will only be able to add information of their own. Ultimately, effectively managing the site's content will be the major challenge we'll have to overcome."

Boulder, Colorado, and Shelley Row, director of the ITS Joint Program Office, strongly encouraged the weather community to step up to the plate and become a major voice in the crowd in support of connected vehicles," he says. "They're taking the charge seriously and seeing where they can go with it."

Mobile on the move?

What will please Row and Pisano is that moves are already afoot within the weather community to pursue mobile data sources, evidenced by the recent tie-up between the USA's National Weather Service (NWS) and Global Science & Technology (GST). Paul Heppner, a self-confessed "weather geek", is the program manager in charge of running the Mobile Platform Environmental Data (MoPED) observation network for the National Oceanic and Atmospheric Administration-National Weather Service (NOAA-NWS). Although he admits there are some similarities between NOAA's MoPED program and what the Connected Vehicles Program is trying to achieve, certainly in terms of situational awareness, the way both parties are going about it is less similar.



In 2009, the GST team worked on the MoPED prototype, which was deployed on a limited number of Greyhound buses. The probes, which Heppner dubs "weather boxes", are supplied by Canada's Weather Telematics and in a second more recent phase have now been deployed to around 1,000 trucks in the Con-way fleet nationwide, a figure expected to rise to around 1,500 vehicles in the coming months. The boxes contain various sensors to gather atmospheric conditions, including temperature, pressure, relative humidity, ozone information as well as precipitation and skylight data. This meteorological data is then merged with vehicle data from the vehicle CANbus, so the mobile platform observation concatenates data from third-party meteorological sensors and the vehicle. On this, Heppner has observed that the third-party instrumentation provides more accurate and meaningful data than obtained (so far) from the CANbus.

"The really neat thing about the weather box is that it's really high-frequency sampling, every 10 seconds, so on a daily basis we're now receiving millions of observations from drivers traveling around at highway speed, every 1,000ft or so, which is great when you're around bridges and overpasses, and so on.

> The mobile platforms are great at spotting precipitation – cold pockets of air in valleys, or areas of fog – radar frequently overshoots the top of low-level precipitation
>
> **Paul Heppner, program manager, MoPED, GST, USA**

Con-way trucks with meteorological probes providing national coverage to the National Weather Service

"People have asked me about the quality of the information we're obtaining. I've been watching the results for months now and benchmarking our numbers against airport data and fixed weather stations. The quality of the mobile platform data is remarkably good," Heppner continues. However, a real plus for the GST meteorologist is that the probes on the trucks are able to detect precipitation, which is where radar falls down. "In the USA where you have a lot of mountainous areas, there are loads of gaps in radar coverage so the mobile platforms are great at spotting precipitation, uncovering cold pockets of air in valleys, or areas of fog – radar frequently overshoots the top of low-level precipitation."

The benefits of filling in the radar blanks are obvious for DOTs, so what's in it for meteorologists? "First off, it serves as more

input to the current tools," Heppner says. "Secondly, it will help the existing tools evolve and develop." He can also imagine initiatives such as *Clarus* potentially merging with the National Weather Service database. "DOTs would certainly be interested in the data we're getting from Con-way, particularly in terms of MDSS – if there's a whole bunch of trucks running in Wisconsin and that can be input data into an MDSS, they'll know only too well the value of that. The connected vehicles movement is interesting but it's very ambitious and there are some people in the industry who think it won't come to pass. I think the critical milestone will be the 2013 deadline that NHTSA has set itself to either mandate this type of technology or not. What we're doing with MoPED exists now – the data is being fed into the NWS database and is helping to improve our weather forecasting and prediction capabilities right now."

Another researcher similarly excited about the potential of these new mobile offerings is Iowa State University's Chris Albrecht, who is also the program manager for the FHWA's pooled fund program, Aurora. "Ultimately, many data points of slightly less accuracy are potentially more valuable than just a few data points of higher accuracy, because the data can be more representative of the entire roadway network," he feels. "I think the idea of connected vehicles collecting useful data is great, for travel time, forecasting, etc. The road weather community could really maximize the use of the data. We never talked seriously about this a decade ago, so now that things on the vehicle side are advancing, along with innovative instruments at the roadside and advances in materials and methods we're applying, we're hitting all sides of the equation.

(Above left) **The weather box in situ on a Con-way truck** (Above right) **RWIS can play a vital role in summer maintenance operations, such as road striping**

A technology for all seasons

The big challenge is that you can put a gazillion tons of salt down to keep roads clear, but that's going to cost a lot of money, and there are serious environmental concerns as well. Finding this balance is key. However, Albrecht is keen to remind everyone that road weather management is not just a winter topic. "Increasingly, the summer maintenance folks are needing data available from RWIS," he says. "Several years ago, Aurora hosted someone from the concrete paving industry who was looking at using RWIS to assess the optimum time and conditions for paving. When is it too hot? When is it too cool? Aspects such as atmospheric and ground temperatures matter quite a bit to them. And when you think about application of pavement markings, the weather is extremely important. It's vital that RWIS and road weather management tools are not seen simply as winter tools. There's a danger they could be perceived to be only useful for half of the year, which could undermine their tremendous value."

Meridian's Tony McClellan and indeed GST's Paul Heppner also agree that we shouldn't get completely hung up on snow and ice when discussing road weather. "Deploying MDSS for non-wintertime operations can provide agencies with a larger cost benefit within their agency – any highway operation that is dependent on the weather and road conditions can benefit from these technologies, even for things like herbicide spraying," McClellan says. "And don't forget that a lot of important weather events occur in the summer, and most fatalities do not take place in snow or ice," Heppner concludes. "That's actually one of the really promising aspects about mobile platforms – you'll be able to identify these potentially dangerous and more localized areas of precipitation and fog, etc, which statistically pose much more of a hazard."

The end of the beginning

There are currently 37 states, five local agencies, and four Canadian provinces feeding their data into the *Clarus* system as well as Minnesota – which in addition to its fixed sites is now also providing data from its snow plows. "That's 2,253 sensor stations connected up to the system, comprising 52,471 individual sensors plus 81 vehicles," confirms Paul Pisano from the FHWA's Road Weather Management Program, which runs the initiative alongside the USDOT's ITS JPO.

"It was supposed to be a five-year project, which has long since passed, but as *Clarus* was winding down, the connected vehicles work was winding up, so a lot of what we're doing now under the *Clarus* banner is actually connected vehicle research.

"We're also continuing to work with the National Weather Service to become the home of an operational tool that provides the same capabilities of *Clarus*. The NWS won't be running it, but they have similar types of database management systems and we're working with them to see if whatever they do contains the same functionality and capabilities that we've built into our system. They're very receptive to the idea."

The Regional Demonstrations have been the big *Clarus* talking point involving over the course of the past year – two multistate teams and the private sector developing decision-support tools for DOTs to better manage their systems. "There were five use cases as part of these demonstrations. The first was improved road weather forecasting, which was a pre-cursor to the other four," Pisano details. "The second was a seasonal load restriction tool that would help states make more informed decisions about when to apply or lift load restrictions resulting from thaw and pre-thaw cycles in the springtime. The third was the maintenance and operations decision-support tool, which is basically MDSS for all seasons, not just winter. The multistate control strategy tool dealt with improving traffic management across state lines, such as when large-scale flooding might affect multiple states. How do those states communicate among one another in such a scenario? The final use case was enhanced road weather content and travel advisories – not to create another 511 but to see how data from *Clarus* could improve what was already out there.

"Now they're all complete, we've conducted independent evaluations and documented how they helped."

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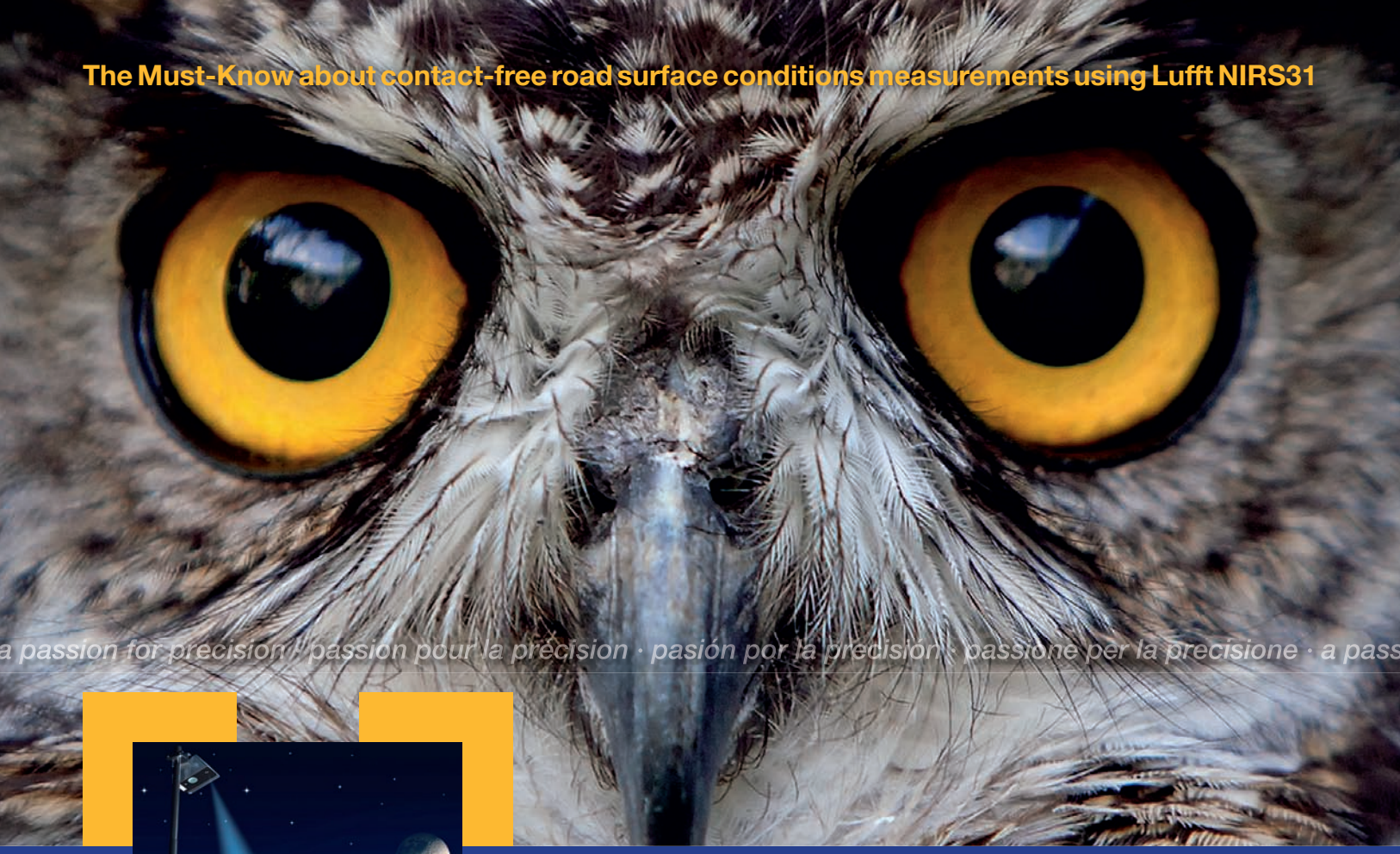

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Interviewed by Leanne Keeble

> The participants in the test had a good understanding of not only how the technology worked but also why we're all pursuing it

The Research and Innovative Technology Administration's Peter Appel has a placard from his boss on the wall of his office that reads, 'For the time being, at the pleasure of the President'. That's right, President Obama. However, RITA's administrator is not at all daunted by this ever-present reminder that the buck pretty much stops with him. Indeed he actively embraces the challenge of making his boss's life – and that of millions of traveling Americans – easier.

Appel's been in transportation for 20 years and has clearly seen a lot of change in that time. But the biggest transformation may be just over the horizon: 2013 is being billed as the milestone for the whole connected vehicles movement. That's when NHTSA may or may not issue a rulemaking about DSRC-based 5.9GHz C2X communication technologies for cars. In terms of legislation, there could be a statement about minimum performance requirements, or even inclusion in NHTSA's New Car Assessment Program to give car-makers credit for voluntary inclusion of safety capability in their new vehicles.

In 2014, the Administration will come to a similar decision related to heavy vehicles, and the year after infrastructure implementation guidance will be issued. So, will NHTSA go for it? "I don't want to presuppose where we're going to end up because everything we're doing – the Driver Acceptance Clinics that kicked off in Michigan in August, the Model Deployment in Ann Arbor next year – they're scientific tests," Appel says. "Our role at RITA is to make sure that it's done in an even-handed way, so we're not really influencing any decisions – we're simply obtaining the best available empirical data.

Acceptance speech

"The technology performed very well, though," he says of that first clinic held on August 11. The name itself is perhaps a misnomer as these tests are much more than simply gauging how the 100 subjects in each of the six clinics will react to driving a 'talking' car. "It's also studying how the technology works when used by a variety of drivers," Appel continues. "Everyone drives differently, so we're attempting to obtain a set of data points that will go along with the Safety Pilot Model Deployment in 2012. These subjects have been scientifically selected in an unbiased process, so we've got a great sample to try and obtain a representative view."

Among the smart technologies analyzed in Michigan were warnings for forward crash, emergency brake, blind-spot, lane change, do-not-pass, and intersection assist. "Overall, the participants in the test had a good understanding of not only how the technology worked but also why we're all pursuing it," Appel reports.

Safety is of course the main driver and although the USA has made remarkable progress in reducing its traffic fatalities over the past five years, 32,788 people were still killed in 2010 in a total of six million collisions. As Appel has pointed out in numerous speeches before, crashes are also the leading cause of death among four to 34-year-olds and as far as he and his colleagues are concerned, a great number of these are preventable with intelligent vehicles.

"NHTSA has conducted studies of unimpaired crashes and calculated that more than 80% could be addressed in one way or another through this kind of technology," Appel says. "There are many things in the safety toolkit, but NHTSA believes crash-avoidance technology to be a huge opportunity and that the Connected Vehicle Program could be the next great leap forward in safety."

Despite his seniority, Appel is not one to grab the limelight and instead singles out

> The extent to which they go from assist to autonomous is yet to be determined, but the research does seem to be promising

his immediate superior, Secretary Ray LaHood, for special praise. "A lot of our drive at the moment comes from the top," he insists. "The Secretary has made it absolutely clear that this Department is focused first and foremost on saving lives, and we'll look at every single approach we can to make dramatic safety improvements in US transportation. That kind of leadership – combined with great technicians, technology, stakeholders, and partners – has really helped us gain some momentum over the past few years."

Behind the wheel

C2X technology itself has picked up enormously even within the two years in which Appel has been in office. And, of course, he has first-hand experience of what it's like to be behind the wheel. "I was personally very impressed," he says. "I've been in a DSRC-equipped vehicle eight or nine times since becoming administrator and even I've seen significant improvements to aspects such as the user interface. When you're in one of these cars and approaching a green signal and you're alerted to the fact that another car may be about to run a red light and collide with you, it's a strange feeling at first, but it really does work."

Appel doesn't go as far as to suggest that it's ready today and could be deployed tomorrow, however. "There are still things to iron out," he admits. "The underlying technology is very solid, but we still have to address security and privacy issues. We need to address infrastructure issues. We need to address policy issues relating to how this will be operated and maintained. What are the roles of local and federal governments? What is the role of the private sector? And cross-cutting all of that, we need to ensure that we address safety as the number one priority in everything we do."

Given the state of the economy, a further question might concern how this is all to be financed? "I can't really predict exactly how that's going to play out because it's a big area of our policy research – we're looking at various models for deployment to assess the best approach."

With the roadmap set out, what's clear is that over the next 18 months all of these questions will more than likely be answered. After the Driver Acceptance Clinics conclude in January 2012 – taking in Minneapolis, Orlando, Blacksburg, Dallas, and San Francisco – the 3,000-car Model Deployment will be on the horizon. "There will be multiple vehicle types – integrated trucks and vehicles, vehicles with aftermarket and 'Vehicle Awareness Device' devices as well as equipped roadside infrastructure. It's so much more than a testbed – it's a real-world environment. The University of Michigan's Transportation Research Institute is taking the lead but there's more than 60 partners involved from numerous public agencies, associations and standards developers, industry suppliers, OEMs, academia, and of course government. The vehicles will operate on public roads and with 3,000 of them involved, there will be a big enough concentration that they'll interact regularly on a day-to-day basis, so we'll be able to test prototype security mechanisms, device certification processes, etc."

In terms of the DSRC devices themselves, the initial procurement resulted in eight awards, with only six vendors making it to acceptance testing. None complied with the tests, however, with the USDOT considering the specification as too weak. An updated specification was issued in addition to a second procurement process, which led to four awards. Later this year, the Qualified Products List (QPL) should be announced.

Predicting the future

Appel is patently not the sort of person to make bold predictions, although he does admit to following developments in autonomous cars, which in a similar vein to connected vehicles have also benefited from some notable advances. "I've seen what Google has done, as well as the Department for Defense [DARPA], so all I will say is that there are a lot of ways that technology can assist in the driving experience. The extent to which they go from assist to autonomous is yet to be determined, but the research does seem to be promising.

So we're not quite expecting *The Jetsons* to come to life yet, then? "It's important for us to realize that not all technology is necessarily high-tech electronics – some of it is just basic common sense infrastructure design. A rumble strip along the side of the highway might seem simple, yet the payoff in terms of alerting drivers when they're drifting out of a lane is so important.

"One of the great things about this job is that I get a chance to meet a lot of people who go well beyond technology and research – enforcement officers, safety advocates, etc. You need good laws, good law enforcement, good outreach, and education and, yes, you need good technology. RITA's a great place to be to see all of that – especially in front of that motivating message from the President!"

Driven by distraction

As if being RITA administrator at such a formative time for connected vehicles wasn't enough, Peter Appel is also a key figure in one of the most concerted traffic safety campaigns in USDOT history – to combat distracted driving. "According to 2009 analyses of fatalities on our roadways, around 5,500 people were killed in crashes that were reported to have involved distracted driving," he says. "And some estimates show that close to 1,000 involved cell phone-related distraction. If we don't address this now, it's going to get much worse in the future.

"I have this unique role in the Department in that I work on behalf of the Secretary on the distracted driving issue as well as on how to bring technology into the vehicle to save lives, so I'm the first to recognize the challenges, but if you're smart about it anything is possible. RITA has devoted a lot of attention and resources to distracted driving since 2009 when the Secretary asked us to put on the Distracted Driving Summit. We brought together academic researchers, safety advocates, auto industry experts, law enforcement – we even had US senators speaking about legislative efforts. We're all going to need to come together to solve this one."

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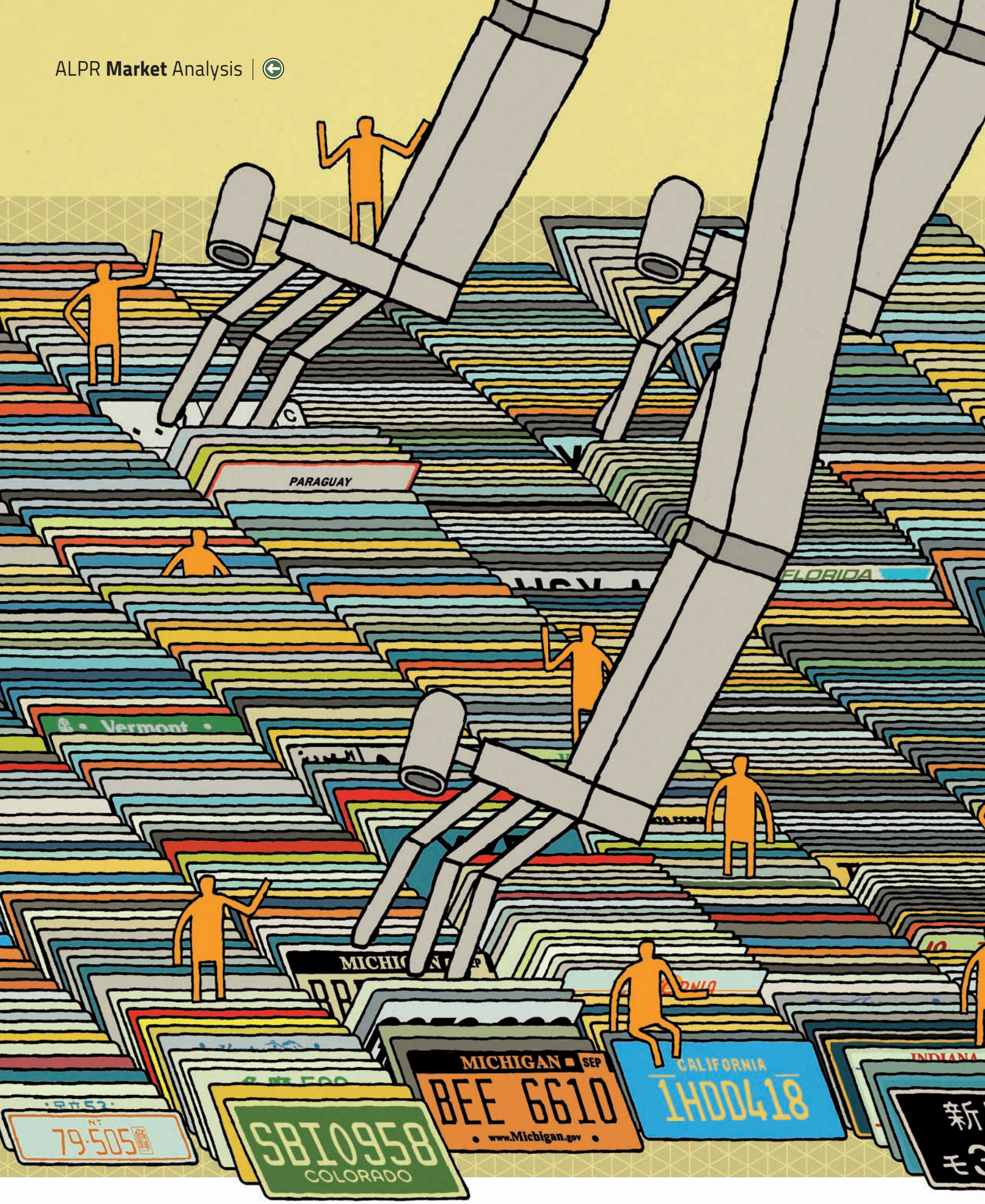
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In one key sector of the ITS market, the business strategies, products and innovations of the next generation are being defined now. **Louise Smyth** meets the brains behind tomorrow's ALPR solutions

Illustration courtesy of Tim Ellis

Tolling, security, parking, enforcement, and more – the list of applications for automatic license plate recognition (ALPR) is vast. Just because it's a huge sector, though, doesn't mean it's an easy one in which to survive. The recent liquidation of a relatively big name in the industry, PlateScan, is testament to this. Likewise, rumors surrounding the flagging status of another key player in the North American market are also a sign that anyone involved in ALPR must keep evolving, diversifying and improving their offerings. The companies that are flourishing today, many of which are featured over the coming pages, are those that are able to bring something new to the table.

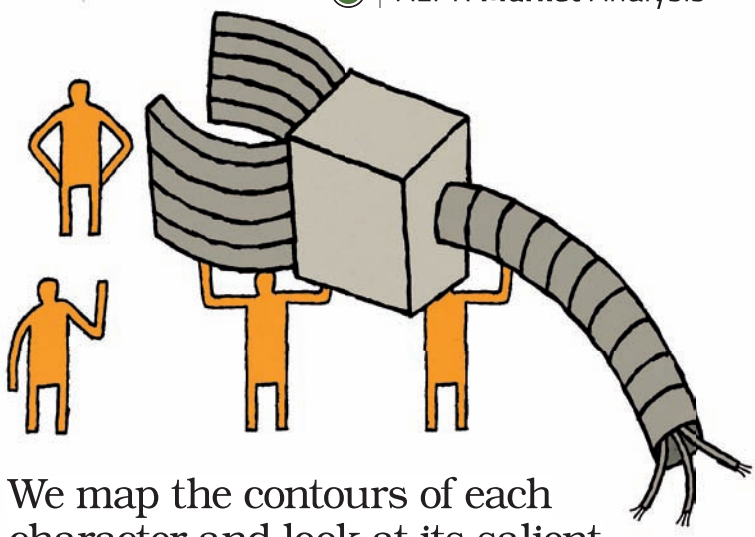
"Although Digital Recognition Systems is a fairly new company, we are not new to the industry,"

explains Paul Kaplanski, who joined the company just after its formation three years ago. "Our founders had a lot of experience with various ALPR companies, but always thought they could do things better – and that's exactly what they did. There's no point entering the market at a later stage if your products do the same as everyone else's, so we created unique products that offer cost-effective benefits to the customer."

The word 'unique' is often bandied about by vendors, but Kaplanski is able to back up the claim: "Most software engines are either based on neural networks or they are a standard OCR solution that relies on a template match – so a letter A in the image is matched with a letter A in the template system," he says. "But in reality a license plate is not always in the optimum position, there could be poor weather conditions or the plate might be damaged. So that A might not fit the template and you're more likely to get a misread.

"We use our own contour-matching method as opposed to matching the whole template," Kaplanski continues. "We map the contours of each character and look at its salient features. It's similar to handwriting – yours is different to mine but everyone can read both because the main features are the same. That's how we read plates and it makes us a lot more robust. We get fewer misreads and are more likely to read plates that others would misread."

Digital Recognition's strategy wasn't to just sell its own software engine but offer an entire ALPR solution. Unsurprisingly, the company has also adopted a 'unique' approach to the camera, as Kaplanski outlines: "We've created a hybrid analog/IP solution. The cameras from most other companies will have two cables coming out the back – one for power and the other for video, which means you have to get power to the pole, which has associated costs. Other companies have a specialist cable that has a limited length, is expensive, and being so thick, is not flexible or easy to get around corners. So what we've done is to devise a solution that uses a simple, readily available Cat 5 cable. Installers can supply their own cable so there are minimal costs there. We can also power up the camera over that cable, which can reduce installation costs as no local power is needed. Nobody else is doing this."



> We map the contours of each character and look at its salient features. It's similar to handwriting – yours is different to mine but everyone can read both because the main features are the same
>
> **Paul Kaplanski, Digital Recognition Systems, UK**

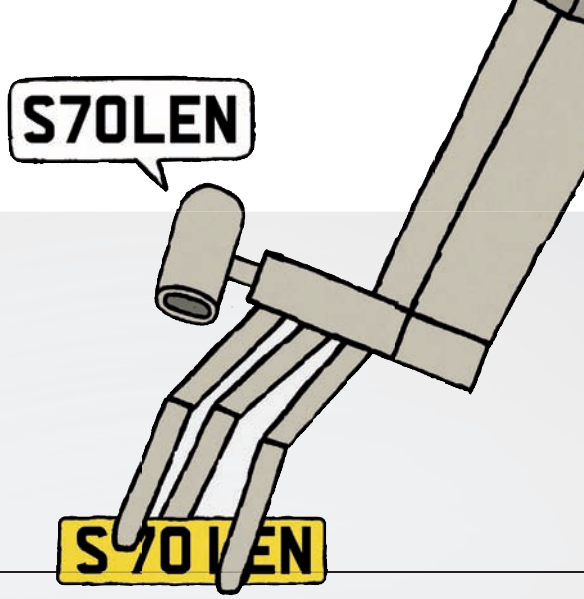
(Left) **The complexity of reading Japanese plates** (Below) **Digital Recognition's iSharp ALPR camera**

This different approach is certainly paying off for Digital Recognition, with Kaplanski revealng the company is winning business around the world, including a huge new partnership with a major law enforcement company in the USA. He also highlights a project that's ongoing in Japan. "For us to come up with a system for every new country, we really need to get actual video footage from our own camera. Once we have that, we can then work on the algorithms to develop an engine to read plates in that country. Using just two days' worth of video from Japan, we got up to 83% accuracy in our initial pilot project."

That's no mean feat given the complexity of Japanese plates: "First they've got numbers as well as Japanese characters," Kaplanski explains. "But they are also not like most plates where you have one or two lines of characters: they've got top left, bottom right, middle, all areas. The trick is to find and segment the many different sections of the plate, which is something not many companies can do. Once we've got up to 90%, the solution will be rolled out among 700 casinos to assist in their security operations."

The UK and beyond

Another UK company that's finding success both at home and abroad is NDI Recognition Systems. "One of our most prestigious sites is the Trafford Centre [shopping mall] in Manchester," says Adie Cadd, sales director, when asked to highlight some recent projects he's been involved with. "We replaced a legacy system with our NDI C320 fixed cameras and software on all entrances to the center to track the 700,000 visits the center receives each week. The system also has links into the Greater Manchester Police, so every

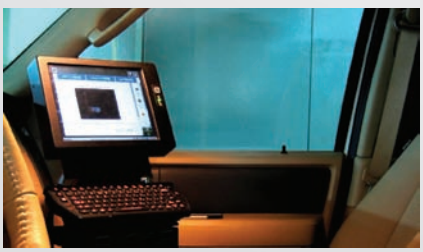


An eye on standards

Conflicting advice and dubious marketing claims have long been a problem in ALPR. **Louise Smyth** meets one expert offering no-nonsense guidance on how to pick the right kit

Having discovered that the industry was "pretty confused" as to the type of ALPR equipment needed for different applications, particularly cameras, Tom Tarach, president of US vendor, Eyenet decided to create a list of standards that can be used internationally to clarify what technology is required.

"The standards cover five levels," he says. "So, level one would be a very simple application; at a gate with fixed lighting where a car comes to a complete stop, for instance. Moving up the levels,



> As computers are becoming more powerful at a lower cost, cameras are following suit

the technology needs increase – so level two would need infrared, then as you move to levels four and five, you add in components such as database management."

Presumably the goal of these standards is to help educate people that if their application only requires level one or two equipment, there's no need for them to spend money on level five equipment? "Absolutely," says Tarach. "We see companies spending US$5,000 for a camera when a US$200 camera would work. Some of our competitors can't work with inexpensive cameras – they can only work with their own, proprietary (expensive) ones, but we want to give our customers real, value-for-money options."

At the other end of the level spectrum, how do Eyenet LPR systems work for more sophisticated applications? "We get outstanding recognition. The technology has been used for the past six years at the busiest border crossing in the world, the Shenzhen border between Hong Kong and China, at a 98% accuracy," reports Tarach.

Eyenet's products are also finding a huge audience at ports, where the drive is to automate as many processes as possible. "Our core product is the OCR, where we use video cameras to read characters – on license plates, for example," Tarach says. "We are also noticing great demand for the combination of reading the license plate and reading the shipping container number to create a fully automated port exit."

Another recent contract for the company was in the law enforcement arena, for the particularly challenging market of Saudi Arabia. "Through our partner, we sold some systems to the Saudi Ministry of the Interior.

vehicle that enters is not only being looked at by the center's own security staff, the police also receive information that could provide an early warning about stolen vehicles or those that might be involved in criminal activity."

NDI also reports significant deals in Australia, including two recent contracts for in-vehicle ALPR equipment. Although geographically far apart, the Australian and British markets have more similarities than one might think, as Cadd explains further: "We're working with Gatso Australia and they have recognized that the way the UK deploys ALPR – such as the Ring of Steel in London and projects that use mobile ALPR to secure areas that aren't covered by cameras – showcases its great potential. There is a similar drive in Australia to the one we've seen in the UK to get police officers back on the streets and not distract them from their daily duties with technology; this is why Australia is embracing ALPR.

> When you've got these wild claims being made of '100% accuracy' and 'we don't miss a plate', it discredits the whole industry

Adie Cadd, NDI Recognition, UK

NDI's Talon engine relies on neural network technology. "Unlike traditional OCR, we don't use template matching – we use a system that does character segmentation," he says. "So it takes the image, breaks it down into individual characters and spacings and then the neural network analyzes every individual character. Essentially, it says 'that could be a 'B' or an '8' but my confidence tells me it's a B because of the similarities between the Bs in our statistical model'. It uses pattern recognition incorporating neural networks."

Cadd and his customers are more than happy with the accuracy of the approach, but what he's less happy about is the issue of

Eyenet is doing big business in the challenging Middle East market

This was a law enforcement project where the software was deployed inside police vehicles with an ALPR camera on the outside. The Arabic characters on the plates are a challenge to read, but it's compounded by the dust and dirt that accumulates in the Middle East, which makes for difficult conditions to read license plates at all. Using cameras that read in both infrared and color simultaneously has really improved the accuracy, because sometimes that dust or dirt will cover up a plate but the color camera will read it where infrared won't be able to because it won't reflect."

Eyenet believes that going down the non-proprietary route is also beneficial to business due to the price of hardware falling. "We can use off-the-shelf computers and cameras, and as computers are becoming more powerful at a lower cost, cameras are following suit," Tarach says. "We're certainly much more competitive because the hardware costs are coming down."

standards – or lack thereof – relating to vendor claims regarding accuracy. "The UK has gone part way down the line of having an accreditation system in that we have the NAAS (National Association of Chief of Police Officers Automatic Number Plate Recognition Standards) system," he says of this particular bugbear. "That is in force but it doesn't govern commercial companies to be accredited every year and say 'we are now proven to hit this accuracy rate'. But in the public sector, 99 times out of 100 in the tender requirement it will be requested that the supplier exceeds the NAAS standard.

"The Home Secretary recently announced a review of ALPR and CCTV and a consultation process where interested parties could put forward their views," Cadd continues. "I put forward the requirement to tighten up the NAAS standard. Reputable companies will freely say that ALPR isn't a 100% foolproof technology – it cannot read in 6ft of snow, for instance – so as long as customers understand that fact, they've got no problem with it. But when you've got these wild claims being made of '100% accuracy' and 'we don't miss a plate', it discredits the whole industry."

Lies, damned lies and statistics

Somebody on the other side of the Atlantic who is also familiar with the issue of unsubstantiated claims is Alusio Figueiredo, the COO of

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(Right) **The Talon V8 software from NDI Recognition** (Below right) **ISS's graphical user interface**

Intelligent Security Systems (ISS). "I have had problems with this in past, notably in Brazil, where one vendor that had been making false claims conducted a massive proof of concept that failed miserably," he begins.

"License plate recognition is not just about OCR – there's a lot of pre-processing behind it. We've been doing this since 1999 and our system uses a set of filters. If it's very dark, we might apply a grayscale filter; if the plate is very dirty, we might do a black and white filter. We have about 36 filters to pre-process the images – for us the OCR is the last step of the whole process."

ISS also relies on templates in its system. "Here in New Jersey, for instance, plates are of a certain size, have a yellow background, black characters and there are always six characters," Figueiredo says. "We add all of this information to the system, which firstly helps us locate the plate in an image, and secondly to recognize the characters – extra detail that increases our recognition rate. The downside to doing so much more than just OCR, however, is that it's more difficult to add a new country. In Central America, for instance, there are no templates at all so I'm not even close to a 98% recognition rate. So I do not even take such projects."

His honesty is refreshing and this strategy allows ISS to concentrate on the projects where it can really make a difference. Lately these include a number of high profile schemes in Russia, including a traffic enforcement system, which Figueiredo details:

Inex/Zamir's DY digital ALPR camera

"The city of Moscow asked us to do an automatic traffic enforcement project. They were looking for people overtaking or crossing lanes and making illegal turns. We have been recognizing Russian plates for years (we even have an R&D center over there) so we were able to produce a system that achieves 98-99% read rates."

On the product side, ISS has recently released a new version of its LPR software for the Guatemalan market. "The plates are incredibly difficult to recognize, with very weird backgrounds for a start!" says Figueiredo. "So we developed a new algorithm that can recognize the background and the foreground and everything is done in color. The system is being used for security checkpoints throughout Guatemala."

Safe and secure

Security has long been a big market for ALPR vendors and Perceptics is another player with a great deal of experience in this sector. "Our security products are now being deployed to multiple military bases as well as one of the most important DoD facilities in the US," says company president, Orlando Carrasco, highlighting a project he's especially proud of. "We are well known in the security sector and have been the sole provider of this technology to the US customs and border protection for almost 30 years. We recently finished upgrading all the in-bound lanes at the southern and northern Ports of Entry."

Carrasco is aware of the need to not rely on just one market and one of his latest

Securing business

Tolling has always been the big breadwinner for Inex/Zamir, but over the past few years, Jim Kennedy, president, has been winning contracts amounting to almost half of his annual turnover in the security and access control sectors. "We've been doing a good deal of work at military bases," he says. "And we're also doing what are referred to as 'secure city' projects, where you encircle a city with cameras and monitor everybody going in or out so if there was an event at 02.00hrs, at the very least you'd know what vehicles were in town."

As tolling remains a key market for Inex/Zamir, Kennedy has also got his R&D team hard at work on improving the software for this market. "We are developing new methods to improve the ALPR reads and the confidence levels for toll roads to minimize the human review," he reveals. "We're taking data from the human review station of the previous day and putting it on a master list. With that data we'll take the time that the vehicle was seen and the place. Then every time we encounter a plate where our confidence is low we'll look at the list and say, 'Well, we've seen this plate every day for the past 30 days within three minutes of this time at this location' and that will raise the confidence. It's based on a lot of data mining; it's not quite neural networking but it is a learning application."

It's not only the software that is being developed – it's also how the ALPR system operates, as Kennedy explains: "On the comms side, we've introduced the ability to go from a triggered mode to self-triggering," he explains. "On toll roads you generally take a trigger because they need a record of every event, but the trigger is usually a loop and as such, it has potential failure. We have built into our system a setting that – if we sense a loss of trigger comms – will automatically switch into a self-triggering mode and catch every vehicle that goes by. We've had that ability written into some bid specs because it's a feature toll roads are anxious to have."

innovations supports this strategy: "We are now getting into the ETC market and we're launching a new, high-res LPR camera for this market. We're also working closely with our resellers to incorporate our ALPR and new DoT Number Reader product at weigh-in-motion stations.

"We have been working in the Middle East and North Africa region, particularly in Saudi Arabia and the UAE. We were the first ones to deploy an LPR system with an Arabic OCR and also to use color as one of the discriminators to identify a plate."

Diversify to multiply

It's a busy time for Italian supplier Intertaff, which is another company diversifying its offerings. "We used to be primarily focused on parking applications, but since December 2010 we have created an average speed enforcement system and now have a couple of installations for it in New Zealand," explains managing director Toni Marzo, who is also currently promoting two other new products: "The first is the LPR Web Server, a new Windows-based, ready-to-use, web server LPR, capable of handling four analog or digital cameras connected to the server at up to 25fps per channel, plus control of up to four separate barriers.

Intertraff's software extracts the plate from the image for reading

Imagine this...

A new imaging system that encompasses ALPR and vehicle signature recognition (VSR) in one package has recently joined the market. Q-Free's latest system relies on its own cameras and Intrada ALPR and VSR software provided by Dacolian, which Q-Free now owns.

Designed for the tolling market, the new imaging system is also complemented by a new single gantry solution for multilane free-flow tolling. The single gantry solution identifies, tracks and interprets both front and rear license plates.

Focusing on the infrastructure needed to deploy ALPR systems as well as the imaging and software components is a smart strategy. Using ALPR on projects remains a costly investment for the end users. If vendors such as Q-Free can improve their infrastructure offerings – and bring the price down – this ought to enable the knock-on effect of a greater take-up of their ALPR products.

> We wanted to be the first company to include the cost of the engine within the cost of its ALPR camera … if the technology is more widely deployed, it will grow the market
>
> **Toni Marzo, Intertraff, Italy**

"The second is our Super WalzCam, which incorporates the recognizer and an opto-isolated output for barrier operation," he reveals. "It can handle speeds from 1-25km/h, making it ideal for applications such as parking or slow-speed traffic monitoring."

Perhaps more innovative than these new products is an entirely new business model that Intertraff is currently exploring: licensing its ALPR engine completely free of charge to those who purchase the WalzCam. Marzo explains that the cost of the engine is included in the cost of the camera, although he is keen to stress that the camera cost has not been artificially hiked in order to achieve this. Indeed, he'll lose money by offering this deal, although his longer-term goal is to more than recoup any initial losses. "I believe that ALPR is still a niche market, yet it has enormous potential," he says. "Cameras and software could be installed everywhere: to open the gate to your house, to manage entrance at offices, for journey-time information systems, and for new speed enforcement projects.

"The only reason it is still niche is because the cost of deployment for the end user is expensive. We wanted to be the first company to include the cost of the engine within the cost of its ALPR camera. Obviously we're not doing this for charity: if the technology is more widely deployed, it will grow the market. If our market share grows by just a few percent more, then our bold example will be justified."

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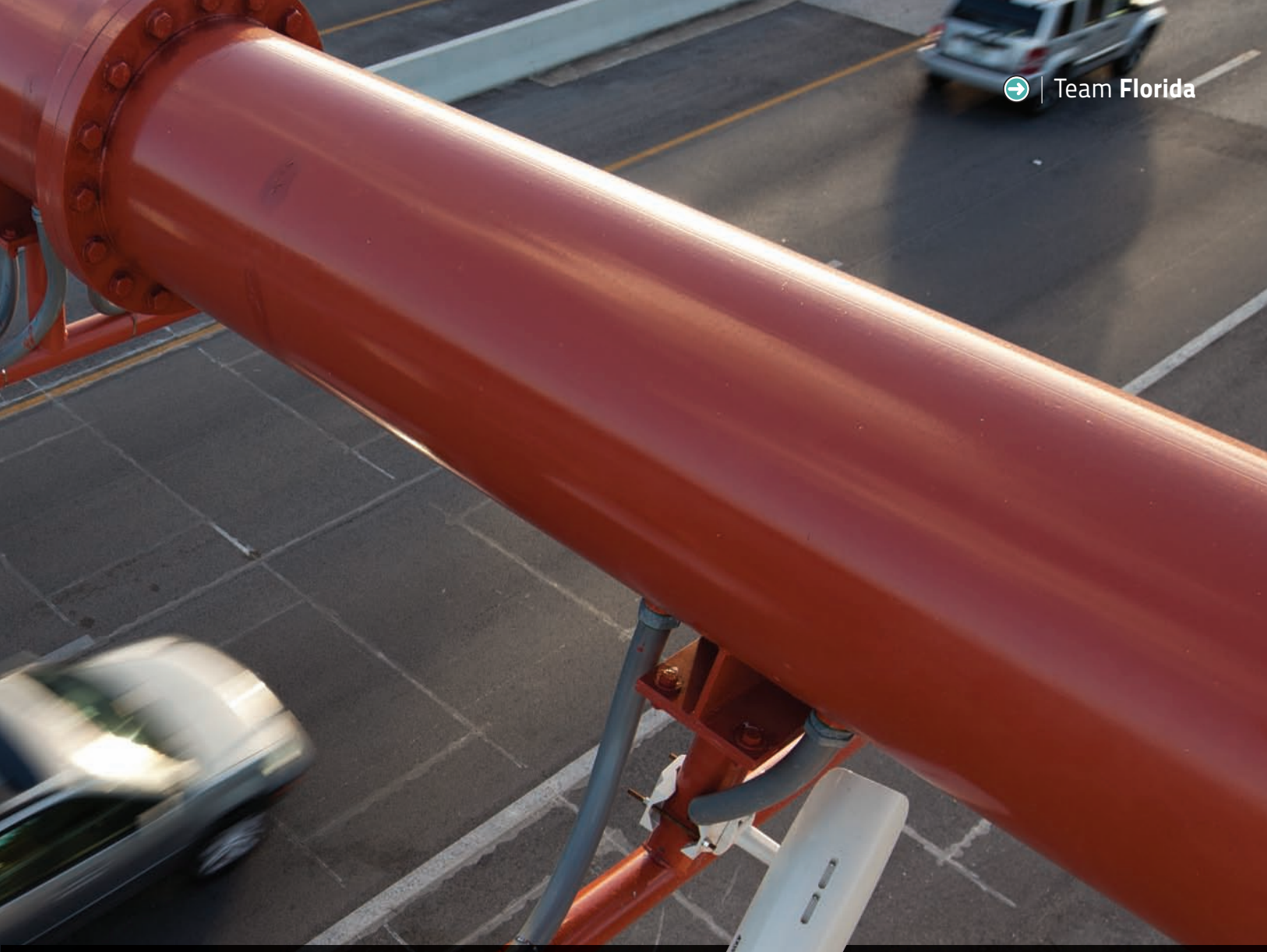
Florida has long been a breeding ground for tolling excellence, spurred by an array of consulting talent working with multiple agencies to keep the state moving. **Greg LeFrois** analyzes the results of this joined-up approach

Photography courtesy of FDOT & Miami-Dade Expressway



Florida's first turnpike opened in 1957. Since then, new tolling agencies have sprung up and banded together into what is now TEAMFL – the Transportation and Expressway Authority Membership of Florida. Through its forums, TEAMFL generates results in better managed toll road and bridge improvement projects, more efficient creation of new roads, and better ways to address financing needs. It also creates and maintains more effective PR programs. From a big-picture perspective, this helps those of us who work with the agencies to build toll roads and bridges that enhance business and move goods and people safely, efficiently and economically. Following Florida's lead, other tolling authorities have since adopted similar team concepts.

Recognizing what's critical

Florida is among the top states in tolling technology, the use of all-electronic tolling (AET) or open road tolling (ORT) concepts, interoperability, and other tolling trends. The state recognized early on that intrastate interoperability is absolutely critical.

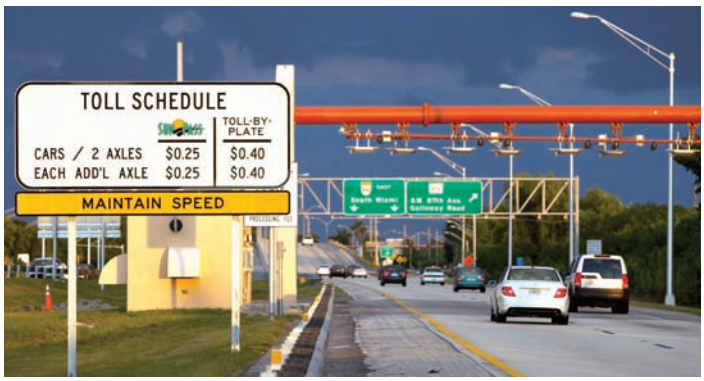
Once ETC began, officials from all tolling agencies launched a statewide initiative to achieve interoperability. In fact, Florida authored many of the current toll specifications and requirements that have been adapted and used by other states, including California and Texas. Florida was also the first state to require interoperability among tolling agencies. This is convenient for average drivers as they can use their transponders anywhere statewide, but for businesses it's a double-positive as they can open an account at a home location, place transponders in their vehicles all over the state and pay a single invoice. With one transponder, you can go anywhere – lost sales due to inconvenience have become successful transactions.

Florida innovates in the tolling domain. On the MDX, tolls are collected electronically by a series of overhead gantries along the expressway that automatically deducts user fees

Tourists aren't left out in the cold, either. Tolling agencies have jointly promoted SunPass for rental cars. Renters simply get a transponder with their rental or the license plate is registered with the driver's rental record and the tolls are collected after the car's return. Feedback from vacationers and other travelers is indeed positive.

Working together

This satisfaction comes in no small part from the ability of Florida's tolling agencies and its department of transportation (DOT)



to work together. In doing so, all players are able to plan for future needs. They help identify traffic and the associated revenue that will come from a project. It can then be financed using toll revenue bonds. Essentially, this is the purpose of a tolling agency: to identify transportation needs and bring the financing to the table for the solutions, typically utilizing user fees.

Using system financing with the revenue from an existing network of toll roads and bridges can then be used as backing for projects that may not be 100%-financeable at the time they're initiated. This makes potentially less attractive projects more feasible from a financing perspective.

This high level of cooperation between the DOT and the multiple tolling agencies helps create a proactive and cooperative approach to exploring new opportunities and planning for future traffic needs in the state. It's also proving to be a model for other states to follow.

State and regional agencies joining forces is only one element that makes Florida's tolling operations shine. Consultants are included in the processes at all levels, particularly in the areas of technology and operations. Agencies typically look to such expertise for engineering, widening of roadways, etc, but when it comes to day-to-day operations many rely on their own staff – but some engage consultants at varying levels.

Florida's Turnpike Enterprise (FTE) follows the latter example, with a dedicated team of consultants in its operations department. Richard Nelson, director of toll operations at FTE, says integrating consultants with staff is part of the culture. "It's like having the private sector as part of our company," he says. "They blend in and all that they've learned from other parts of the country gets brought here – it's like a national think-tank mentality on a daily basis."

Nelson believes that consultants' expertise has been key to interoperability. "Knowing that HNTB and some of our other consultants are working on the plan, we'll reach east coast interoperability by the end of this year," he feels. "We're also making the commitment that all of E-ZPass customers will be able to use their transponders in the state by the end of the year. This is where consultants come in – they have the expertise and the perspective to get this done."

Many toll agencies and DOTs are struggling to determine what factors should be considered when and if they implement AET

The Miami-Dade Expressway has approved an MDX *Open Road Tolling Master Plan* that is looking at technology and to designing a multi-year community outreach effort to implement this new concept

Proof in the pudding

The FTE man thinks this cooperation pays off in multiple ways, and offers the implementation of AET as one example. Indeed, when we look back 10 or 15 years from now, he thinks we'll ask ourselves, 'Did we really stop people in the middle of the road to get money?'.

"We're seeing a 66% reduction in accidents at former toll plaza locations where we've replaced them with AET," Nelson says listing the benefits. "Customers like it because it's faster. Visitors' bureaus are complimentary on how we've incorporated AET. This has been good for tourists, especially those from out of the country. Toll plazas can be difficult for them yet SunPass has a 98% approval rating. Businesses can make more trips without being tied up in toll plazas, as can commuters. And then there's fuel savings."

Florida's initial findings are indicative of trends seen elsewhere. A recent HNTB white paper noted that an AET lane can process up to 2,200 vehicles an hour – equal to the maximum capacity of a free-flowing highway lane. Comparatively, a manual toll plaza processes only 200 to 400 vehicles per hour.

AET also eliminates the need for the costliest items on an agency's balance sheet – toll collectors, toll booths and toll plazas. AET is also safer, and Florida's findings are in line with a 2007 study conducted by the North Texas Tollway Authority that

Best practices in action

Although it helps that Florida's tolling agencies partner with consultants, none of the success experienced today would have been possible had all players involved not followed best practices for AET. *Video tolling*: Agencies with AET must have a video tolling component to capture customers without transponders. *Conduct extensive public and public official outreach*: This is critical because existing customers are being asked to change their habits. *Proactively addressing workforce displacement*: Ample time must be offered for employees affected by an AET conversion to consider new positions or careers. *Accommodate loyal cash customers*: Some customers don't want to share personal information or don't even have checking accounts or credit cards. Give them plenty of options to remain good customers. *Segment the approach to multiple implementations*: If facilities do not share a common customer base, AET should be implemented one facility at a time. Be patient, it's not a sprint – move at a measured pace. *Create and continually update a revenue assurance plan*: Identify procedures and programs so implementing AET doesn't adversely affect net revenues.

Partnership, best practices and realistic approaches will help to ensure a smooth conversion to AET and keep upward momentum rolling as full integration is achieved. The tolling agencies in Florida and their customers are proof!

> When we look back 10 or 15 years from now, we'll ask ourselves, 'Did you really stop people in the middle of the road to get money?
>
> **Richard Nelson, director of toll operations, FTE, USA**

found between 65% and 75% of incidents happened as vehicles maneuvered for position when entering and exiting toll plazas. AET's free-flowing lanes, however, eliminate the need to weave and merge, creating a safer facility overall. Fuel consumption and emissions are also reduced, which gets agencies closer to their sustainability goals and mandates. Lastly, AET substantially lowers capital costs by eliminating the need for wider roads to cater for more toll booths and wider plazas.

Intrastate interoperability,

Nelson highlights that Florida continues to document efficiency and customer satisfaction. "The intrastate interoperability is important to labor savings and to the overall efficiency of a tolling agency in general," he says. "FTE has around six million customers while Orlando-Orange County Expressway Authority has about 500,000. We perform the SunPass billing and collection function for Miami-Dade Expressway Authority, Tampa-Hillsborough Expressway Authority and several other agencies. Three years ago, we charged 5.7 cents for each transaction. Today, it's on a sliding scale from 4.25 cents each for the first 100 million down to two cents at 400 million. As their transactions grow, they'll save even more. Because of the volume that occurs when you get the interstate working on one system, the efficiencies benefit it – and customers – alike."

Nelson also stresses FTE's devotion to customer satisfaction, with its 'We Care' program at call centers monitoring customer service agents daily. Each agent is scored and knows how he or she is performing; they're also coached on ways to improve if issues arise plus they receive bonuses based on strong performance.

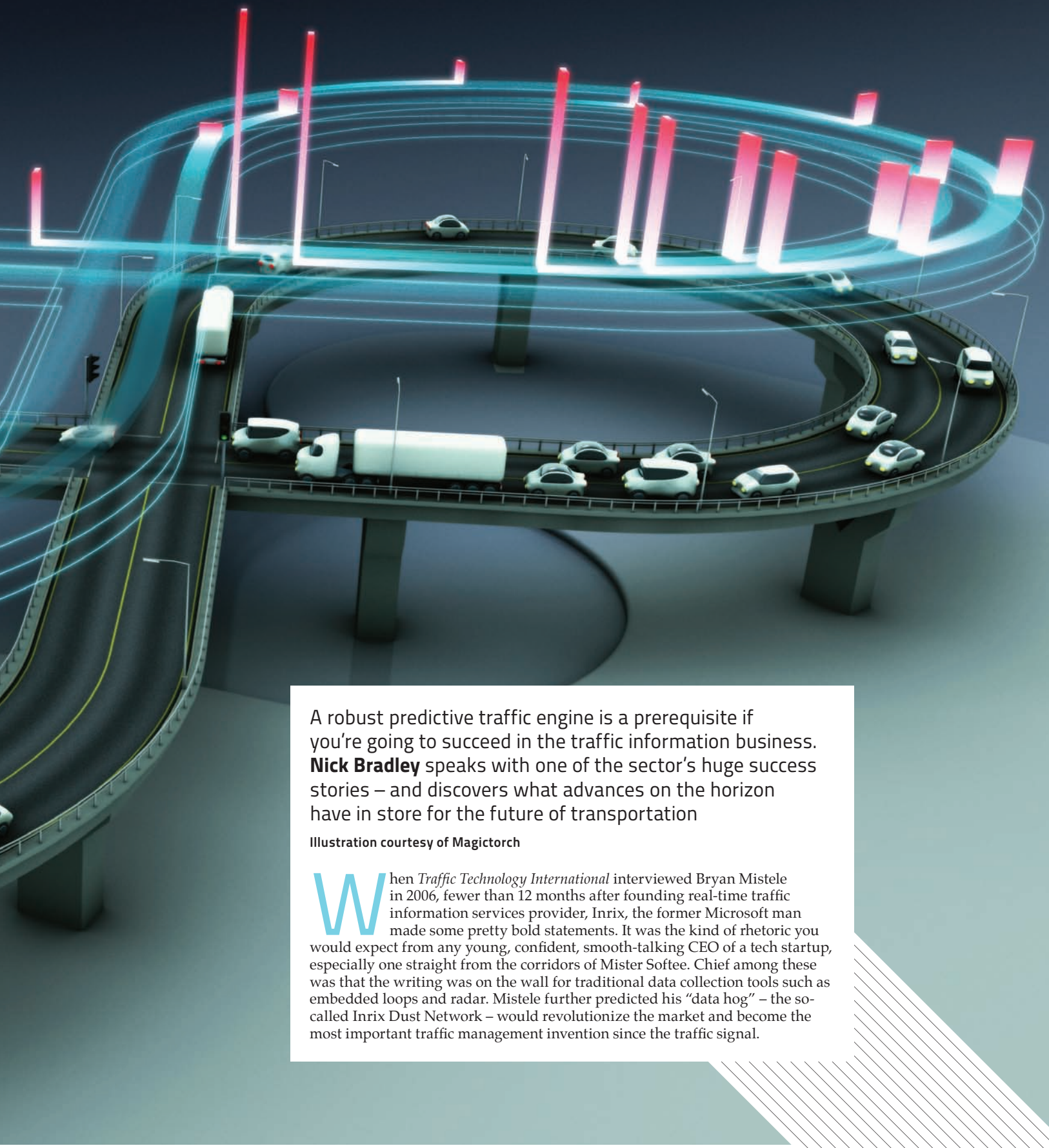
Nelson also points out that cash customers enjoy the benefit of AET. In fact, there are several options. There's BAG, or 'buy, activate, go', where they can pre-pay for a transponder with a specific dollar amount on it. They can receive a bill by choosing the 'toll-by-plate' option or prepay using 'toll-by-plate'. There are even 3,000 kiosks at which customers can buy prepaid SunPass transponders and another 1,500 are in the works. Customers can also buy prepaid transponders at service plazas.

"We specifically searched for options to help cash customers become electronic customers," Nelson says. "We researched the telecoms industry, which uses kiosks to let people pay their bills, and then used the infrastructure that was already in place so that the cash-preferred customers could pay for SunPass and not worry about having a checking account or credit card."

It worked… Nelson says they projected a 75% participation rate but actually started at 77%. By April 2011, FTE's AET facility, the Homestead Extension, was at 88% participation. He insists that this has come about simply by giving cash customers more options to become electronic ones.

• Greg LeFrois is vice president at HNTB and is director of the company's toll facilities group

Rise to power



A robust predictive traffic engine is a prerequisite if you're going to succeed in the traffic information business. **Nick Bradley** speaks with one of the sector's huge success stories – and discovers what advances on the horizon have in store for the future of transportation

Illustration courtesy of Magictorch

When *Traffic Technology International* interviewed Bryan Mistele in 2006, fewer than 12 months after founding real-time traffic information services provider, Inrix, the former Microsoft man made some pretty bold statements. It was the kind of rhetoric you would expect from any young, confident, smooth-talking CEO of a tech startup, especially one straight from the corridors of Mister Softee. Chief among these was that the writing was on the wall for traditional data collection tools such as embedded loops and radar. Mistele further predicted his "data hog" – the so-called Inrix Dust Network – would revolutionize the market and become the most important traffic management invention since the traffic signal.

Action men

They're claims we're all-too familiar with in ITS, of course, but actions definitely speak louder than words in Mistele's world. So let's just quickly recap what that world is. Inrix's business model is to collect and formulate traffic data and then sell it on as traffic information – generally to auto-makers and DOTs. Five years ago, this data pool was a mere 500,000 GPS-based probes (fleets, taxis, rental cars, airport shuttles, etc) and a combination of historical data and data aggregated from existing DOT sensors, including loops and toll tags – still more than enough coverage to be able to provide high-quality, accurate, real-time predictive traffic information. What a difference six years makes. "It's fascinating to have seen the space evolve so quickly over such a short time," says Inrix's Jim Bak, who's worked with Mistele since his Microsoft days. "GPS becoming available on mobile phones has been the catalyst, and has been a wake-up call for the auto industry, which has now come to realize it can't keep selling US$3,000 nav systems that don't provide any value-added data to make them more useful than the apps people are getting on their phones for much, much less."

The market is awash with these tools now – some very good and some not worthy of gracing the App Store. The Inrix Traffic app, though, has been a particular success. Available for free, to date it's had a million downloads. "It contributes to our overall crowdsourced network, which is why we offer it for free," Bak says. "We provide users with a valuable tool that will help save them time and money and in return they're providing us with trip data that we factor into our model to determine what traffic looks like for the broader community."

Too much is never enough

Bak says that Inrix is pretty conservative with the numbers it reveals, although the latest probe count is something in the region of 10 million. But surely there's a limit to the amount of data that can be processed? And equally, is the quality of data you get from 500,000 probes any different to that you'd get from 10 times the number? "That's an excellent question, but I would say that the folks who are you telling you can have too much data are the same folks who don't have enough! Our stance is that you can never have too much. Having said that, all the data in the world doesn't necessarily equate to good traffic information either, which is why the secret of our success has been our in-built intelligence models and algorithms. If you're collecting data from fleets, is that truck stopped in traffic or is that truck making a delivery? That's where outlier detection, etc, comes into play.

"Putting such factors aside, the key aspect is not only to have the data, but to have data that's timely." What Bak is getting at here is that if the last data point you have

> …the more immediate and real-time the data is, the faster you're able to act on it, which is especially important when looking at an accident or an incident that's stopping flow
>
> **Jim Bak, director of community outreach, Inrix**

A warmer embrace

The transportation community has been relatively cautious when it comes to mobile apps, mainly in light of the driver distraction issue. But Jim Bak thinks we're starting to see a shift and potentially a much warmer embrace of such technologies as a way to provide road users with information to better help them plan their trips before they even set foot in their cars. "What we're doing at Inrix is sourcing traffic information from GPS data or we're getting passively crowdsourced data that doesn't require anybody to touch their phones while driving in order to share their traffic speeds," he says. Because of this, the Inrix man feels the public sector is beginning to switch on to the concept for not only consumer purposes but also as part of how they run their operations and project planning. "We've always talked about this idea of having a better appreciation of what traffic is like on the entire road network and as a result being able to efficiently use that network and being able to maximise the use of it. I think folks are waking up and seeing that mobile technologies are providing them with a bridge to that point. You get to know where the trouble spots are, which are the biggest problems areas, and which ones can benefit from any sort of investment."

A substitute for capital expense

Procurement law is a crucial factor regarding the use of real-time data, with governments controlling DOT spending by separating capital and operating budgets. But as Inrix's data is available on a subscription basis, it is often bucketed as an operating cost when Bak thinks it should be viewed more holistically as a substitute for capital expenditures as well. "We continue to find on the I-95 Corridor Project here in North America that you can do things with this type of data and in this way for much less expense than in other ways," he says.

"We recently did some work with North Carolina and they compared the Inrix model with road sensors and discovered the cost of the latter over the entire lifecycle where they didn't have coverage would be about US$50,000 per mile. Whereas working with us by licensing our data, we could give them the same coverage for 25% of that. Folks in government often look at traffic operations as an infrastructure cost and a capital expense – actually building something. But an ITS expense, which is somewhat different, is more of a licensing cost. They could achieve so much more if they had the flexibility in terms of how they apply the funds they're given. When people start seeing that states such as North Carolina are saving 75% by looking at such an investment from an ITS perspective rather than a hard-wired infrastructure cost, you're going to see a changing dynamic out there."

Such savings will be all the more important in the years to come, particularly with the austerity measures that many authorities are up against. "Even when the economy picks up and traffic starts to increase, budgets are likely to stay as they are now," Bak says. "This means that you're going to have to do more with less – and this is one way of doing that and potentially providing a better service also."

Greening our commutes

Evidence of the green credentials of real-time traffic information surfaced at the beginning of 2011 when Inrix conducted a data-mining exercise on users of its Inrix Traffic App. "We looked at how much time they were spending in traffic over a certain period and calculated the cost of these delays," Bak reveals. "Although the average driver spends around 34 hours a year in traffic, these guys were spending 12-15 hours, which if you're driving an average passenger car is the equivalent of a free tank of gas back. It's also the equivalent of saving 350 lb of carbon, which is the amount an average passenger car will pump out on a trip from Los Angeles to San Francisco." That's a pretty good chunk of carbon, according to Bak, especially if you look at the wider picture. "If you can make these systems ubiquitous to the point where nearly every driver has access to this kind of information and can act on it, the cumulative impact could be enormous. In a sense, the app is the automotive equivalent of changing to compact fluorescent bulbs in your home – an easy way to make your current car and/or the road network that vehicles travel on greener – saving vehicle owners time and money and helping road operators reduce pollution in the process."

from a probe is more than 10 minutes old, the reliability of that data point continues to degrade at that point. If it's another 45 minutes before the next probe passes that same road segment, the reliability, quality and accuracy of all of that data in between is much more prone to error, and much less useful in real-world terms. "Sure, you can produce traffic information from a much smaller number of probes, but the life-cycle of that data is going to be very much shorter than it is when you've got a much larger amount of data that's being refreshed pretty much continuously. The only true recipe for high-quality traffic information is as much data as possible, fast and frequent updates and a healthy dose of intelligent analytics."

Fifty seconds to comply

It's obviously a successful recipe and was attractive enough to the Highways Agency in England, which recently signed a seven-year contract with Thales and Mouchel for the National Traffic Information Service, the

backbone data of which comes courtesy of Inrix. "One of the things they're tasking us with has really never been done before," Bak says. "We collect the data, process it and send it back to them as traffic information every 50 seconds, which is more demanding than we're used to in the USA. Typically, Inrix and companies like us have a two-minute cycle to refresh data, but the HA wanted much more granularity and a much faster speed, so we're working to push our algorithms to turn information out more frequently." And the value of this 50-second cycle is? "You'll have to ask the HA that!" Bak responds. "But what we do know is that the more immediate and real-time the data is, the faster you're able to act on it, which is especially important when looking at an accident or an incident that's stopping traffic from flowing.

"We're also working with the HA to develop a system that predicts the amount of time that it takes for traffic to return to normal following an incident. This has a great value for consumers because if they know how long they'll be stuck in a jam, they can choose whether or not to take an alternative route or how it will affect their arrival time at a particular destination."

Back in the USA, Inrix data is now also powering the Texas Transportation Institute's *Urban Mobility Report*, the much-awaited state-by-state breakdown of the economical and ecological impact of traffic congestion. "Those guys are constantly looking at ways to take the data that we use to drive their analysis further," Bak says. So in what ways has Inrix's data influenced the results? "They're definitely more precise. One of the things they [TTI] found is that historically traffic congestion has not really been as bad as it was perceived to be, when the economy was booming and traffic was at its worst, say four or five years ago. What I think our data has done is rein in some of

Future road planning

Gaining a network-wide view of traffic and travel conditions with real-time data that can better predict conditions based on impacts on the road network, Bak suggests that governments and transportation agencies can benefit from an increased ability to plan ahead. This is both in terms of pinpointing where investments in road construction and public transit can most benefit as well as in terms of managing the flow of vehicles during special events or times of crises. "The Highways Agency, for example, will have the data and tools to model the expected impact of the 2012 Olympics on traffic flows in and around London for planning purposes," reveals Bak. "It will help them figure out what resources are needed to better manage flow, whether special lanes need to be created for traffic, how they operate their congestion models during the Games. Similarly, US states in areas prone to hurricanes and other types of events can develop better evacuation plans."

Improved public safety

You wouldn't think that real-time traffic information could have too much of an impact on traffic safety, but Bak has a perfect example that highlights how the data can inform traffic managers about incidents before it's called in from the field. "We're talking about flow-generated incidents, determining whether an incident has occurred based on anomalies in traffic flows," Bak says. "Somebody from the English Highways Agency was out here a few months ago visiting New Jersey DOT as part of our I-95 work, and all of a sudden in the TMC a stretch of I-95 westbound turned all sorts of colors, ultimately to black. They had not had report of an incident, but decided to dispatch a DOT truck out there to see what the problem was. It turned out to be an overturned vehicle. Around 10 minutes later the police turned up. The sooner you can get to an incident, the sooner you can get them to safety, and the sooner you can clear the road and get the traffic back to normal. It's just another example where real-time traffic information can be valuable - if you have a better snapshot of that data across your whole network versus just a limited sensor network, you can respond that much more quickly across your whole system."

Performance measures

One of the major thrusts of the US national policy debate on future financing of the transportation infrastructure is that funding should be based on outcomes. Inrix's experiential data creates archive data that supports performance measures and ties in with planning for targeted congestion relief, improved efficiency, and optimized use of capacity through information provided at a system level. "It's all interesting," Bak says. "You can no longer apply and get federal monies based on need; you have to show outcomes, positive change. Once more, it shows how this data could be valuable from a planning point of view, but also in terms of analysis on the outside."

Does that therefore make Inrix the enemy in some senses? "Potentially yes, which is why we remain neutral. I talk about this quite a lot when I work on the Annual Traffic Scorecards – the data tells the story. That's how we work with our customers, particularly in the public sector. The data can help them, but if it doesn't play out as expected it could have a certain amount of consequences.

The impact of SYNC

In Bak's opinion, Ford's development of Sync was the first real move to democratize real-time traffic information. "They [Ford] were really smart by harnessing the mobile phone to create the connectivity feed that everybody has; and by developing a software platform with Microsoft that can scale all the way from entry level to the high end, so you just switch features on or off depending on what the consumer wants – it's great economies of scale."

All of the features of Sync – connecting hands-free to your phone, music, navigation services, turn-by-turn directions, through voice recognition, etc – are driving customers to Ford. "The rest of the auto industry has looked at this happening and is beginning to copycat. Sync gets customers into Ford showrooms, so you're now starting to see Audi and BMW evolve on this turf, Toyota is coming out with Entune, the Hyundai guys have Blue Link. So whereas before these were expensive extras, they're becoming standard features, so you'll see traffic becoming an increasingly pervasive part of all of the systems. As more smartphones have GPS and more automakers provide a way to help consumers make these devices work more safely and better in the car, the dynamics of how people travel will change."

Predictive text

There are some great use cases for real-time traffic information, but knowing the state of traffic just as you're rolling into the back of a queue is about as much use as a chocolate teapot. "Most people have a general feel for what their commutes are going to be like, but what they really want is to plan ahead," explains Bak. "Our premier product projects traffic conditions 12 hours into the future, using single-overlay maps or a multilayer website. The predictive element is based on some algorithms and analytics that we originally licensed from Microsoft that factors in current traffic, weather, local events, school schedules, etc, as well as historical data for day of the week and time of day.

"This Traffic Ahead feature is pretty unique," he continues. It basically tracks traffic conditions ahead and adjusts arrival time and route guidance continuously. "As these systems become connected – to each other and to the larger grid – from a traffic operations and a public sector standpoint, we'll be operating quite a robust neural network, so as you start to do smart routing guidance, the more you know about traffic and volume, the more you can maximize the use of it. The more drivers anticipate changes to conditions and find alternative routes, the better you can distribute the cars across the network during the day, in doing so helping to reduce congestion at peak hours."

the estimates to be much more reflective of the actual experience out there."

Measures of success

There's little doubt that Inrix's technical innovation has been key to the company's meteroic rise over the past six years, although the business strategy certainly deserves a mention, too. Recently securing US$37 million in Series D round funding from venture capitalist Kleiner Perkins and August Capital, just a few days later Inrix announced it had tendered a US$60 million offer to buy the UK's ITIS Holdings. The acquisition was confirmed on August 22, 2011, and grows Inrix's business massively in areas such as geographical and market reach, customers and revenue, and technical expertise. New domains now include Australia, Brazil, South Africa, Singapore and Russia, in addition to enhancing its coverage in the UK and Germany. Moreover,

More reliable, better quality data

The FAST system from Inrix constantly assesses actual travel times against the predicted travel time. The process continuously refines and improves the quality of its traffic information in real-time, as opposed legacy that can take a year or more to implement. "We credit this with having a huge impact on what we've achieved with the I-95 guys, such as the level of accuracy with our speed data," Bak says. "Basically, instead of having to go out every year or two and have people drive a limited number of roads to get enough of a sample to determine the quality of your data, we can run this system 24/7 across our entire network – it's constantly doing outputs and granular improvements that help us improve the quality of that data much faster."

When the I-95 project team was testing the data of the Inrix information, they used Bluetooth pucks – they count the cars, the speeds of the cars, and the data is compared side by side with the Inrix figures. So what does Bak think of Bluetooth as a collection tool? "It has a value, just as traditional road sensors have value, but we feel they're cost-prohibitive because you're building infrastructure that's exposed to the elements, requires maintenance. Do they provide good data? Sure they do, but at the end of the day, are you going to put Bluetooth sensors on every street, in every city in every state? That's an incredibly lofty goal, particularly when you can harness the people who are out there with the devices they already have."

Democratizing the data

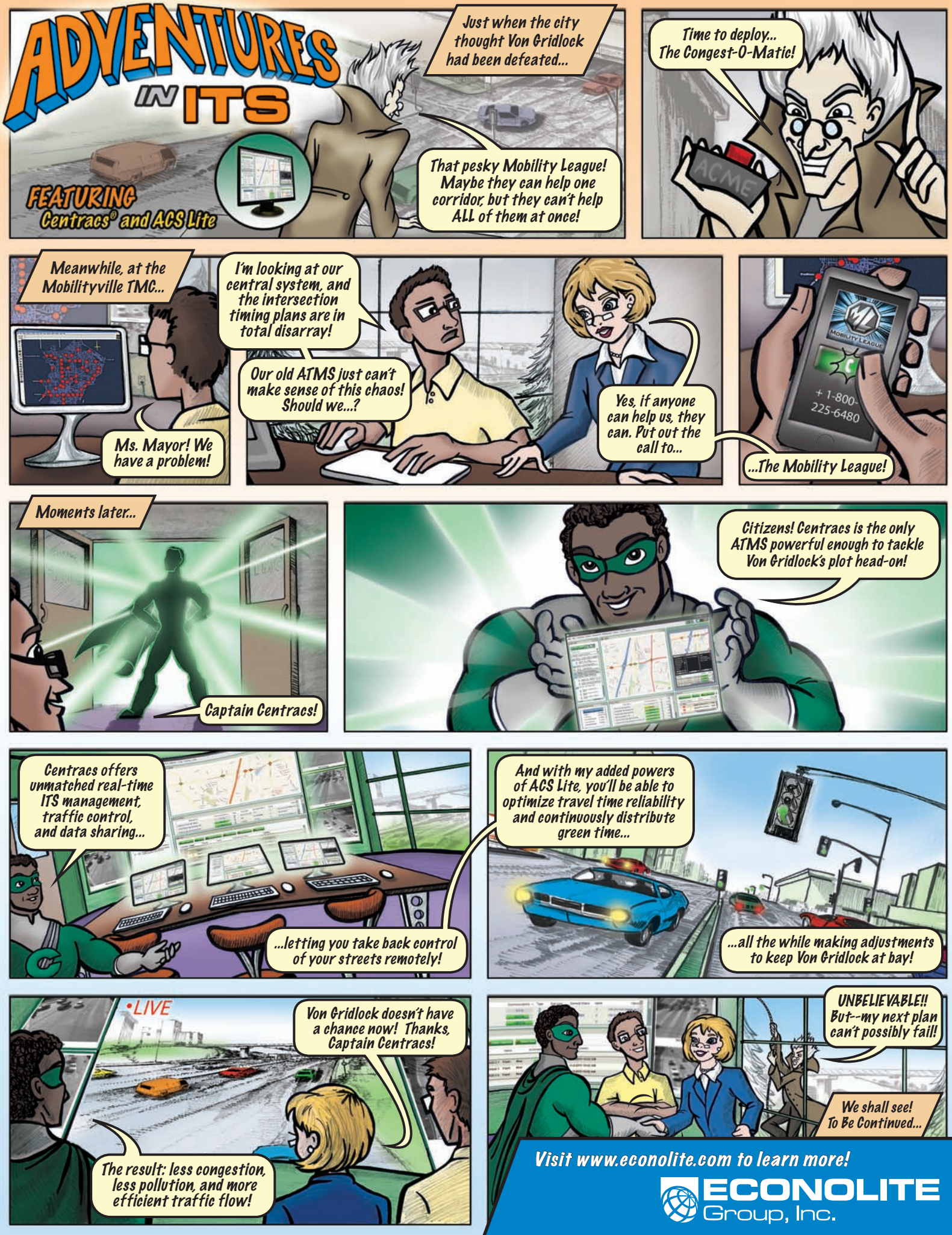
Bak and his Inrix colleagues feel there's a huge opportunity to provide better and more useful services resulting from traffic data as opposed to limited and more controlled services.

"Standards have great value but at the end of the day, innovation is what creates new opportunities," he says. "The first service for traffic was basically data from road sensors that was presented on a map inside a car. That's great, but you're telling me what I know – I'm in a jam. What more could we do with that data if we were able to invest in analytics – can we do predictive and help users anticipate what conditions are like before they get out there? You're better off creating a much more democratic approach to who can use this data and for whatever purposes they can use it for.

"Information-based intelligence empowers decisions," Bak insists, adding that we should be looking at demand management based on informed decisions by users rather than imposing of a top-down policies.

through ITIS's TrafficLink subsidiary, Inrix will now deliver daily traffic broadcasts to millions of UK listeners across the entire BBC local radio network, major commercial radio stations nationwide, and television outlets such as ITV and Sky News. Observers had previously ascribed a US$500 million valuation on Inrix prior to the ITIS announcement, so now the deal has been signed and sealed the company could be well on its way to Bryan Mistele's goal of being a US$2 billion concern by 2012.

There are few other companies you would approach to find out where this market is headed – and how the technology could impact transportation in the future. This is an oft-discussed topic at Inrix, the highlights of which you can read about in the sidebars. "It's a bit *Jetsons*-esque, but one of the things we talk about a lot is intelligent vehicles and making the experience more seamless for the consumer," Bak says. "How do you make these systems work in a car when people have to be cognizant, functionate and drive at 50-60mph? Our vision is that your car will act as a concierge service for you. It will be connected to your calendar, so the morning you have a 10am meeting, your vehicle has already been monitoring the traffic situation. It will know that roadworks or an accident is going to impact your journey so will send you an SMS or an email to your PC to let you know you'd better change your plans. You won't have to go out and seek this information – ultimately, it's going to come to you."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What will the command center of the future look like? **Vinodh Swaminathan** has a pretty firm idea. And with a recent deployment in Rio, maybe we're halfway there

Interviewed by Nick Bradley

> What we at IBM did was provide the city with a platform that actually allowed for the easy integration of all these various siloed agencies

The eyes of the sporting world will be on Rio de Janeiro a fair bit over the course of the next five years, with the FIFA World Cup staging soccer matches in 2014, and the city playing host to the Olympic Games in 2016. Vinodh Swaminathan's eyes won't be on the goals or the 100m final, though, when these auspicious events roll into Brazil's capital – they'll be on the city's new Operations Center in Cidade Nova.

The global director of ITS for IBM is in Rio to observe how the Big Blue's Intelligent Operations Center (IOC) platform is performing. IOC is part of the 'Smarter Cities' portfolio – which comes under IBM's 'Smarter Planet' umbrella – so Swaminathan wants to see how it will fare on its first true litmus test. Upwards of 1.5 million people are expected to converge on the world's largest rock festival to watch the likes of Guns n' Roses, Metallica, and the Red Hot Chilli Peppers. Although Swaminathan doesn't have a back-stage pass for Rock in Rio, held in September, he does have access all areas in Mayor Eduardo Paes' multi-million dollar command center.

Incident command

Similar to many other operations centers, the aim of the Cidade Nova facility is to integrate and interconnect information from multiple government departments and public agencies to enhance city safety and responsiveness to anything that might go pear-shaped in the city. In Rio's case, this includes flash floods and landslides, which have brought particular tragedies to Brazil's capital in recent years, killing thousands of people. "Mayor Paes has driven this project forward," Swaminathan reveals. "What became clear to him upon taking office in 2008 was that there was not the coordinated capability that you need in times of crisis, so he invited not just IBM but other technology companies to demonstrate solutions that would showcase Rio in the right light with all of these major events on the horizon.

"What we at IBM did was provide the city with a platform that actually allowed for the easy integration of all these various siloed agencies – police, fire, transportation, traffic management, media, etc."

Such interagency coordination within the same building is nothing out of the ordinary nowadays, certainly in traffic management – but through IBM Research a number of unique and totally innovative analytics tools have been added – and will continue to be added into the future. "We are currently in the process of implementing, calibrating and fine-tuning PMAR – a high-resolution weather forecasting and hydrological modeling system," Swaminathan explains. "Other meteorological technologies indicate storm patterns up to 24-48 hours ahead of time, and it's pretty generic. Our system has a much narrower window, so up to six hours ahead of time we're able to precisely predict down to a square mile the location a storm will hit and the impact of that weather phenomenon, which is going to vastly change the city's ability to get prepared for the type of massive rainstorms seen in recent years. They're heading into their rainy season so it'll be intriguing to see how the IOC and intelligent analytics help out."

As a software suite IOC can be tailored to individual domains, although IBM's intelligent transportation product was one of the first out of the blocks, according to Swaminathan. "It's an integral part of our vision for the TMC of the future," he says. "We have the ability to literally pipe in data from multiple TMCs and create integrated visualization capability on the intelligent transportation product. On top of that, you now have the capability to add seemingly

> The cloud could dramatically change the way TMCs are designed, operated, as well as the budget you allow for them

unrelated but essential data to augment some of the richness of the information."

What Swaminathan means by this is that because the IOC platform is designed for cross-agency collaboration, it can pull, for example, video data from a police department, security services or even within the DOT itself. "They have a ton of cameras out there looking at real-time traffic feeds, but the general analytical value of that video feed is when an operator looks at it on the videowall. It's not just about knowing and reacting; it's all about providing a much richer insight to operators so they can anticipate and avoid.

"Video, of course, is only one example. With IOC, we can also 'mine' social media feeds by looking at traffic-related information on Twitter, Facebook, etc. We're seeing an increasing use of social media to source up-to-date traffic information. Then of course you have companies out there specializing in cell phone data, and we're working with a few of them right now to pilot some interesting solutions."

Predictive analytics

A third level of functionality of the IOC is predictive analytics. "With this we're truly changing the function of a TMC from a monitoring center where operators find out what's going on and then react to one where they can anticipate and avoid situations," Swaminathan continues. "So the traffic prediction tool has the capability to look at all this data on a cross-TMC/cross-agency scenario, all of the traffic-related data, and essentially predict the likelihood of the traffic situation in 15-, 30-, 45- and 60-minute intervals, with greater than 95% accuracy in the shorter timeframes."

Other applications are also benefiting from this IBM analytics expertise, as Swaminathan details further. "In California, we're working with Caltrans and the University of California Berkley to build a citizen- and commuter-centric application called Smart Traveler Program. It's where people like you and I opt in to a monitoring program where the software essentially learns your common driving patterns using your GPS-enabled cell phone. Say, on a Wednesday, you're going to the office in the morning, returning back, you have a soccer game in the afternoon. With that knowledge and the traffic prediction capability, the program now pushes data to you based on what the situation is likely to be for that particular pattern. It's an excellent modification to 511, which frankly not a lot of people use. States spend a lot of money on 511, but I've never called it – I get most of my information from radio stations."

Another application is core to TMC operations – incident response. "One of the biggest challenges for operators after they know of an incident is getting their emergency teams to the scene," Swaminathan says. "With our predictive capability, we are not able to forecast an accident, but we are able to predict the likelihood of an incident happening, based on information such as traffic volume, speeds, flows, real-time data and historic information, too. The ability to pinpoint down to that level makes a significant difference to response times for TMCs."

So, now onto the 'cloud', or in IBM's case, the SmartCloud. "It's about time to value for clients and helping cities rapidly adopt new capabilities and controlling cost," he says. "TMCs can benefit from the cloud by simply connecting and taking advantage of standard deployments without having to worry about customization, and once they have the experience with the tools, they're soon able to fine-tune the capabilities."

A more exciting use of the cloud is that it offers true on-demand capability. "Let's use predictive analytics as an example," he says. "Clients can tap into higher service levels around predictive analytics in times of special needs, whether it's a rock festival or a natural disaster. The standardized deployments will be available on a cloud, which TMC managers can tap into and then shut off when not required. Potentially, you could have a situation where a TMC operates differently using certain technologies on a cloud during the rush-hour in the morning and the afternoon, but settle into 'ho-hum' kind of attitude in the afternoon when there isn't so much of a demand for the same capability."

In Swaminathan's opinion, with the cloud there's no real need for a data center at the TMC. "They're full of operators who you wouldn't expect to have the necessary data management and analtyics expertise, so you could shrink the footprint of the TMC down to just a videowall. It could dramatically change the way they're designed, operated, and the budgets allowed for them."

The whole TMC of the future product that Swaminathan has been detailing was developed in cooperation with AECOM, who he says "bring a vast amount of expertise in designing and managing TMCs".

"We worked with them in the UK for TfL, and we're looking to work with them in emerging markets that are keen to embrace new technologies as they roll out their infrastrucuture. These guys are looking for expertise around aspects such as where you locate a TMC. How should it be built? Where should the videowalls be and what should the operator consoles look like? AECOM has built many of these TMCs around the world and in combination with an information base provider such as IBM, I think our combined skills and capabilites will really resonate in the marketplace."

Political will, political won't…

One of the things that IBM's Vinodh Swaminathan has noticed in the transport sphere is a great deal of demand for short-term fixes to some of the major problems clients have. "Whether it involves new types of taxation or changes in policy, transportation is a topic that is very, very sensitive from a political standpoint, and not just the whole tolling debate!" he says. "It involves moving people, goods, and it has a direct impact on the economy. A 10% reduction in congestion, for instance directly leads to a 3% improvement in local employment and a 2% improvement in local GDP. WIth this type of impact, you've got a lot of opinions and emotions around transportation.

"There are some challenges around implementing some of the solutions we have, but I always tell clients, technology is not the inhibitor. We have solutions today that not only us but many other industry stalwarts can implement that requires a little bit of political leadership from a policy-making and implementation perspective. We have no control over that, but the technology is there."

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Saving grace

Florida DOT's ITS evolution is driving forward change for the better in the Sunshine State. **Elizabeth Birriel** and **David Chang** discuss some of the latest innovations that are saving costs, time, and more importantly lives

Images courtesy of Atkins & Florida DOT

What enables the stringent safety protocols necessitated by reversing lanes to optimize existing highways? What integrates connected vehicle technology with transportation management center operations? And what populates smart phones with reliable information for travelers? SunGuide software, the statewide advanced traffic management system, is the heart of the Florida Department of Transportation's (FDOT) ITS Program. In fact, it enables real-time, 24/7 operation of Florida's traffic infrastructure.

Savings from software

The software is the backbone of FDOT's efforts to increase safety and optimize existing infrastructure. The use of SunGuide by FDOT Districts, 15 TMCs, toll authorities, and local agencies is estimated to have already saved over US$80 million. Given that a lot rides on SunGuide software, who ensures its reliability? Atkins, FDOT's statewide ITS general consultant, verifies and validates all SunGuide releases and oversees enhancements.

Traffic fatalities dropped 30.8% in Florida from 2005 to 2010, so the mission of FDOT to provide a safer system is already being realized. And with its 2010 adoption of a Transportation Systems Management and Operations (TSM&O) Program, the state's traveling public is enjoying further system improvements. The program actively manages the multimodal network to ensure safety and mobility for all travelers by leveraging FDOT's SunGuide and the state's increasingly sophisticated ITS.

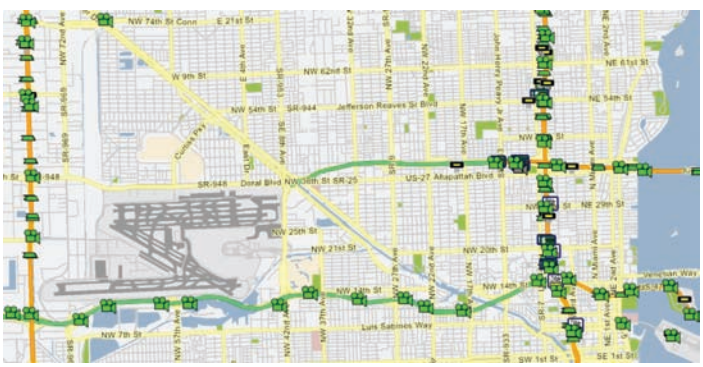
For instance, given that Florida suffered a traffic fatality rate 33% higher than the national average in 2008, that congestion (wasted fuel and hours) in the state's seven urbanized areas costs US$5.9 billion annually, and that infrastructure construction funds have dwindled, TMS&O emphasizes a more savvy use of the transportation network Florida already enjoys. Streamlined communication, coordination, and collaboration among agency partners saves even more.

For example, FDOT estimates that traffic on an eight-mile stretch of I-595 near Fort Lauderdale will mushroom to over 300,000 vehicles per day in the next 25 years; it already bears 60,000 more vehicles than its 120,000 per-day capacity. Optimizing this roadway is vastly cheaper than new construction. So reversible lanes along this stretch will soon allow motorists to traverse the same road – in different directions at different times of day – optimizing capacity without a single bulldozer.

(Above) **FDOT's new 'My Florida 511' app allow travelers to get real-time transit data for up to 200 miles around their current location** (Right) **SunGuide software powers 24/7 operation of Florida's traffic infrastructure**

Enabling 'social' traffic

Just as social media and crowd sourcing transform how information travels, 'connected vehicles' will transform how traffic information and how traffic itself moves. The next frontier, connected vehicles, enable real-time communication from vehicles to TMCs as well as



(Above) **In 'social' traffic, vehicles communicate with traffic management infrastructure – and eventually with each other**

ultimately between vehicles. Onboard equipment sends location, speed, and direction data to TMCs so traffic data is aggregated to become ever more accurate and robust – and travelers get trip-relevant messages delivered straight to their dashboards.

How does it work? A digital, short-range radio communications channel links onboard equipment and roadside equipment, while FDOT's SunGuide software connects to roadside equipment units. The DOT is proud to be the first state to implement the connected vehicle module into TMC software, supporting traffic operations by enhancing safety and mobility. To help achieve FDOT's vision of a fatality- and congestion-free transportation system, FDOT has arranged for Florida to retain connected vehicle infrastructure after the 18th World Congress on ITS demonstration (see sidebar).

Connected vehicles may seem futuristic but meanwhile Florida's statewide 511 phone system (over 2.7 million calls in 2010) and website continue to update hundreds of thousands of travelers each month. The DOT recently unveiled a new smartphone application to increase safety and convenience. The new GPS-enabled application safely lets motorists get real-time travel data for up to 200 miles around their current location via an audible alert, and provides traffic data via an onscreen list, a map, and traffic camera views. The app even allows users to record and send a brief traffic report or leave feedback, making traffic reporting a two-way street.

The state's ever-popular Road Ranger service patrols will also benefit from a new FDOT-developed smartphone application. Enabling law-enforcement agencies to exchange critical information is as vital to Road Rangers as helping to clear roads of damaged vehicles and debris. Road Rangers are testing their new app – along with GPS tracking and 'ruggedized' tablets – in Jacksonville. So far, results indicate a 70% reduction in radio use, allowing both Road Rangers and TMC operators to accomplish tasks more efficiently.

First responders call Road Rangers "life-savers" and "essential to promoting safe travel in Florida". Continuing public confidence and such agency kudos show how well FDOT is achieving TMS&O safety and collaboration mandates.

Laboratory tests

Tallahassee's Traffic Engineering Research Laboratory (TERL) staff also improves safety and streamlines communication. Since failures or errors in traffic safety devices could be deadly, TERL tests more than 1,000 products from over 120 vendors in a controlled environment. If TERL finds problems, vendors fix products at once before the state deploys them – and motorists rely upon them.

TERL has streamlined communication by bettering the product-procurement process itself. Florida-based vendors seeking 'Approved Product' listing now enjoy less paperwork and faster turn-arounds – without FDOT's increasing risk or sacrificing quality. Ronald Meyer, Atkins' senior ITS analyst, notes that a statewide purchasing contract saves significant cost by reducing multiple regional contracts. "Further, it establishes maximum prices for the duration of the contract, while allowing negotiation of discounts," he says.

• *Elizabeth Birriel is ITS program manager at the FDOT. She can be reached at elizabethbirriel@dot.state.fl.us. David Chang is ITS program manager at Atkins and serves as project manager for the joint Atkins/FDOT Project Office. He can be reached at david.y.chang@atkinsglobal.com*

Mobile village

During Florida DOT's connected vehicle on-road demos for the 18th World Congress on ITS, drivers will feed data info from roadside equipment units (RSEs) to the SunGuide software. The on-road demo network includes: I-4, International Drive (a low-speed minor arterial), and John Young Parkway – a high-speed major arterial.

USDOT is providing 28 RSEs, which provide two-way communication links to vehicles using DSRC. FDOT is installing the RSEs on existing CCTV and traffic signal poles. They connect to the District 5 (Orlando) TMC via an existing fiber-optic communications network. The RSEs then connect to a USDOT service delivery node at Oak Ridge National Laboratories in Tennessee – one of three nodes developed under USDOT's VII Proof of Concept program.

FDOT's infrastructure deployment for the World Congress in Orlando includes SunGuide software enhancements that use vehicle/probe information (such as travel times) to facilitate advisories issued via specially equipped vehicles. FDOT has even coordinated with local agencies to maintain the connected vehicle infrastructure after the World Congress.

Disappearing act?

Statistical VMT evidence from some of the world's most congested countries clearly points to declining car use. **Bern Grush** analyzes whether this is a short-term blip or a sign of things to come

Illustration courtesy of Magictorch

The term 'peak car' has appeared increasingly in the 2011 media, purporting to describe a permanent cap and gradual decline in the use of the automobile in the developed world. This differs critically from a transient vehicle-miles traveled (VMT) dip or stagnation due to economic downturn and from a plateau due to saturation or demographic trends. There is clear evidence of a VMT dip in the USA, the UK and Australia between 2004-2008 – and possibly earlier in some interpretations of the data. This trend has likely shown up in other countries as well. There are several interpretations of such data that prematurely point to a long-term VMT plateau.

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Peak car is different and more ominous, and the arguments for this interpretation are tentative. The data horizon is too short to predict the end of a major technology and there are some underlying anthropological factors that demand that 'automobility' stay with us for at least the current century. The expression, 'automobility' is used in this instance in place of 'the car', as in all likelihood the car, as we know it, will not last beyond 2035 or 2040. It will not, however, be replaced to the extent some may wish by bus, bike or train. Rather, intelligent, self-driving technology that we have not yet invented will retain a major role in surface transportation, and this is likely to increase VMT.

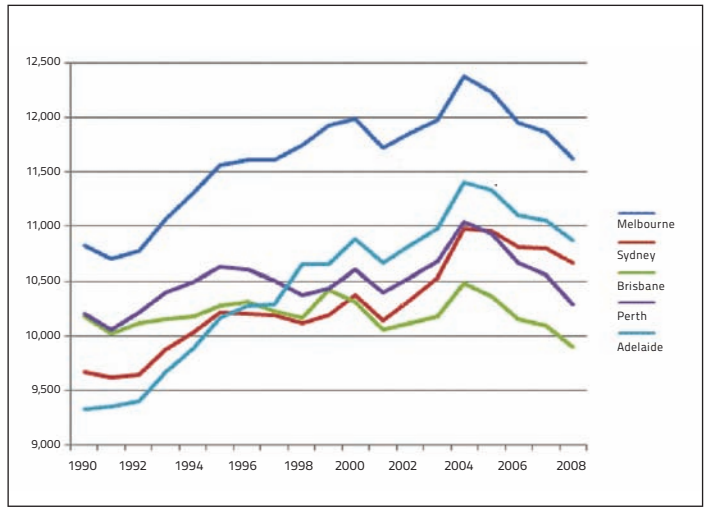
My prediction is based first on the divergent pace of innovation for automobility systems as compared with transit systems, and secondly the unworkability and undesirability of governments creating the policies needed for a complete transition. It is also based on a bias toward autonomous, powered vehicles in human settlement design and organization, and lastly nearly instinctive and universal anthropological factors relating to travel budgets (time and money).

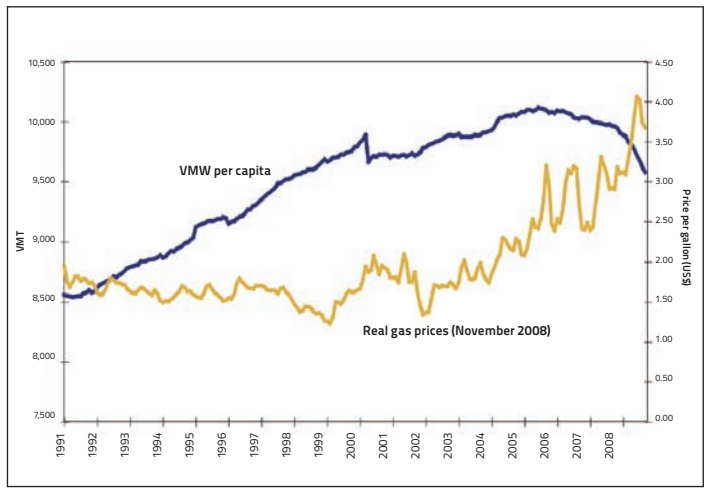
How we interpret faltering VMT data in countries where this occurs informs our response to problems such as transportation funding, demand management, and global warming. To convince ourselves that VMT is in permanent decline is to risk justifying continued abdication of our responsibilities for solving our surface transportation problems and simply let road and highway funding and demand management 'sort themselves out'. We also risk gloating prematurely over the effects that global-warming messaging may be having. We should be cautious.

Let's look at the data through the lens of each of these three interpretations…

Fuel demand is relatively inelastic if prices creep slowly

(Figure 1, top) **Estimated car passenger km per capita (FY 1990-2008). From an online document, *A Sustainable Population Strategy for Australia: Submission by the Bus Industry Confederation*** (Figure 2, bottom) **From *The Road... Less Traveled: Analysis of Vehicles Miles Traveled Trends in the USA*, Puentes and Tomer, Brookings, December 2008**





Source: Traffic Volume Trends and Energy Information Administration

VMT dip?

The evidence that something significant occurred cannot be set aside. The decline shown in Australia from 2004 to 2008 (Figure 1) has been interpreted as a permanent trend rather than transient in a 2011 paper by Newman and Kenworthy called, *Peak Car Use: Understanding the Demise of Automobile Dependence*.

The US numbers are similar to the Australian numbers, showing a slowdown then a decline in per-capita VMT from 2004 to 2008 (Figure 2). This Brookings study, possibly the first in-depth examination of the decline in US VMT, concluded: "…reduced driving will only intensify … governments' need to seriously reconsider … reliance on the gas tax to fund surface transportation. Environmentally, stalled or reduced driving should offer a positive development in the creation of a more environmentally sustainable transportation network. Developmentally, reduced driving demand will instinctively lead to more demand for development less reliant on the automobile and could signal a continued reinvigoration of this nation's cities and inner suburbs."

However, a little over two years after the Brookings study was released, an FHWA press release from March 2011, *The Nation's Highway Traffic Reaches Highest Level Since 2007*, contradicted this conclusion, "… underscoring the "need for continued investment in roads, bridges and tunnels. … Americans drove three trillion miles in 2010, the most vehicle miles traveled since 2007 and the third-

highest ever recorded…".[1]

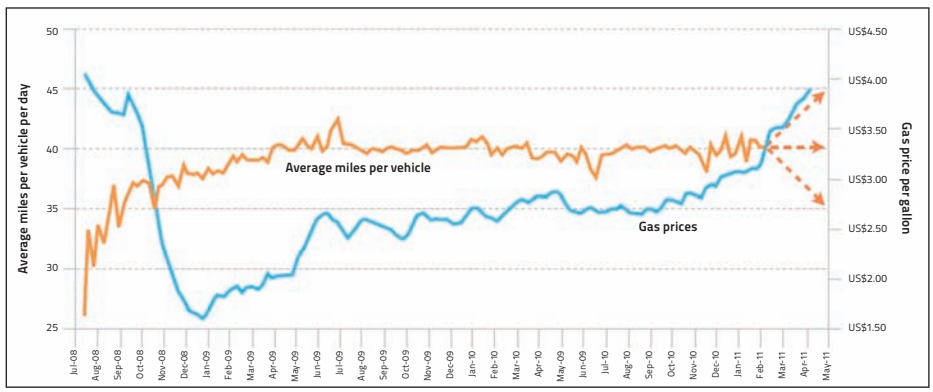
A graph compiled by Progressive Insurance (Figure 3) plotting VMT/vehicle-day in monthly averages since mid-2008 shows a resurgence in VMT and could be seen as evidence that the 2004-08 VMT decline was transient. I do not know if Australia experienced the same VMT recovery as the USA.

Note that Figure 1 and Figure 2 show miles per capita, making it difficult to align numbers in these two datasets with those in Figure 3 (but we are only considering trends). There appears to have been a strong recovery to 40 VMT/VD (from 26) during the nine months commencing with July 2008. Quite a jump, as gas prices tumbled to US$1.75 from over US$4.00. Thereafter VMT remained steady while gas prices have slowly crept up. This view of the data says fuel demand is relatively inelastic if prices creep slowly. Unfortunately, the VMT data was not available for Figure 3 after the March 2011 fuel price spurt.

VMT plateau?

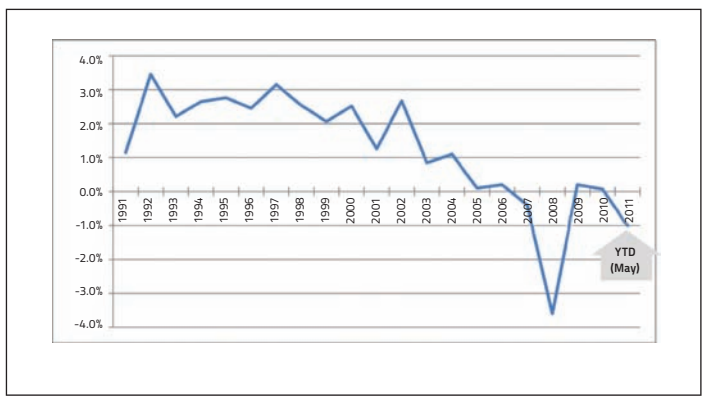
Clearly there has been a sustained dip that is easily pinned on economic variability and political events since the dot-com crash and, more recently, on fuel prices. As these are the most significant correlates in the data, might they be hiding a longer, permanent trend, in spite of the VMT uptick announced in the 2011 FHWA press release and that Figure 3 seems to contradict the analysis of peak car based on 2004-08 data used by Puentes-Tomer at Brookings (Figure 1) and Newman-Kenworthy at CUSP (Figure 2)?

Considering this, I used the FHWA source data to compile a plot of percentage differences in US VMT year-over-year (Figure 4). There is a slowdown in the annual VMT increases that appears to start at the dot-com crash, nudged down again after 9/11, rallied a bit at the front-end of the Iraq War, continued to slow until it finally went negative in 2007 over 2006, and lost a further 3.5% in 2008 over 2007 through the



Source: USDOT, Federal Highway Administration: Progressive

(Figure 3, above) **Miles per vehicle day from 2008 to early 2011**
(Figure 4, right) **Shows percentage difference in US VMT year-over-year (everything above 0% is growth and below that is decline)**



The daily commute influences everything from where we live to how we travel

subprime crisis. So the studies showing a 2004-2008 decline are not overstating those four years. However, there was a sharp recovery in 2009 over 2008 that was sustained in 2010. This was followed by a new decline in the first five months of 2011 – (possibly) negative again for the third time in four years – as gas prices climbed.

For whatever combination of reasons, VMT is declining and it is not a minor dip. Will this turn into a plateau in a few years as these factors settle out, or will it continue to decline until the "demise of automobile dependence" as Newman and Kenworthy suggest?

Many of the reasons offered by the studies depend on underlying trends to defend at least a long-term plateau – if not a new, permanent decline – but none is enough to sustain a permanent decline.

Fuel cost increases are no longer seen as occasional political blips, but as a permanent bumpy ride as oil-extraction continues to be more costly. While no-one thinks pump prices will drop and stabilize, I assert that peak oil will eventually lead to more cars and more VMT, since a rise in value for energy for automobility would drive sustainable power innovation, as well as smarter, smaller, safer and swifter cars – i.e. the qualitative advantages of cars will continue to grow whereas transit, biking, and walking are unlikely to show similar advances. This would lead to a further increase in congestion and put yet more pressure on demand management policies. Upticks in fuel prices may create dips, and help sustain a lengthy plateau, but they predict an eventual resurgence in VMT.

The growth of urbanism implies aggregation to higher densities, fewer VMT and increased transit use. This appears in some data sets to be gradually taking hold and would likely be a very long-term trend. But how deep can it go? Urban land prices will climb, which would admit only trendsetters to return to the city. Suburbs will become the new slums. Phil Hayward, an independent researcher in New Zealand, commented, "It will be impossible for more than a small minority of people to relocate into dense urban locations before the rising land prices at those locations 'price out' those not already there." I predict growth in urbanism will help sustain a long, shallow plateau, but will not have a permanent effect.

The aging of cities implies that as the population of a city gets older, it drives less. This is from the Australian study – a country with a pronounced baby-boom population. This would contribute to a 15-20-year dip or plateau as this cohort passes through. It might exaggerate that dip, but not indicate a sustainable peak.

The growth of public transport does not necessarily imply a reduction in VMT. Historically, VMT growth outstrips growth in Transit Miles Traveled, but this may be changing. In an article in the *New York Times Magazine* (January 2011) the Center for Clean Air Policy's Steve Winkleman pointed to a 38% growth in US transit ridership since 1995 – versus a 14% growth in population and 21% growth in highway VMT. He also noted that by 2008 teleworking would contribute (only) about 1% of the drop in VMT. This would also contribute to a plateau, but would have to be sustainable to maintain that plateau. The kind of public systems we have now (large vehicles, fixed routes) has too many limitations and entrenched inefficiencies to cause the demise of automobile dependency.

Fundamental demographic shifts are also in play. Winkleman's research also points to other causes for VMT saturation, such as the growth of knowledge- and service-oriented sectors, full penetration of women in the workforce, increasing percentage of households without children, and growth in minorities and immigrants that typically generate fewer VMT.

VMT peak?

All of these factors would contribute to a long plateau and would exaggerate short-term dips as they all put more people on the modal decision boundary between automobile and non-automobile in times of rising fuel costs, new-car purchases, and moving domiciles. But the question now is whether a long plateau will end in a slow return to former levels, or would the decline signal an absolute peak?

Automobility will indeed peak at some point in humanity's future. Whether that has already happened in some countries needs to wait for more data. Certainly it has not happened worldwide. As and when this peak unrolls across the economic development gradient of the countries in the developed world it will be followed by a plateau of automobility – but never its demise. What will that plateau look like? How long will it last? And will a new post-oil peak arise in 20 or 30 years? I predict the plateau will be modest at best – in the range of 80-100% of current volumes, that it will last 10 to 20 years, and will be followed by a post-oil peak significantly surpassing current VMT levels, but we will have technology to mitigate its congestion effects.

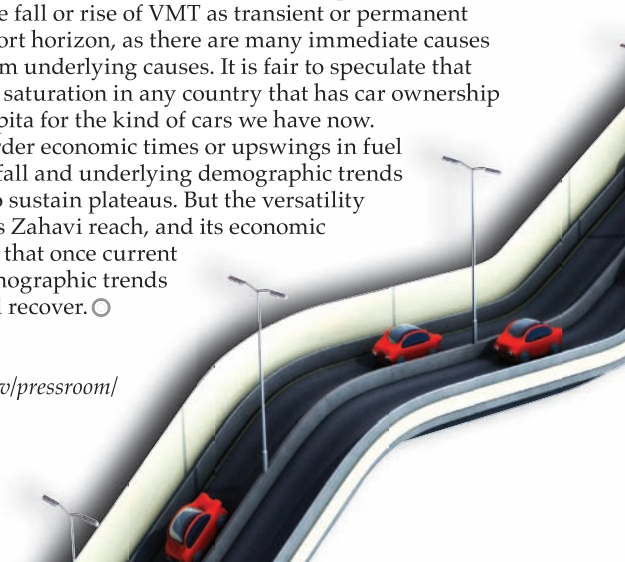
The travel behavior models discovered by J. C. Tanner in the 1960s, developed by Y. Zahavi in the 1970s and elaborated by C. Marchetti in the 1990s teach us about two travel invariants, or 'Zahavi budgets', that limit natural human time and money expenditures for mobility. Humans intuitively seek to limit daily travel time to 'about an hour'. It predicts the radius of pedestrian cities would be about 2.5km and the car expands that to 20-25km. Cities that are bigger than that either tend toward having people live and work within the radius of a one-hour round trip or have people spending more than their instinctive time budget on travel. This correlates well with our anxiety over congestion study reports of 'average commute times' of 75 or 90 minutes (or more) in some larger cities. It also influences where individuals locate, which modes they will choose, and which jobs are 'within reach'. Most importantly, it selects for the automobile where there is not transit that is within the time budget, because in most door-to-door circumstances the automobile is considerably faster than public transportation. This time budget tells us why our many attempts to reduce driving will continue to fail, and why a new peak will materialize, post-oil.

Commuters aim to keep their daily journeys to 'around an hour'

> I predict the plateau will be modest at best – in the range of 80-100% of current volumes, that it will last 20 years and will be followed by a post-oil peak

The automobile also leaves the Zahavi radius whole – the car can reach almost anywhere within a radius. Job and location reach via public transportation is more fragmentary. The area that can be accessed within the Zahavi radius functionally defines a city. As the automobile adds so significantly to that radius, this forms a significant barrier to the 'demise of automobile dependence'.

Interpreting the fall or rise of VMT as transient or permanent is difficult on a short horizon, as there are many immediate causes as well as long-term underlying causes. It is fair to speculate that VMT is close or at saturation in any country that has car ownership at 0.6 or 0.7 per capita for the kind of cars we have now. Hence, during harder economic times or upswings in fuel prices, VMT may fall and underlying demographic trends can be expected to sustain plateaus. But the versatility of automobility, its Zahavi reach, and its economic power all indicate that once current economic and demographic trends play out VMT will recover.



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Sweet harmony

TMCs are dramatically expanding their capabilities to fine-tune the way they respond to fast-moving and potentially safety-critical incidents. **Timothy Compston** speaks with the front-line conductors who have to face the music on a daily basis

Illustration courtesy of Magictorch

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Through the rollout of intelligent systems and robust management techniques, traffic management centers (TMCs) are very much at the heart of efforts to orchestrate the smooth running and safety of their extensive highway networks. Anticipating and tackling incidents is key. If proactive steps aren't taken at the earliest possible stage, situations out on the roads can very quickly escalate out of control. Even the smallest of delays can have severe follow-on cost implications for highway operators, but crucially also repercussions across the wider regional economy as commuters find their journeys disrupted while time-sensitive deliveries miss their critical deadlines.

Thankfully, the need for personnel to access the 'bigger picture' without missing a beat is being facilitated by a number of technologies, including the adoption of the latest visualization systems and videowalls as well as moves from wireless to fiber backbones to enhance data flow and – from an information-gathering perspective – the installation of IP-enabled camera networks. The take-up of video analytics for incident detection and the integration of speed and traffic flow sensors at key points is also a prerequisite for creating harmony on the roads. TMCs are additionally making extensive use of physical and virtual media to communicate geographical and audience-directed messages to maintenance personnel and the wider traveling public, whether through Dynamic Message Signs (DMS), emails, SMS, websites – and in this day and age even social networks.

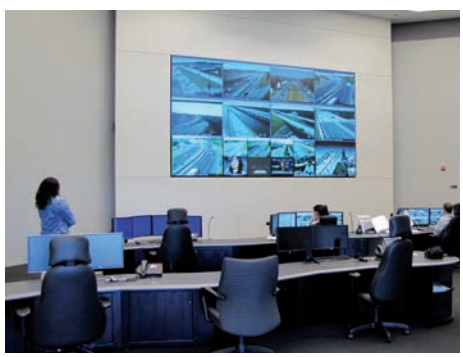
Regional focus in New Orleans

Emergency scenarios are when TMCs have to become command centers, demonstrated all-too frequently in the USA over the past few years. But such events do initiate change for the better. The traffic management infrastructure across New Orleans, for instance, has certainly been transformed in recent years as a result of the city's experience with Hurricane Katrina. Steve Strength, the district traffic engineer from the Louisiana DOT and Development, is enthusiastic about the resources that are now in place. In particular, Strength, who is responsible for overseeing the New Orleans TMC – which is coming up to its second anniversary – believes there has been a major step-up in capability over what was previously in place. "There's no doubt things have improved dramatically since Katrina, when there were essentially a few portable cameras and message signs on trailers with wireless capability to implement the contra-flow operations for the evacuation," he says. "Traffic was then being managed from my office on a laptop, including communication with state police and other relevant agencies."

When emergency conditions arise such as hurricanes, floods, industrial explosions, or terrorist attacks, the EOC at Houston TranStar is activated

Many of the lessons learned from events such as Katrina have been addressed in the design of the new facility: "During the planning of the new center, we regarded enhanced communications with our partners and the local agencies – covering the interstate highways and major roadways – as a priority in order to share information," Strength says. "And to this end, we now have a statewide fiber-optic network, which means we are linked with centers in other parts of Louisiana." With the new strategy in place, there is now complete redundancy with Baton Rouge so both regions are able to see each other's video feeds. "We have also been working on sharing video with the police and local public works personnel," Strength adds. "With previous events we found that it was impossible to be on the phone with multiple agencies at the same time, as things simply became confusing; so from an operational perspective the more information that can be made available in other ways the better. Our website, for instance,

> We regarded enhanced communications with our partners and the local agencies – covering the interstate highways and major roadways – as a priority in order to share information
>
> **Steve Strength, district traffic engineer, Louisiana DOT, USA**



At the New Orleans RTMC, advanced cameras, viewing screens and VMS are designed to monitor and direct regional roadway operations year round and during periods of congestion and hurricane evacuation

Baltimore visualizes ROI

When traffic planners in Baltimore, Maryland, saw that their options for new roads were becoming limited they decided instead to focus on overlaying smart technology onto their existing infrastructure. Funding was secured through the Mayor's Office and the Baltimore and Maryland DOTs to rebuild Baltimore's TMC. The city's planners were also charged with minimizing capital and operating expenses.

As a consequence, Baltimore selected an open, IP-based, traffic management solution. The solution is now operational and consists of an IP-based network of existing and new ITS devices such as cameras, sensors, newer LED traffic signal systems, electronic signs, and wireless devices. This network allows two-way data transmission and remote control and troubleshooting of traffic devices and has significantly improved information flow and overall situational awareness across multiple city, state, and police departments.

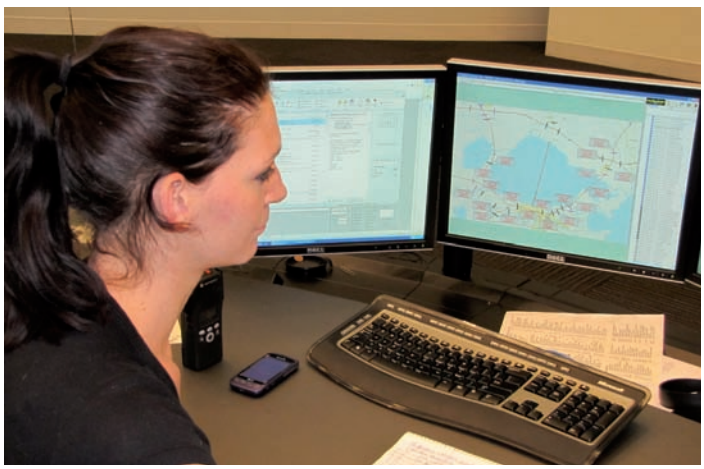
The centerpiece of the new TMC is a network-based visualization and collaboration solution that features a large video display wall in the main conference room, which can – if required – also serve as Baltimore's Emergency Operations Centre (EOC) to handle severe events such as hurricanes. It leverages technology from Siemens integrated with advanced visualization and collaboration software from Activu. Information from thousands of video and data sources can be controlled, prioritized, and selected in real time for viewing on the videowall. Information can also be accessed and viewed on secure, authorized, network-connected devices.

"With tight budgets and the proliferation of broadband wired and wireless networks, we believe that IP-based open systems such as the one in Baltimore are able to deliver a high return on investment and increasingly replace legacy systems in TMCs worldwide," says Paul Noble, CEO of Activu, which supplied the visualization solution.

offers traffic data and information that means even agencies that don't have a direct connection to us can view camera footage and other data."

The New Orleans TMC has been designed with flexibility in mind and has space for up to 12 workstations, raised floors and a computer room should agencies want to sit in for major incidents. Strength also sees the benefit of having a boardroom upstairs with a large glass window overlooking the operation: "People can go up there to see what is going on without impacting negatively on the work of the control room operators.

"Ironically, with all the changes we haven't had to conduct an evacuation since we opened," the TMC manager says. "The closest we've come was the very recent tropical storm Lee, which was the first major weather event for us. In the case of Lee, we were able to process reports of roadway flooding including outside the levee system that we don't normally monitor, put them on the website and 511 system and deliver email updates to selected officials and public highway representatives."



(Left) **New Orleans RTMC operator Dixie French keeps a watchful eye on events out on the road**

Of course, things don't just get hectic when storms roll into town. With planning well advanced for the National Football League's Superbowl 2013, Strength believes the TMC's capabilities will ensure a much smoother process than when the Superbowl last came to the city in 2002: "As the first major sporting event post 9/11, one of the challenging things was that the authorities didn't want any trucks in and around the Superdome," Strength recalls. "Being right in the downtown area meant that this impacted on our entire Interstate system so we were scrambling around to put up static signs and other measures before the event. Now with intelligent traffic management systems in place, such as video monitoring and variable message signs – which can be controlled directly from the TMC – it will be far easier to communicate restrictions and to obtain a bigger-picture view of what is actually going on."

Houston's intelligent approach

As with New Orleans, the operation of Houston's TranStar TMC in Texas has

Houston TranStar, a national leader in freeway incident management, uses state-of-the-art technologies to reduce congestion on major roadways

benefited from years of experience handling major incidents. According to David Fink, manager, transportation management systems, a case in point is the way that TranStar has been able to build on the experience of Hurricane Rita in 2005 so that when Hurricane Ike came around three years later its operations ran much more smoothly. "It was like night and day in our ability to deal with the two hurricanes," Fink recalls. "For the first event it became apparent early on that all of our ITS were concentrated in the urban area while unfortunately many of the hurricane-related problems were actually outside of this ITS coverage. As a consequence, we dramatically extended our monitoring footprint into the rural roadways and now have around 900 cameras compared to around 400 previously.

"The result of this investment was that during Ike we were able to keep a watch on traffic from the TMC to a greater extent across the critical evacuation routes," Fink explains. Unlike Rita, though, alongside this **Houston TranStar had incident** management contracts in place to remove stalled vehicles during the evacuation. "If we saw a bottleneck developing, somebody could be sent out quickly to deal with it before the situation escalated. On I-45, for instance, one of our hurricane evacuation

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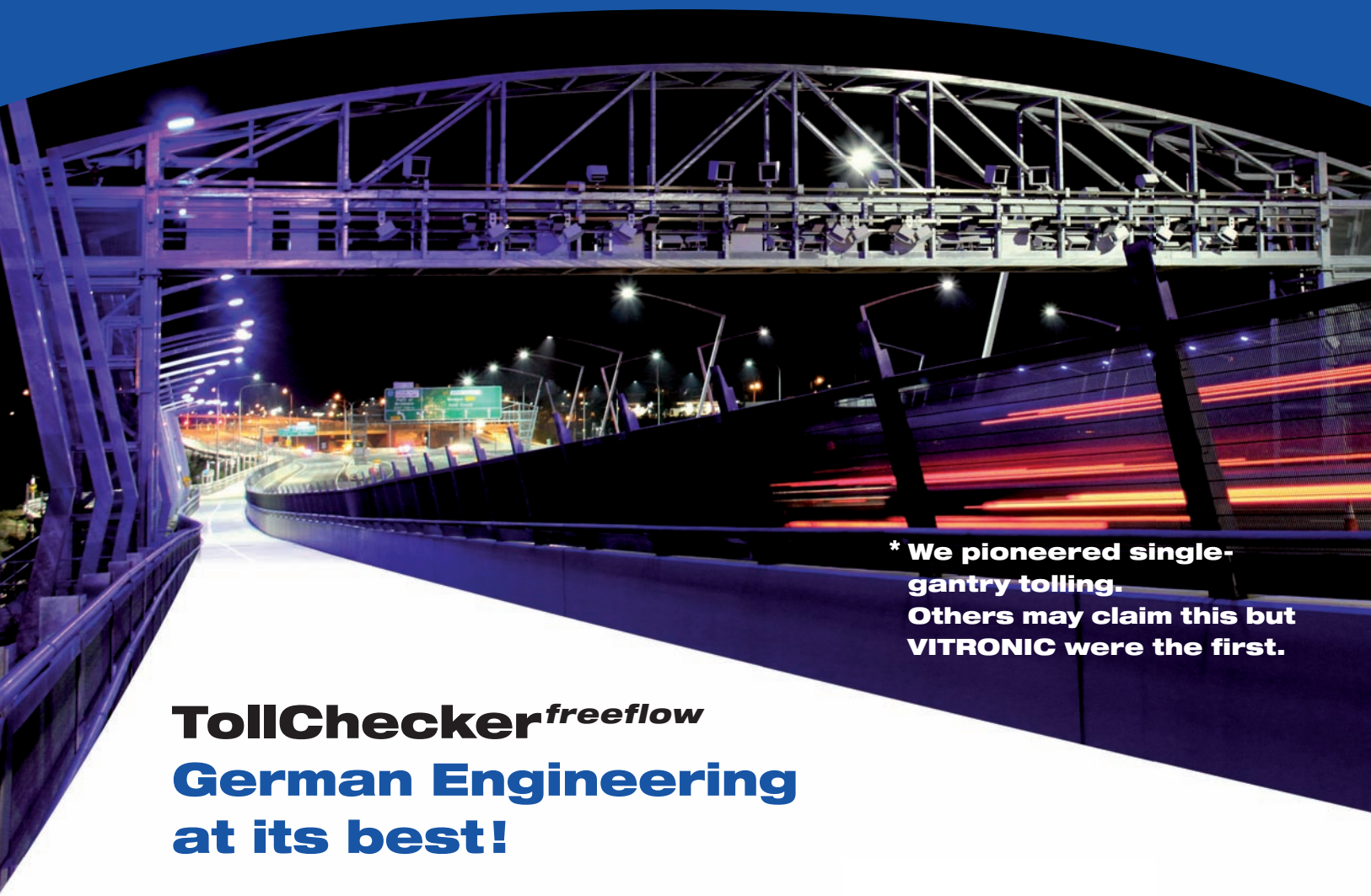

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routes, we are currently trialing Bluetooth technology to determine vehicle travel times on the roadway and to pick-up on closures. An early implementation of this for us was when we had major icing across Texas so we could monitor road conditions based on the data collected for speed and the number of vehicles out there."

The operators at Houston TranStar also found themselves handling the consequences earlier this year following the huge Tri-County fire – the largest in Fink's living memory: "It was about 60 miles from the center," he says. "Our main tasks during this time were to deal with road closures and to direct people around the area. It was challenging but being more localized it was not on the same scale as a hurricane-type evacuation."

NTTA focuses on detection software

Dallas-based North Texas Tollway Authority (NTTA) – which continues to win awards for its operations – reports that it is now using night-vision cameras and incident detection software to provide an early warning of potential problems to operators at its command center. Clayton Howe, assistant executive director of operations at the authority, sees the application of this technology as an important advance: "When you have a couple of thousand cameras and three or four people to monitor them, then it makes sense to implement this type of approach," he says. "The technology we use was originally applied at airports to detect what should and shouldn't be there. In the case of traffic, it establishes trends relating to how vehicles should be moving at a certain time of day. If there is a difference between what should be expected, the software will identify the cause and bring it to the attention of our operators."

Despite the rush to deploy ever-more sophisticated technology Howe still sees a place for the good old-fashioned eye on the ground: "During rush-hour traffic, you just can't beat people being there," he insists. "Within two or three seconds, we'll receive calls from motorists surrounding an incident, which is something technology still can't match. We also had a recent example where a mechanically stabilized wall failed and moved 5ft. The initial buckling was actually picked up by one of our Roadway Customer Services team, who was passing the area and was then able to alert the command center to initiate a roadside closure.

"Once you know that there is an incident, the advantage with cameras of course is that they allow the command center to look at the situation remotely, send the right resources, and monitor progress," Howe adds. "In the past, without these cameras in place, if there was an incident out on the road such as a tanker fire everybody would be dispatched. Now there is at least the potential to identify who really needs to be at the location rather than needlessly tying up resources and impacting on response times for other events."

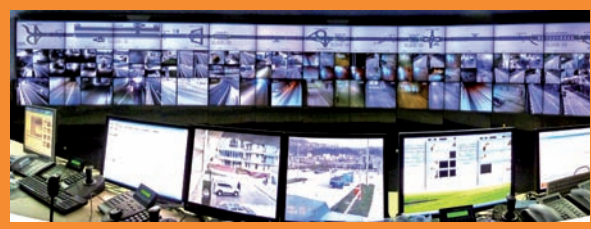
(Top left) **When a problem occurs on an NTTA road, motorists can count on its 24/7 incident management teams within the command center**

> When you have a couple of thousand cameras and three or four people to monitor them, then it makes sense to implement this type of approach
>
> **Clayton Howe, assistant executive director, North Texas Tollway Authority, USA**

Roadwork realities in Edmonton

One of the most problematic scenarios that TMC managers and operators have to deal with are major public works, with the associated disruption to normal traffic patterns causing more than a few gray hairs. Just ask Gord Cebryk, director of signals, street lighting and infrastructure rehabilitation in Edmonton, Canada, who will gladly tell you what he and his local TMC team faced when dealing with the large-scale CA$161 million Quesnell Bridge Rehabilitation Project, which sought to widen the bridge

Wonder wall for Winter Olympics



When it comes to hosting a major event such as the Winter Olympics, invariably transportation management comes under the spotlight. The forthcoming 2014 event in Russia's Sochi is no exception, with a key development being the construction of a massive 4.2km tunnel – the third largest in the country – to deliver a critical connection from Sochi to the mountainous region of Krasnaya Polyana in the Western Caucasus, scheduled to host outdoor competitions such as downhill skiing. The Baranovsky tunnel, which took 10 years to complete, was officially opened by Prime Minister Vladimir Putin in December 2009.

From a TMC point of view, it was seen as imperative at an early stage by the Russian authorities to set up an ultra-modern facility to ensure traffic safety in the tunnel. The purpose-built center takes feeds from more than 300 CCTV cameras deployed both for tunnel monitoring and to keep a watchful eye on the surrounding environment. Given the extent of the camera network it was decided that the optimum solution would be to display the outputs on a massive screen, alongside various computer signals, via split high-end graphic controllers. The impressive video display wall solution from eyevis includes 36 of the company's 46in LCD screens installed in an ultra-thin 12x3 arrangement. The resulting display layout has been optimized to mirror the layout of the Baranovsky tunnel and the relative positions of the associated camera feeds, and will ensure that center operators have an optimum view of any tunnel-related incident during the 2014 Winter Olympic Games.

over the North Saskatchewan River. "With up to 120,000 vehicles transiting it each day, the Quesnell Bridge is a key part of Whitemud Drive, one of the busiest commuter corridors in Edmonton," Cebryk explains. "We were involved with the posting of specific road disruption information via strategically located dynamic message signs at an early stage," he reveals. "This allowed us to provide tailored messages for motorists with details on the roadworks and significantly, the lanes that were being closed in each direction. For peak periods, we were also able to deliver constantly updated travel-time information to provide commuters with an indication of the potential impact on their journeys."

According to Cebryk, it was imperative in this situation that the Edmonton TMC was able to liaise effectively with other agencies involved in the Quesnell Bridge project. "Our TMC operators regularly dealt with messaging requests to highlight construction disruptions on this vital corridor from Edmonton's Traffic Control Group. A pivotal element in the successful handling of the travel disruption was the constant coordination regarding the content of these messages and where they were to be displayed. In addition, TMC operators closely monitored congestion in the area to manage any unplanned events, such as collisions and stalled vehicles, notifying the Edmonton Police Service and verifying the situation on the ground through our network of CCTV cameras."

Cebryk feels that the experience gained in Edmonton from this project underscores the importance of providing directed information to the traveling public: "We reaffirmed the benefits of a proactive messaging approach in alleviating the frustration of motorists over the inevitable disruption to this key arterial route while the construction work was under way," he says. "Ultimately, this helped them to make informed decisions as they were at least able to know why traffic flows were abnormal and to alter their travel plans accordingly."

(Above and right) **Efficient TMC operations in Edmonton enable improved incident response and traffic management along monitored corridors, creating more efficient traffic flows**

Switch to better TMC efficiency

The clutter inherent with a computer terminal at TMC workstations – the mouse, keyboard and monitor – limits space, and generates noise, heat, dust, and health and technical issues, all when operators must maintain utmost levels of concentration. However, the KVM (Keyboard, Video and Mouse signals) extending and switching technology from Guntermann & Drunck streamlines the system, allowing users to access a pool of computers – even different platforms – through one keyboard, video (display), and mouse. The solution is not only beneficial ergonomically, but also facilitates the work of the controller as computers can now be operated with one set of input devices. The free working space also allows for more staff within the same space, while economically it reduces materials costs and IT total cost of ownership and saves primary energy (for components, etc.) and secondary energy (such as for cooling).

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Life in the HOT lane?

The enthusiasm for managed lanes in the USA has helped the nation develop and fund new road capacity – and keep traffic moving. **Charles Russell** examines whether or not the UK could achieve something similar

Illustration courtesy of Anna Davie

There has been much talk in the press recently about the development of 'Managed Motorways' across the UK. First introduced on the M42 in 2006 – and now to be extended to different sections of the M6, the M1, the M25 and of other roads – they essentially entail the enabling of hard-shoulder running, accompanied by a full array of traffic management and surveillance systems designed to regulate use and ensure safety.

At the same time, the Confederation of British Industry (CBI) and others are still calling for more radical intervention – for the wider introduction of tolling on existing and on new motorways. This, they say, would not only provide essential new capacity but also give government the revenue streams through which this expensive investment could be funded.

Over a number of years now in the USA, these approaches seem to have been amalgamated. In many states across the country, a program of PPP-funded development of new high-quality capacity has been inaugurated through the development of new tolled traffic lanes running alongside the existing capacity – HOT or Managed Lanes. Could this be adopted in the UK?

Managed lanes in the USA

Building on the well-established – if perhaps less than successful – High Occupancy Vehicle (HOV) lane program, transport authorities in a number of states have procured the development of limited new highway facilities, generally built within the footprint of the existing highway corridor. As such, these facilities can be built with limited (if any) land acquisition requirements, and can be provided within the very tight planning constraints in place.

When comparing behavior between the UK and the USA, we must remember that the USA seems to not want to shirk from the challenges of new construction. What it might consider a minor extension, the UK might see as something completely different!

The thinking behind this program is threefold. There are truly problems in developing new roads – especially within established urban areas. New capacity has to be added, as far as possible, within the existing corridors. New building is – of course – costly, and anything that successfully captures payment from users is immediately attractive. While moving cost from the tax bill, it will also allow the introduction of private finance and PPP procurement.

With aggressive pricing, the road operators can ensure that the new capacity is used to provide a high level of service for those who are willing to pay.

The first of these projects – the SR91 in California – includes a single section running parallel to a very highly congested commuter route. The project has been thought of as very successful – both for the developers and the users. It is interesting to note – especially when you are trying to estimate the likely ridership of such a facility – that although the Expressway runs alongside – and in full view of – the main carriageways, research shows that most users over-estimate significantly the time-saving that they have achieved. Even during off-peak periods (and overnight) when the use of the Express Lanes provide no time savings, a significant proportion of the

traffic continues to pay the toll and drive the expressway.

The advances of electronic tolling now allow complex full-speed charging – dealing not only with single sections but across whole networks and allowing tolls to vary in real-time. Under new contracts, operators are required to vary toll rates in such a way that they guarantee the maintenance of a minimum speed on the managed lane whatever the levels of traffic and congestion across the corridor as a whole. This requirement underpins the major new urban systems now under development in a number of states, including Texas, Florida, Georgia and Virginia.

On each of these projects, new capacity is being introduced into complex and very congested urban networks – where the tolls will be set to ensure that a stipulated level of service will be maintained on the managed lane. It is anticipated that, at peak times, the levels required to achieve this may be as high as US$0.75 per mile – against the US$0.05 commonly seen across conventional roads.

These projects are not small – and not cheap or easy to construct. On the I-635, across the north of Dallas, the scheme will include six new running lanes, built essentially under the existing highway in cut-and-cover tunnels.

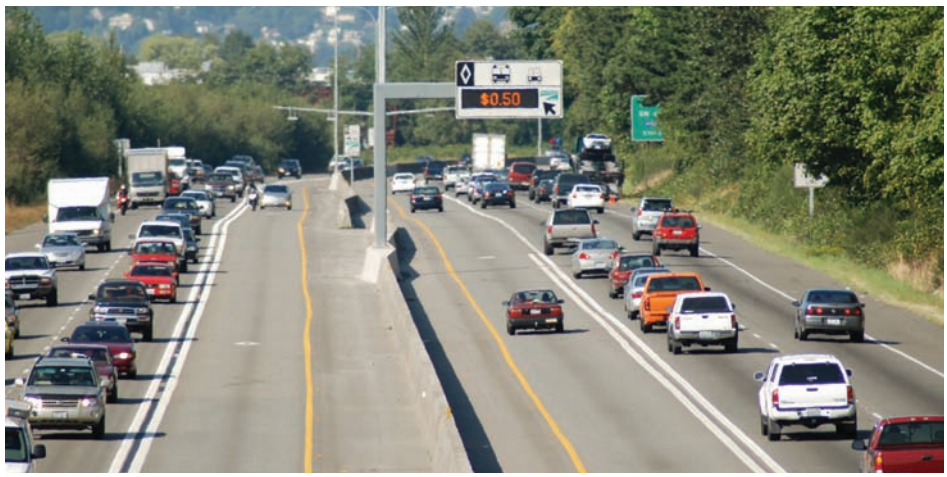
It is anticipated that the capital costs associated with the works might be as much as US$3 billion. However, if 50,000 vehicles use this facility each day, paying on average US$0.20 per mile across the 17 miles of the corridor, the investment will generate toll revenue of some US$50 million per year.

This approach allows the state to introduce new tolls, where their power is heavily restricted, to raise money from those willing to pay – or to provide a high level of service for those willing to pay. It also leaves capacity available for those not choosing to pay – and avoids the risk of the diversion of traffic to inappropriate routings.

Could we do this in the UK?

To date, there has only been very limited use of tolls on the UK road network – on a few major bridges/tunnels and on the M6Toll running to the north of Birmingham. These have been largely successful – and, aside from some sections of the trucking sector, are broadly accepted.

However, despite extensive support from academics and transport practioners, it has always been hard to see how the program could be extended. The orchestrated political outcry that any new proposals would face would be very difficult – or impossible – for any government to overcome. And at the same time, there really could be huge transport problems in trying to re-engineer a toll road system onto our toll-free network.



Could the USA's managed lanes approach work on UK roads?

But could managed lanes be the way forward? Could the UK use the techniques that we have been developing to control traffic flow on newly accessible hard shoulders to make possible a chain of managed lanes whose use is restricted by the need to pay tolls?

With the need to limit access to the managed lane at only key points and the need to ensure that traffic on the managed lane can systematically run faster than that on the parallel lanes, physical separation of the lane has to be considered – which would certainly bring different engineering problems that might even require significant new construction. With the tools available to inform and control traffic, the engineering problem cannot be insuperable.

But is the UK as a country ready for what was once referred to disparagingly as 'Lexus Lanes' – a high level of service available only to the wealthy? Although the welfare economist might point out the efficiency of providing high-quality services to those who are willing to pay, is the UK public ready to accept the principle that the same sort of road is not available to all equally – and that money can buy a superior service?

> The economic and environmental costs required to provide adequate new capacity are so large there must be little realistic expectation that they will be met – certainly in the short term
>
> **Charles Russell, director, Steer Davies Gleave, UK**

The latest reports on how much congestion is costing the UK suggested a figure of between £16 and £20 billion each year. Yet however gigantic this figure is – and however beneficial it would be for the country to upgrade our transport networks and provide the level of service we need – can we really afford the investment required? The costs in both economic and environmental terms required to provide adequate new capacity are so large that there must be little realistic expectation that they will be met.

Perhaps Managed Lanes are the solution, where fuller utilization is made of the existing infrastructure and the new available capacity is reserved for those who really need or indeed value it.

• *Charles Russell is a director with Steer Davies Gleaves. To contact him, please email charles.russell@sdgworld.net*

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TRL veteran **Goff Jacobs** was talking about road safety in developing nations decades before most of today's so-called leading lights even acknowledged there was a problem

Interviewed by Nick Bradley

> The way you build roads in developing countries and the materials you have at your disposal are clearly different

This year marked Dr Godfrey 'Goff' Jacobs' 50th year in road safety and his golden anniversary with the UK's Transport Research Laboratory (TRL). Back in 1961 – the year John F. Kennedy was sworn in as US President, The Beatles played their first gig at The Cavern Club, and the first edition of Joseph Heller's *Catch-22* was published – Jacobs, clutching a degree in Chemistry, joined the Bituminous Materials Section of the Road Research Laboratory (RRL), as TRL used to be known. It didn't take him too long to conclude that chemistry and materials research wasn't for him after all, so after encouragement from the RRL's then deputy director, Reuben Jacob Smeed (of Smeed's Law fame), the softly spoken Welshman took a sideways step within the RRL to join its small traffic and safety division.

Getting his hands dirty in the exciting field of road safety couldn't have been a more stark contrast to the rather mundane study of adhesion agents in roadstone. A number of Jacobs' safety assignments throughout the 1960s focused on pedestrians, including the design of pedestrian-friendly new towns such as Bracknell (Berkshire), Crawley (West Sussex), and Harlow (Essex). His findings into the effectiveness of pedestrian guardrails on the busy streets of London no doubt stood him in good stead, and his later work into relative risk rates among pedestrians led to the introduction of 'zig-zag' markings in the proximity of pelican crossings. Perhaps the highlight of these first few years, though, was his research into the frequency of drink-driving incidents, the results of which were a precursor to drink-driving legislation.

Global phenomenon

A decision Jacobs came to in 1968, however, shaped the rest of his career when he opted to transfer to the rather fantastically named Tropical Division of the RRL.

"I was seconded to work for two years with the government of Cyprus to help them with their transport and safety problems," the 74-year-old engineer recalls. "When I came back in 1971 and looked at the structure of what TRL now refers to as its International Division, the staff was made up of geo scientists, materials experts, pavement design specialists, and so on. The one area that wasn't being covered was safety, although it was clear to me there was a dire need for it – in developing nations in particular. Before I could do anything, though, I had to prove there was a traffic safety problem in those regions, and once I'd convinced the powers-that-be of that fact, that's when our international road safety work really took off."

At the time, TRL's International Division was funded by the British Aid Ministry, which Jacobs freely admits was a wonderful way to conduct research without too many financial constraints. "But it wasn't just a case of transposing technology deployed in the UK," he stresses. "The way you build roads in developing countries and the materials you have at your disposal are clearly different."

So what exactly was it that attracted Jacobs to solving road safety problems in these far-flung locations? His drive, essentially, boiled down to helping countries that couldn't help themselves. "The problems in such nations are particularly

> Unless you understand the magnitude and nature of the [road safety] problem, you just can't come to grips with it

severe, simply because they *are* developing countries and don't have so much money to spare," he says. "People have to be housed and fed and educated and given decent drinking water, so the amount of money to spend on roads is limited, and the amount to spend on road safety even more so."

Safety on tour

Over the course of the ensuing 30 or so years, Jacobs' work took him to more than 30 countries in Africa, Asia, Latin America, and the Middle East, in the process completing an astonishing 100 projects. "If Tanzania wanted to address its road safety problem, for instance, it would approach either the World Bank or what is now known as the Department for International Development (DFID)," he reveals. "It was then my job to ensure that the terms of reference were written properly, that the right team of transport consultants was appointed, and that things were actually implemented. In some cases, I've even helped countries implement the recommendations that are put forward."

Demonstrating that such projects have paid dividends through lives saved and casualties reduced, though, is not as easy as you might suspect. "When I started my work in India in the early 1970s, there may have been around 10,000 deaths a year from road traffic accidents, and now of course India has the second-worst record in the world with around 90,000 road deaths," Jacobs says. "Not that long ago, private vehicle ownership in China was very, very low and now they're out there in front with more than 100,000 road deaths annually. This doesn't suggest that their road safety problems are completely out of control; it's more a case that vehicle ownership has increased from a zero base to very high numbers. What I tended to do to show change was track the same group of countries over a long period of time – 10 in Asia, 10 African countries, five Middle Eastern countries and maybe eight Latin American countries, for instance. What's evident in most cases is that their fatalities climb like a mountain and then start to plateau, so in actual fact the rate of increase is declining in many cases, which is always your starting point."

Jacobs cannot pinpoint any one success story over the years, particularly after so many projects; his passport has been stamped in Indonesia, Burkina Faso, Malawi, Kenya, Malaysia, Thailand, Pakistan, Ethiopia, South Korea and even the Seychelles and Mauritius, to name just a handful. So twisting the question to just state his biggest achievement, he simply says putting road safety in the developing world on the map. "I was talking about the issue a long, long time before action was taken by any of the leading aid organizations," he says, without so much as a hint of arrogance. "I remember going to Washington in the 1970s after some perceptive guy in the World Bank thought it would be a good idea if people sat up and listened to me. They didn't quite regard me as a scaremonger – more that I was raising issues that were of little importance."

Now, of course, it's a completely different story. When the World Bank commits to any transport investment, road safety components are a prerequisite. "It's heartwarming to see that after initiating all of this interest over so many years, it is beginning to pay off," Jacobs says.

However determined any individual is to succeed, though, the TRL man insists you can't get away from the fact that to reduce KSIs, you have to spend money, you have to have the right management structure in place, and you have to have the appropriate plan or strategy – which is where TRL comes in. "It's not easy to identify how much money a country needs to spend on road safety in order to have a positive impact," he says. "The UK is one of very few countries in the world that puts a figure on its road safety spend – around £3 billion a year – because we know from our accident-costing programs that road accidents cost us well over £20 billion a year.

"One of the most interesting things that struck me during my research into the developing world is not how much money these countries have spent on road safety, but how much money road accidents have cost them – roughly the same amount of money they receive in aid from all sources.

"Placing a figure on the cost of road accidents is also tricky," Jacobs believes.

Getting the basics right

In a world where increasingly intelligent vehicles and ITS are hitting our roads, Goff Jacobs cannot stress highly enough getting the basics right first, citing in particular a systematic way of collecting, storing, and analyzing accident records. "For a number of years, my TRL colleagues and I have been working on a tool called MAAP, or Micro Computer Accident Analysis," he says. "It's been refined and polished since it was first introduced, to the extent that it's now a very sophisticated system yet still very easy to use." Jacobs also highlights the need for appropriate audit techniques to ensure that roads are built with road safety in mind.

"And of course TRL has been instrumental in developing tools such as TRANSYT and SCOOT. We assisted the British Aid Ministry in producing three of four computer-controlled signal systems in Beijing, without which the city would probably have completely seized up by now. Bangkok is another city famous for its congestion and I remember working with the police there to introduce 100km of bus lanes, which were very effective indeed when they were introduced. Sadly, though, their effectiveness declines over time, especially when not enforced properly."

Jacobs pictured (far left) **outside TRL in 1998 with some of his fellow road safety practitioners**

"I've assisted many countries in setting up crash-costing procedures because it's vital to get some kind of handle on it. It's a complicated process; looking at it simplistically you've got the lost output, the cost of pain, grief, and suffering (or human costs), insurance costs, medical costs, police costs, the cost of vehicle damage, damage to street furniture, and so on. All of these must be taken into account. Once you have a total figure for the cost of accidents to a nation, it's a lot easier to justify the expenditure to put things right. Unless you understand the magnitude and nature of the problem, you just can't come to grips with it."

His glass definitely half full rather than empty, Jacobs insists there is light at the end of the tunnel, which is something he couldn't have predicted 15-20 years ago. "There are very few countries left in the world now that do not accept they have a road safety problem," he says. "And you've got organizations such as the Global Road Safety Partnership (GSRP), the United Nations, and the World Health Organization advising and assisting – plus you've got the huge multilateral aid agencies such as the World Bank, the Asian Development Bank, and the Inter American Development Bank all being very concerned about road safety. It's far from doom and gloom."

What does concern Jacobs going forward, however, is the rate at which Third World cities are growing. "It's indescribable," he states. "In 1945, Nigeria's capital, Lagos, was about the same size as Bradford yet today it's one of the largest cities in the world with a population of something like 20 million. When you consider cities like this, it's impossible to think in terms of a 'neat' transport solution – a magic wand, so to speak. In the 1950s, there were just a few cities in the world with a population of more than 10 million and by the 1960s there were around eight. I recently gave a lecture on the subject at the University of Southampton and discovered during my research that there are now around 30 such cities, 80% of which are in the developing world. That's the way things are going. If you ask me, to talk about potential transport solutions to aid mobility in such environments is very optimistic indeed." ○

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As Vienna prepares to host the 2012 ITS World Congress, we speak with **Martin Russ**, one of Austria's most prominent figures in ITS

Interviewed by Tori Read

Although Austria has produced some of the leading lights in the wider ITS industry – the likes of Kapsch, Swarco and Siemens – it is not necessarily a country that springs to mind when you think of pioneering deployments of the technologies developed by such vendors. Yes, it has nationwide DSRC truck tolling – but so do several other countries. And yes, the country has participated in some successful European research projects – but again, so have many others. However, in the next 12 months, our perceptions – and likely, our misconceptions – about Austria's role within the ITS sphere are likely to change.

In 2012, Vienna will host the 19th World Congress on ITS. Visitors from all over the world will descend upon the picturesque city keen to hear the latest developments in ITS in the host country. And one man has more reason than most to give them something impressive to talk about.

Martin Russ is currently managing director of AustriaTech, the government-funded agency whose primary goal is to bring all relevant players together to drive forward innovation in transport.

> For the past 10 years we focused on technology – on getting the right technologies – and now we have them, but we need new concepts for deploying them

> We have to create and guarantee an efficient, affordable, comfortable mobility system where different high-quality modes are proper options

Despite only being 41 years of age, Russ has a wealth of experience that someone 20 years his senior would envy. He's worked in transport planning (focusing on modeling and GIS). He's worked on projects within the EC's 4th and 5th Framework Programme. He's worked on rail technologies in both Germany and Austria. He's been a consultant. He's also worked in the cabinet of the Austrian Ministry of Transport. It's this rounded knowledge that encompasses technology, multiple modes of transport and, critically, policy, that makes him uniquely well suited to addressing the mobility needs of Austria's citizens.

So why did he decide to move out of the cabinet and take the job at AustriaTech? "Because it was perfect timing," he says honestly. "Things will change fast from now on. For the past five or 10 years we've focused primarily on technology – on getting the right technologies – and now that we have them, we need new concepts for deploying them. And harmonized deployment is also a big issue for Austria, bringing with it new requirements.

"When AustriaTech was founded five and a half years ago, it did a good job of building competencies and participating in European projects such as COOPERS and InTime, but now we are reaching a new phase. Our role is to guarantee that future research projects do not end at the research stage; we need to develop the commitment for bringing these ideas into real-life. And this role involves strong support for mobility providers and infrastructure providers in their innovation strategies. On the other hand, it's also about support for the economy and the industry – the industry partners. We have a strong industry – the likes of Kapsch and Efkon don't need strong innovation support, but all the small- and medium-sized enterprises do."

Nationwide commitment

In time, AustriaTech will become technical secretary of the national ITS platform, responsible for encouraging ITS deployments and then monitoring them as they roll out. This role will effectively define mobility choices for coming generations of travelers, and Russ is thoroughly embracing the challenge it presents. One current priority – and a scheme that showcases where Austria's ultimate aims for future mobility reside – is the development of a national, intermodal real-time traffic information system. "It's a kind of business-to-business platform where all the mobility and infrastructure operators put their data in and work on a common platform, so one routing for all," he explains. "And what's needed in this cooperation is a neutral platform and a clearinghouse, which we are planning to set up soon. This is a new role that puts AustriaTech into a totally new position compared with what we've done in the past. The intermodal journey planner element should be in full operation by next Autumn – in time for our World Congress."

Another scheme that Russ is keen to promote is a new project (as yet without an official name) on cooperative systems, which is based in Vienna and headed up by ASFINAG. It sees a number of key industry players joining forces. So what is AustriaTech's role here? "We are the technical coordinator. We are defining the use cases, so we set up the specification and the requirements for the future services," he says. "It's again a kind of coordinating role and involves matching the policy and technology aims so the results of the project can be delivered and implemented in the real world."

Alhough Russ's main priority is obviously to make a difference in his home country, he is well aware of the value in working with neighboring countries and is intent on fostering such relationships in the future. "We already collaborate on various projects funded by EU regional funds," he details. "We want to strengthen those bonds to create an integrated mobility region, encompassing Vienna, Brno in the Czech Republic and even going as far as Budapest in Hungary – the idea being one system with common standards."

Russ also welcomes inspiration from countries further afield. "Sweden has a strong ITS industry coupled with clear policies on what problems ITS has to solve. They're very much focusing on safe transport and the idea I like the most is the deployment of intelligent speed adaptation for all cars used by public authorities. That's a great example of how political leaders and public authorities should act in this field."

Should Austria then follow Sweden's safety-focused approach? Russ, surprisingly, thinks not: "Of course we have a strong interest in safety – we recently released new transport safety programs to cover what should be done over the next 10 years – but for Austria the main priority is in intermodal transport. We have to create and guarantee an efficient, affordable, comfortable mobility system where different high-quality modes are proper options.

"Work needs to be done now to develop and promote alternative modes because the circumstances surrounding transport could change greatly in 10-15 years; the rising cost of fuel could mean some very hard times for commuters. Therefore we have to offer effective – even desirable – alternatives to individual transport."

Testing times

Cooperative services, or telematics, are just as useful for public transport as they are for drivers. Their real-time information can encourage people to get out of their cars and take public transport instead (even part-way through their journey), which is a key part of Austria's hopes for future mobility options. A new nationwide project is bringing the telematics industry together with telematics service providers to build a center of competence. The two ingredients to get services into the real world are testing them in real conditions and user acceptance, hence the focus of the project.

Therefore a testbed will be deployed in the greater Vienna region, mainly on the highway junction A4-A23-S1, including a link to public transport information and the secondary road network, based on existing systems and services. Its aim is to deliver cooperative information services for mobile devices (such as smartphones or navigation devices) and to establish a direct communication link between public authorities and operators to travelers, commuters and users of travel information services. The fruits of the effort, the telematics services themselves, will be available for testing during the ITS World Congress in Vienna.

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True grid

The Manhattan Traffic Model (MTM) is one of the most complex large-scale simulation models in existence. **Vassilis Papayannoulis** and **Alexandre Torday** explain how this integrated modeling platform is used to assess traffic operations for Manhattan, New York

Images courtesy of TSS-Transport Simulation Systems & Claranet

Manhattan's grid system was introduced 200 years ago, transforming New York into a 'city of angles' and spurring unprecedented development. However, the rigid 90° street matrix also gave birth to vehicular gridlock, jaywalking and a whole new breed of creative parking.

Manhattan's infamous congestion problems are further complicated by round-the-clock truck deliveries, bikes, buses and more than 10,000 taxis, not to mention the pedestrian movements of its 1.6 million inhabitants and vast working and tourist populations. Keeping Manhattan moving is an even more daunting challenge when you add the complexities of traffic enforcement, managed-use lanes, signal coordination, various bridges and tunnels connecting the various New York boroughs, and the disruption of various major construction projects dotting the network.

Small wonder, then, that by 2009 the New York City Department of Transportation (NYCDOT) was feeling the need for an analytical tool that would permit the consistent assessment of the network-wide cumulative impact of current and future traffic management projects. "Our long-term aim," says Michael Marsico, assistant commissioner at NYCDOT, "is to have a base network that forms the cornerstone for future analyses and expansion to other boroughs and where possible, the region."

Model scope

The Manhattan Traffic Model (MTM) is a multi-tier model developed for NYCDOT by Cambridge Systematics, STV and TSS-Transport Simulation Systems. Although it will probably expand in the future, the current model incorporates different levels of detail: the core focuses in fine detail (including pedestrian movements) on the area between 28th Street and 44th Street and includes a microscopic traffic model stretching from 31st Street to 37th Street; the primary area is a detailed mesoscopic model stretching between 14th Street and 66th Street; and the larger secondary area is a less detailed mesoscopic model covering the tip of Lower Manhattan up to 179th Street and also including major links in Eastern New Jersey, Queens and Brooklyn. This area acts as a kind of wide-ranging background model: it covers over 1,000 miles of roadway (2,800 miles of lanes), 1,583 centroids/zones, and millions of private vehicle trips throughout the day, making the MTM one of the most complex large-scale simulation models in existence.

It became apparent to NYCDOT that there was a need for an analytical tool that would permit the assessment of network-wide cumulative impacts

Building and running the MTM

The MTM covers a sub-area of the New York Metropolitan Transportation Council's (NYMTC) macroscopic Best Practice Model (BPM) – the region's multimodal activity-based travel-demand model that consists of over 3,600 zones and 70,000 links. The BPM is utilized in regional and corridor analysis studies and constitutes, among other things, the primary source for the Origin-Destination (O-D) trip table in the mesoscopic study area. Data from the BPM is also supported in the MTM by a GIS database, which fuses data from a variety of sources and formats and, crucially, includes public transport lines and schedules.

Although this level of detail is sufficient for regional analysis, closer evaluation requires additional network and zonal detail along with a model capable of analyzing the operational effects of any proposed traffic management operations. "There was a need to investigate all of the complex time-varying phenomena in the network, right down to the nuances of parking regulations, transit priority schemes or managed tunnel lanes," Marsico explains.

In contrast with the travel-demand models, mesoscopic and microscopic models are particularly well suited for assessing the traffic operating conditions of congested environments. The mesoscopic and microscopic layers of the MTM both use the Aimsun software, which has also been used successfully by NYCDOT and its consultants in Lower Manhattan, the Upper East Side and Long Island.

The initial trip table for the mesoscopic study area was extracted from the BPM model and then adjusted to reflect more detailed traffic counts in the project area using a series of O-D Matrix Estimation (ODME) techniques, ranging from proportional fitting to sophisticated linear programs. The challenge was to keep the data and calculations consistent between the BPM and the dynamic model. This has important consequences for the bigger picture, as Marsico points out: "All work on the MTM goes hand in hand with the task of maintaining a GIS database where all information for a large-scale dynamic model can be stored while ensuring consistency with the BPM model to facilitate interchanging updates and results from one modeling level to another."

The model includes all applicable traffic signal plans and hour-by-hour information on parking and turning regulations as well as incorporating curbside observations such as the presence of stopped and double-parked vehicles. Surveying played an essential part: although the roadbed may show five available lanes, in practice stopped or double-parked vehicles can reduce that number to three. During a particular simulation, lanes and turning movements become available as a function of time, adding significant complication to the operational characteristics of the model. This is particularly true of tunnel operations where toll booths open and close and lane directions change according to complex and dynamic criteria.

The model includes three scenarios – morning, midday and evening, each consisting of millions of trips – in which drivers select routes in accordance with a generalized equilibrium principle. An important innovation is the software's ability to retrieve data from previous equilibrium runs and use it to set up runs for subsequent periods, in doing so maintaining consistency.

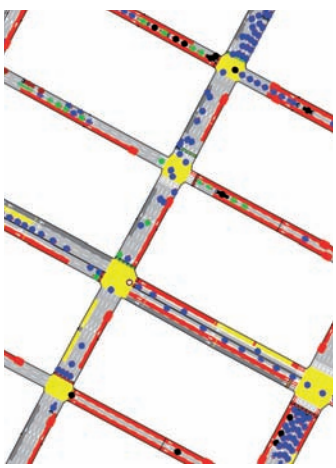
The best of both worlds

Microscopic traffic simulation models the movement decisions of each vehicle inside a traffic network in every time step - typically every fraction of a second. These models are capable of modeling complex interactions between public and private vehicles, or between vehicles and pedestrians. Their disaggregate nature allows them to realistically represent a variety of complex operational conditions although they require some effort to put together and calibrate.

Macroscopic models rely on relationships between pairs of aggregate measures such as flow, speed and density and, unlike microscopic models, they are typically link-based rather than lane-based. The assumptions they rely on limit in many ways their applicability to operational problems but, at the same time, makes them easy and quick to set up. For these reasons, they are better suited to modeling strategic planning decisions.

Depending on the adopted approach, mesoscopic models may simplify the demand, the supply or just the way these interact, compared to a microscopic model. They can potentially approach the speed and ease of calibrating macro models and (especially if they are lane-based) the dynamic nature and realism of micro models; as such, they excel in dealing with medium-term planning decisions with straightforward operational challenges. In the form of concurrent hybrid simulation, mesoscopic models are the ideal complement to microscopic models approaching what might be thought of as 'the best of both worlds'.

> There was a need to investigate all of the time-varying phenomena – parking regulations, transit priority schemes or managed tunnel lanes



(Below right) **A screen shot showing the less-detailed secondary area mesoscopic model**
(Below left) **Showing more detailed microscopic data**

What's next?

With the mesoscopic model calibrated and the microscopic area nearing completion, future plans include the addition of detail in areas where previous modeling work has been undertaken.Marsico also explains that NYCDOT is working with other regional agencies to coordinate modeling activities where the MTM network will be made available to address cumulative network impacts of construction projects, roadway closures and traffic operations plans, as well as to provide a point of departure for future work. "By working with other agencies, we can leverage ITS data to create a sustainable regional model," he concludes.

• *Vassilis Papayannoulis is a principal at Cambridge Systematics in New York. Alexandre Torday is a consulting director with Spain's TSS-Transport Simulation Systems*

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Pedestrian simulation taken to new level

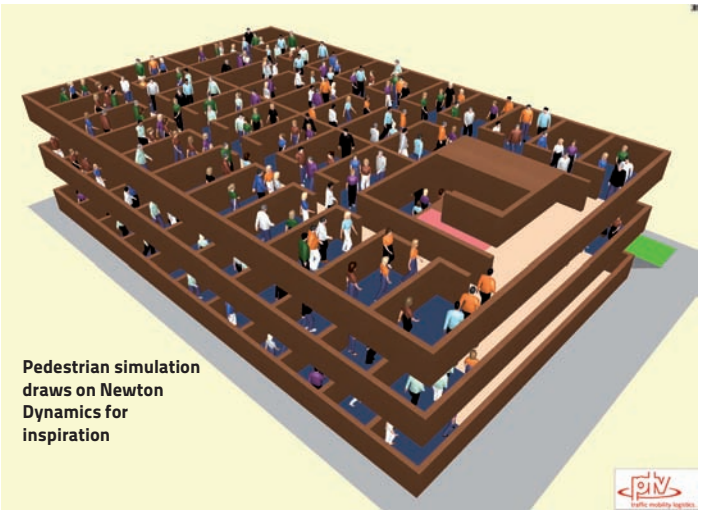
The pace of urbanization is speeding up. According to a recent study by Frost & Sullivan, around 60% of the world's population will be living in cities by 2020, which the consultancy firm forecasts could even reach 80% in Europe. The number of megacities with over 10 million inhabitants will be continuously increasing. According to a study by the United Nations Department of Economic and Social Affairs/ Population Division, the world urban population is expected to grow at an average annual rate of 1.8% until 2025, which, if maintained, would lead to a doubling of the urban population in 39 years. This trend poses new challenges to our urban infrastructure, in particular to the provision of secure and attractive routes and spaces for pedestrians.

Microsimulation is just one of the techniques that will help planners prepare for this complex future, and recently developed software from PTV, VISWALK, could be the ideal tool that will allow them to realistically model pedestrian behavior in this busy urban scenario.

Pedestrian engineering is the discipline that focuses on the most prevalent mode of transport – walking. It deals with the most dynamic element in urban areas: pedestrians. Unlike car drivers, they do not follow strict rules; they spontaneously stop, change directions or make sudden turns. Pedestrian engineering contributes to improving pedestrian flows in terms of security and efficiency. To this end, transportation planners and engineers design routes inside and outside buildings, evaluate planning alternatives, determine journey times and develop evacuation scenarios by using microsimulation software in the form of PTV's VISWALK.

Close to reality

"Our software is based on the latest algorithms that provide highly accurate results for pedestrian behavior, such as laning behavior and queuing, cross-flow interaction, mass evacuation as well as travel times in train stations, sports venues, public spaces and airports, for example," reveals Dr Tobias Kretz, product manager at PTV and a leading expert in pedestrian simulation. The simulation also takes psychological aspects of behavior into consideration that no other pedestrian simulation tool can provide. "One of the special features is dynamic routing," Kretz adds. Pedestrians just as vehicle drivers usually try to arrive at their destination as quickly as possible. Often the quickest route is very similar to the shortest route. However, there are situations where this is not the case – the simplest of which is when a large group of pedestrians walks around a corner or could even be doing a u-turn. "The software includes both shortest and quickest path routing in the simulation and therefore models pedestrian behavior in a highly realistic manner," Kretz continues.



Pedestrian simulation draws on Newton Dynamics for inspiration

The scientific basis

But what does 'realistic pedestrian behavior' actually mean? Something that appears for somebody watching from outside as collective intelligence is inherent in pedestrian crowds: they automatically form stripes in corridors or create oscillatory flows at bottlenecks. Scientists call this type of dynamics 'self-organization'.

Both physical and social factors – which can be described by means of the Social Force Model (SFM) – have an impact on the interaction between pedestrians. The SFM was developed at Stuttgart University by Professor Dirk Helbing, Department of Sociology now at ETH Zürich, and Péter Molnár, now at Clark Atlanta University, in 1995. The pedestrian movements that are affected by different physical and social forces are modeled inspired by Newton Dynamics. One of the forces is the driving force. Pedestrians move purposefully as a rule, meaning they walk at a desired speed toward their destination – along the shortest or quickest path. Various elements influence them when doing so and impose modifications to their desired path. Pedestrians always maintain a kind of 'safety distance' or personal space, not only to other pedestrians but also to obstacles, buildings or streets. This distance usually gets smaller with an increasing number of pedestrians, or if they are in a hurry.

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Modeling pedestrian interacton with traffic is a key tool for everyone from town planners to traffic management personnel

Emergency situations

VISWALK is based on the SFM. Right from the beginning, PTV integrated the model into VISSIM, its traffic simulation software. Since then, it has been continually enhanced and used in numerous projects, one such example being SKRIBT. This research project looked into threat scenarios that could affect tunnels, bridges and their users. And it analyzed people's behavior in these specific emergency situations. The Institute of Psychology at the University of Würzburg supported the project. "The scientists have developed a psychological model that shows how people react to the specific conditions and visual sensations in case of a tunnel fire," Kretz explains.

This included emergency exit signs that may be invisible due to heavy smoke or which are hidden behind large vehicles. "Further aspects, such as the mental state of people involved in a tunnel fire, also play an important role. Some people may no longer be able to see the signs and try to reach the tunnel entrance instead of using the emergency exit to get to a safe area," Kretz states. Others may feel safe and stay in their cars or do not get out early enough. The results of this research study on pedestrian behavior have been included in PTV's simulation software on a consultancy basis. They help improve security concepts for building evacuations and events.

Need to know?

Software solution for the microsimulation of pedestrians for urban, traffic planning, and evacuation simulation applications

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- Visualization capabilities help present plans graphically to the public, which builds the bridge between traffic engineers, architects and decision makers with little or no traffic planning background

Simulations in action

"VISWALK is the ideal tool for planners, owners and operators of public infrastructure and space, major event organizers and increasing numbers of architects," says Miller Crockart, vice president sales and marketing PTV Vision. "We have taken a well regarded and importantly open concept, the Social Forces Model, and enhanced the software to provide the market with a credible platform to simulate pedestrians. Of course, we also have the benefit of being able to provide our clients with a single cost-effective platform that also allows the user to simulate both pedestrians and vehicles at the same time and accurately simulate their interaction."

With VISWALK, 2D and 3D models are generated concurrently, in doing so saving project time and money and also providing a newer clientele, architects, with a credible 3D visualization tool. "Commercially we have also created really flexible licensing arrangements, a top-quality aftersales user support network and prices that we believe to be highly attractive," Crockart concludes.

• *A paper exploring quickest path routing is available at http://arxiv.org/abs/1107.2004. A YouTube animation on quickest path routing is also available at http://www.youtube.com/user/ptvvision#p/a/u/2/8SmRBTJ-jeU*

Contact

PTV
+49 721 9651 300
info.vision@ptv.de
www.ptv-vision.com

A modular approach to winter service

What appeared in the 1960s as a fancy and mainly academic attempt at road condition monitoring has for Boschung 50 years later turned out to be a cornerstone technology for all transportation departments. Focused initially on winter-related dangers, road weather monitoring now fully supports ITS for better and more efficient traffic management.

The successive setup of such systems has led to various degrees of integration covering a whole spectrum of needs. In order to support all companies active in this market with solutions to their individual requirements, the Switzerland-based company has expanded its product range to offer standalone sensors able to meet basic system integrators' requirements to complement its complete, enterprise-wide solutions.

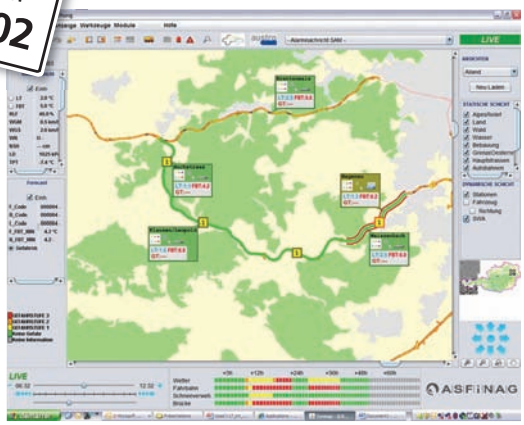
READER ENQUIRY NO. 502

Standalone sensors for ITS

Intelligent transportation systems base their decisions on many traffic-related parameters, including pavement and atmospheric conditions. The basic requirements for pavement conditions call for status recognition (dry, moist or wet roads typically for automated maximum speed setting) as well as water film thickness (to warn of hydroplaning danger).

As far as atmospheric conditions are concerned, the measurement of the type and rate of precipitation – as well as visibility – provide a valuable basis for efficient traffic management.

Although the needs of the ITS industry are not as specific as those of winter service, requirements concerning durability and accuracy still remain. Hence why Boschung is now applying its 30+ years of experience in RWIS to ITS.



(Main) **The new IT-Sens pavement sensor** (Left) **Screenshot from test data within the Borrma-WEB MDSS system used by ASFINAG in Austria**

Resulting from the high level of integration within ITS applications, the principle of Remote Processing Units (RPU) centralizing the measurements of sensors has been dropped in favor of standalone probes delivering their measurements directly via CAN, RS232 or RS485 bus technology. This new concept will allow any variable message sign manufacturer or ITS system integrator, for instance, to directly connect the sensors to their processing electronics and use the measurements in their own logic.

Pavement conditions: The brand-new IT-Sens pavement sensor provides the basic pavement temperature and condition. Boschung's history in conceiving and implementing in-pavement sensors for winter service played a key role in the development of a virtually manintenance-free rugged design with an expected mean time between failure (MTBF) in excess of 60,000 hours. All the advantages of an embedded pavement sensor, such as accuracy and low cost, are also made available with a direct connection to the customer's electronics. An optional casing, meanwhile, allows for a quick removal of the sensor in case of pavement renewal.

Several versions of the IT-Sens are available, ranging from basic ITS needs up to specific winter service performances. Additionally, Boschung provides non-invasive sensors able to depict road conditions and temperature from a nearby roadside pole. Although not as accurate as in-pavement sensors, the technology doesn't require

The new PWS (present weather sensor)

Need to know?

Timely and accurate road condition information remains the cornerstone of efficient winter road management

- Remote Processing Units record pavement condition, type and intensity of precipitation, visibility, air temperature, relative humidity, and any other parameters required by the customer
- FAST is automatically controlled by Ice Early Warning Systems (GFS), which sprays the road surface with a chemical solution before ice can form
- BORRMA-web software collects data and weather forecast and provides advanced controlling and management functions

any roadwork and is therefore an attractive alternative for certain projects.

Present weather: The PWS (Present Weather Sensor) is a very compact sensor that provides both precipitation (type and intensity) and visibility measurements. Using back-scattered light technology, it requires very low maintenance.

Boschung also provides complete RWIS packages both for ITS or winter service applications. The equipment can integrate other, more sophisticated sensors (typically active freezing point measurement sensors) as well as cameras.

FAST: Road segments prone to local icing conditions (elevated structures) or road segments that are significant distances from the maintenance center can be equipped with Fixed Automated Spray Technology (FAST) systems. The accurate measurement of freezing point temperature performed by pavement sensors can automatically trigger the application of an anti-icing chemical minutes before the beginning of ice formation. This is the most economical way to guarantee a safe pavement, as de-icing (i.e. applying chemical after ice detection) requires the application of more chemicals and leaves a period of insecurity until the ice has actually melted. Boschung installed its first FAST system back in 1979.

AVL (Automated Vehicle Location): As a manufacturer of solid/liquid spreaders and other surface-treatment vehicles, Boschung knows only too well the importance placed on the design of onboard control units and electronics. Its solution in this regard is Vpad, a flexible onboard computer that can be connected to various tools and sensors. Vpad reports online and offline all vehicle activities and supports real-time management of fleet operations, quality control, and reporting.

Borrma-WEB: All of these components deliver their data to corresponding modules of our powerful central management software Borrma-WEB. Designed as a stable, robust, and scalable platform, the Borrma-WEB supports local or remote access and can be provided as a hosted service by Boschung, avoiding any IT-related investment and offering the customer an easy to budget flat monthly rate.

Various display windows and control functions support the best assessment of road conditions on the entire network as well as the management of the treatments applied in winter conditions or other maintenance activities.

Built-in as well as customer-specific alarms can be generated (email, SMS, pager), in order to make sure that no situation goes unnoticed, escalation functions of these alarms are provided.

The Borrma-WEB can also integrate numerical weather forecasts. This data (which corresponds to standard outputs of most models used by meteorological institutes) is processed within the Borrma-WEB to indicate future dangerous conditions for specific road segments. The integration of measurements from reference RWIS allows for a constant crosschecking with the conditions prevailing on-site. The high rate of situation re-assessment (every 10 minutes) makes sure that any new parameter (new forecast or new data from RWIS) is being considered at once.

The image on the previous page shows a typical Borrma-WEB display with RWIS data (flags) as well as road weather segment information. The bottom part of the screen shows the forecasted dangers for the selected segment. This advanced information allows for a correct anticipation of any incoming problem.

Information is key

Mobility has become a key factor of an efficient economy. The need for reliable information about current and future road conditions is therefore increasing. With capabilities ranging from single, standalone sensors to highly integrated, countrywide systems, Boschung can provide appropriate solutions to any kind of needs.

Contact

Boschung Mecatronic
+41 26 460 4411
sales@boschung.com
www.boschung.com

Installing road visibility and present weather forecasting systems

READER ENQUIRY NO. 503

Weather can create dangerous driving conditions and costly maintenance regimes for companies managing road safety. Those people responsible for road safety will know the weather conditions that cause the greatest problems.

Fog can occur in patches at blind spots, such as dips in the road, near a river or around a corner without any prior warning, resulting in an unexpected hazard. Falling precipitation such as heavy rain or snow reduces the visibility of the road ahead and affects drivers' vision through the windscreen as the precipitation lands on the glass. Meanwhile, spray from vehicles passing over standing water adversely impacts a driver's visibility, especially at higher speeds. When road surfaces are icy or snow has settled, they need to be treated quickly so drivers have traction in such treacherous conditions. Whereas sand or dust storms can blow across large stretches of the road at astonishing speed and very suddenly cause a dangerous driving situation in near zero visibility.

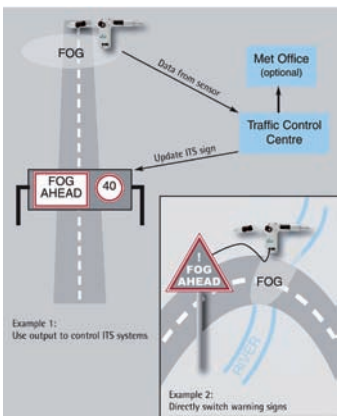


Diagram showing how a fog sensor is deployed on a roadway

With all this to contend with, road management costs can be expensive in terms of time, people, machines and materials, especially in winter – even more so if the weather information upon which your actions are based does not reflect the local conditions or is badly timed. Road users also rely on very high levels of accuracy from roadside warnings and expect timely gritting of roads, so it is important to get it right first time. Additionally, the economic effects of traffic congestion caused by bad weather can only be minimized by effective action from the agencies responsible.

Using visibility and present weather sensors such as the Biral SWS to monitor roadside weather can save valuable time and money when it counts most, while satisfying the demands of road users. The right choice of sensor will provide reliable, consistently accurate weather information day and night, allowing road managers to make timely decisions about spraying or gritting road surfaces and switching road warning signs, in doing so achieving the best results from limited and valuable resources. At the same time, road users will be safer and happier with their journeys.

Visibility and present weather sensors are typically installed within 3m of the roadside and measure the local weather conditions (fog, snow, rain, spray, sand and related parameters). The information provided by the Biral SWS sensor is easy to understand and integrates into any control system. The sensor switches a warning sign locally via relay and/or transmits the data via a second data output to an ITS control center.

One of the meteorological stations in Dubai

Need to know?

Enhanced weather sensors to measure visibility reductions cost effectively on the road infrastructure

- SWS sensors combine a 45° measurement angle with 880nm wavelength light source and horizontal measurement path to generate excellent results
- No additional need for capacitive rain devices to measure precipitation, so fewer devices that can fail mechanically or electrically
- Lightweight, portable, easy to use, allowing for virtually any installation location, power requirement and application

An effective sensor should offer several features. It should be robust enough to withstand the aggressive roadside environment for many years. It should also be low maintenance and not require spare parts or consumables. Additionally, it should boast a measurement concept that is valid in both rain and snow, yet also unaffected by reflections from the road surface in such conditions as well as from vehicle headlights, to avoid false readings.

Improving safety in Dubai

As a result of a serious road accident in Dubai (March 2008), in which more than 200 cars crashed, the Dubai Municipality decided to install a road fog early warning and forecasting system. Deployed in 2009, the system has now been in successful operation for well over a year.

The entire system comprises eight new meteorological stations, five integrated onshore meteorological stations, one marine buoy and a new central data collection point, database and data presentation system, with local area weather forecasting models.

The main purpose of the system is an early warning and forecasting of fog (visibility), the accurate, reliable measurement of which is crucial for early warning and calibration of forecasting models.

Data from the meteorological stations is collected in real-time, with a data collection interval of two minutes. The stations are powered by solar panels and batteries to save as much energy as possible, with visibility sensors only switched on for the minimum necessary time within the two-minute measurement period. In this way, around 40% of energy is saved. Experience to date shows that the Biral SWS-100 works well in this 'switch off/on' mode.

The enhanced performance of the road system and reduction in serious accidents has meant that Dubai Municipality intends to extend the system this year. A new station will be added, with satellite remote sensing information. Forecasting models will be improved by forecasting additional weather phenomena using the Biral SWS-200 and a rain gauge for accurate visibility and present weather data.

Contact

Biral
+44 1275 847787
fog@biral.com
www.biral.com/roads

Eric **Sampson**

eric.sampson1@btinternet.com

I've written in previous columns about my liking for a good paradox (July and January 2011, for instance). While reading the program for the imminent World Congress on ITS in Orlando recently, another example came to mind. In a sense it is the opposite of the Abilene Paradox (look it up on Wikipedia!). I'm calling it the Paris Paradox. We all agree that something should be done, justified by a set of reasons that we know aren't really true because it is more acceptable to use these arguments in public than ones we all recognize privately as carrying the weight.

Why do we clamor to attend World Congresses? The reasons we give to those holding the travel budgets are likely to be, in order of emphasis: hearing from headline international names in the Executive or Plenary Sessions; being successful in the competition for a slot at a Technical Session; being invited to speak at a Special Session; attending a specialized 'Parallel' Session; or, almost as an afterthought, the chance of meeting at least 15 of the 20 international experts you really rate in your area.

I submit that the reality is the precise reverse of this list. But why is this the case? "If I have seen further it is by standing on the shoulders of giants," Isaac Newton said over 400 years ago – meaning that in making his own discoveries and calculations he had been able to start from the progress made by others. That is how science and engineering advance – rarely by one man or woman working totally in isolation; usually by a team with complementary skills in one location interacting with similar teams across the globe.

The World Congress is unsurpassed as a networking venue and gives us the chance to walk and talk with the giants and thus figuratively stand on their shoulders. These real experts will frequently be involved in Special and Parallel Sessions, which are usually excellent occasions to learn what is going on, what is planned and, most important, what are considered to be the dead ends no longer worth exploration. The Technical Sessions to my mind have most value as a training ground. They rarely bring revelation or adulation, as the material they convey has to be put forward for assessment so far in advance of the event that invariably it lacks topicality and the real sense of 'News!' that can be found at a good Special Session.

So then we have the Executive and Plenary Sessions, where the Great and the Good offer their experience, wisdom and foresight to us all. That is the theory; the trouble is it rarely happens because most of the speakers at these sessions are so senior that their staff prepare their material, and protecting the image of the parent organization replaces making an exciting, provoking presentation.

So we end up with two Paris Paradoxes: very senior public- and private-sector people attend the rather unexciting Executive and Plenary Sessions so that there is top-level endorsement of the idea of World Congresses, plus raised media profiles. And more junior people submit rather unexciting papers to Technical Sessions in order to get a speaking slot, which becomes the justification for their attendance. Meanwhile the real red meat of the Congresses is consumed at the Special and Parallel Sessions and through hundreds of people interaction events ranging from shared breakfasts, coffee shop chats, drinks receptions to ad hoc debates and arguments in the corridors.

Well, as someone once said: "Let sleeping dogs lie" – so no more barking from me!

> The real red meat of the Congresses is consumed at the Special and Parallel Sessions and through hundreds of people interaction events
>
> **Professor Eric Sampson, Newcastle University/ITS-UK, UK**

Geveko ITS

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- Low installation costs
- CO_2 neutral operation
- 2000 hours of operational time
- Theft proof
- Built-in intelligence

Video showing intelligent roundabout with LED-Guide

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The source code: nothing hidden, nothing secret

If a catastrophic event were to damage the custom-developed software that keeps a toll facility's operations running – or if the software supplier becomes unavailable – how does the toll agency recover and continue operations? Unlike a PC, where you keep a backup of most programs or can repurchase them if needed, the custom applications of toll operations are usually the result of months or even years of effort, and the only practical way to ensure continuity is to have access to the full source code of the entire application and configuration files.

Most companies in our industry do not make their source code readily available, and when required to do so, the most common practice is to place the code in escrow through a certified escrow agent. Although this may technically fulfill the obligation to provide the code, it can be a costly and cumbersome process that generally allows the code to be released only upon the occurrence of a specific legal event such as bankruptcy of the software vendor or the violation of terms of a contract. Since these types of events are often litigated, it could take years before the source code becomes available from the escrow account.

Placing code in escrow requires the hiring of an escrow agent, agreeing on a program of updates at specific ongoing costs, and often requires incurring costs every time the code is accessed. In addition, the escrowed code frequently requires hiring a consultant to verify that it is complete and operational. In the fast-changing world of software updates and upgrades, the costs incurred from the verification process can quickly become burdensome – in time as well as in money.

Systems integrator TRMI finds that toll agencies are increasingly asking for simple and open access to the source code it develops, which it can readily provide through a non-exclusive source code license. Having a copy of the code not only reassures clients that they will be able to recover from disaster, it also allows them immediate and direct access should they wish to understand the workings of the code or perform self-maintenance.

Importance of access

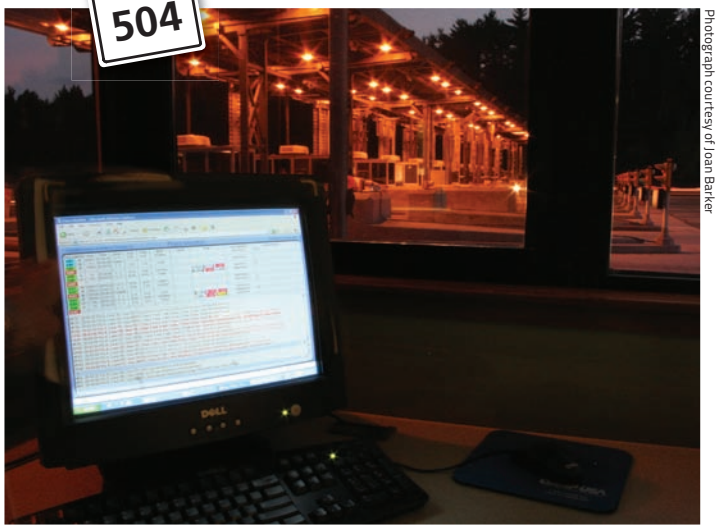
With full access to the source code, toll agencies and their IT departments can verify that the software meets security standards and industry best practices. They can also verify that they have everything they need to build – or rebuild – the software if necessary, with all the correct versions of the build in place. Also, if an audit of the code is required for any reason, it is readily available as no legal event or court decision is required to gain access. The toll agency can rest easy, safe in the knowledge that they have the ability and freedom to work with the software in any way they need for continuous operation and expansion of the toll facility.

There is more to the issue of source code availability, however, than whether or not it should reside in escrow. Raw source code may not actually run in the environment it's intended for unless it is compiled and built correctly. Even if the code has been meticulously updated and upgraded, it may not function as intended unless the development environment and support software is properly configured. For example, if the computer used to compile the code has a different version of the software tools than the original computer, the result will be software that may not work in the toll agency's environment. So, in addition to just the software source code, an identical build environment is needed to guarantee identical results and proper functioning.

The solution is to provide the toll agency with the entire build environment, not just the code. The environment should contain all the different software tools used to make the complete application. This arrangement provides a true insurance policy for the agency, should it experience a catastrophe, while it substantially broadens their choices for maintenance, upgrades and expansion.

Providing toll agencies with the complete source code is a start, but having a fully configured build environment is the next big step toward improving the resiliency, viability and flexibility of their systems. It's also good customer relations.

READER ENQUIRY NO. 504



Photograph courtesy of Joan Barker

Keeping custom developed software running is critical for toll road operations

Need to know?

How sharing source codes can ensure continued operations during catastrophes

- What happens to toll operations if a software vendor goes bust or if custom-developed software is damaged
- Why sharing the software's source code can alleviate headaches during catastrophes
- Issues associated with software residing in escrow
- How best to offer toll agencies peace of mind

Contact

TRMI Systems Integration
+1 845 626 8655
inquiry@trmi.com
www.trmi.com

Customer-managed RWIS networks

Two very different operational models have emerged in the RWIS marketplace. In the vendor-managed model, environmental sensor stations (ESS) are often owned and operated by the vendor with data from the stations controlled and distributed as a service product to the customer. The customer-managed model is newer on the scene, and includes the customer taking a more active role in network management and system control. In this model, the customer owns and operates the ESS network and makes the decisions about data distribution and sharing.

The customer-managed model, the focus here, allows for true open-architecture RWIS-ESS environments, which leads to better system flexibility and customization, at a lower cost. Customers can specify best-of-breed hardware and software, including products from multiple vendors. The result is a customized, economical alternative to one-size-fits-all product offerings, while still supporting industry standards and data formats, such as NTCIP. The life of an ESS is extended when its architecture allows individual components to be upgraded or added. This also avoids the necessity and cost of total station replacement due to component obsolescence.

The ability to customize ESS configurations to match specific sites and goals at the beginning of a network's life – and then to add to it at any time – leads to another advantage of open-architecture RWIS networks: the ability to partner with other organizations. In a time of tight government budgets, partnering allows all involved to save money and achieve their goals. Often, the addition of only a sensor or two to the ESS can make it a valuable measurement site for another fund-sharing organization.

Partnerships

Since 2005 (when migrating to an open-architecture RWIS network), the Utah Department of Transportation (UDOT) has demonstrated various types of partnerships, including Intra-Agency, Inter-Agency and Public-Private.

Intra-Agency: For traffic monitoring and safety purposes, UDOT has integrated components of traffic management systems (TMS) with its portable RWIS sites, including vehicle detection radar and traffic-monitoring video cameras.

(Left) **Sharing information between various departments helps all players in the weather and roads sectors**

Inter-Agency: The National Weather Service (NWS) shares two measurement sites with UDOT – one on SR 143 by Cedar Breaks National Park and the other on US 6 over King's Canyon Summit. Both of these sites are maintained by the NWS office in Salt Lake City, with the infrastructure provided by UDOT. These RWIS-ESS sites employ surface instrumentation that helps UDOT operations as well as a full quiver of atmospheric instruments, provided by NWS, which are on the UDOT right-of-way.

Tooele County, Utah, is home to the Deseret Chemical Depot

READER ENQUIRY NO. 505

(Left) **TCEM ESS in Toole County, upgraded by UDOT, has a siren used to initiate emergency evacuations**

Need to know?

The benefits of taking a more active role in RWIS network management and system control

- Customer in Control Technologies allow users to select the 'best-of-breed' hardware and PC software, including products from other vendors
- Customer-owned data allows for the modification and redistribution of data without additional costs
- Non-proprietary/open architecture; low cost; proven reliability in harsh weather conditions; NTCIP compliant; low power consumption allows remote operation without AC power

Winter road surface conditions can have a big impact on traffic management strategies

at which military warfare agents (e.g., nerve gas, blistering agents) are stockpiled and 'demilitarized'. The US Army funded the Chemical Stockpile Emergency Preparedness Program, owned and managed by the Tooele County Emergency Management (TCEM) office, including 27 weather stations providing data for wind dispersion models, ultimately to drive a county-wide evacuation plan in the event of a chemical spill. The original system did not take into account winter road surface conditions, but UDOT was able to add rain gages and road sensors at very minimal cost to several existing stations alongside state roads within the county. With a limited budget, UDOT expanded its network for road maintenance forecast use, and the TCEM accesses current weather and road condition data to take into account for routing traffic during an evacuation.

Public and private: On SR 31 over the Wasatch Plateau, private industry and state government have formed a partnership for weather modification efforts where UDOT has allowed a droplet-size-detection instrument to be placed in the array of the RWIS-ESS. This allows UDOT to get data in real-time to help with timing issues and benefits the private sector and the public by not having to install additional measurement towers on federal lands.

On Johnson Summit, UDOT is integrating an RWIS-ESS with a PTZ camera provided by a private company. This partnership allows the private company access to the existing measurement platform and saves UDOT money by not having redundant sites to gather operational data and traveler information separately.

Partnership can also occur with organizations that are completely unrelated to road weather, but have common needs for remote measurement platforms. Some of these application possibilities include flood warning, fire weather, avalanche forecasting, air quality, and pavement design.

Pros and cons

Although there are many advantages to customer-managed RWIS-ESS networks, there are some disadvantages. Systems customized for double duty may require more-technically-skilled users and a greater time commitment to RWIS-ESS system maintenance. These points should be considered in a customer-managed RWIS network.

Several vendors specialize in customer-managed RWIS-ESS networks, which have also been referred to as Customer in Control Technologies.

ESS instrumentation technologies are constantly evolving, as are the needs of DOTs. Open architecture hardware and software have been shown to increase the flexibility, cost savings, and longevity of RWIS networks.

Contact

Campbell Scientific
+1 435 2279080
rwis@campbellsci.com
www.campbellsci.com

Wise words from an expert in solar roadstuds

READER ENQUIRY NO. 506

Seemingly hardly a day goes by without the next latest and greatest technology being unveiled to the market, yet every now and then one will stand out from the pack to offer something new. One that Denmark's Geveko ITS believes falls into this category is currently being introduced worldwide with a set of recommendations to road owners on the most pertinent selection criteria.

Although solar roadstuds have existed in the market for several years, until recently they were all much of a muchness. Geveko ITS, however, believes its latest innovation sets a new standard in the field. "Since we didn't have sufficient internal resources for bringing the solar roadstud to a new stage of development, we entered into a cooperation with Sweden's Luleå Technical University," reveals Bruno Hansen, managing director of Geveko ITS. "They have handled much of the R&D, while we have contributed crucial know-how surrounding aspects such as solar cells, charging technology, and conditions on the road.

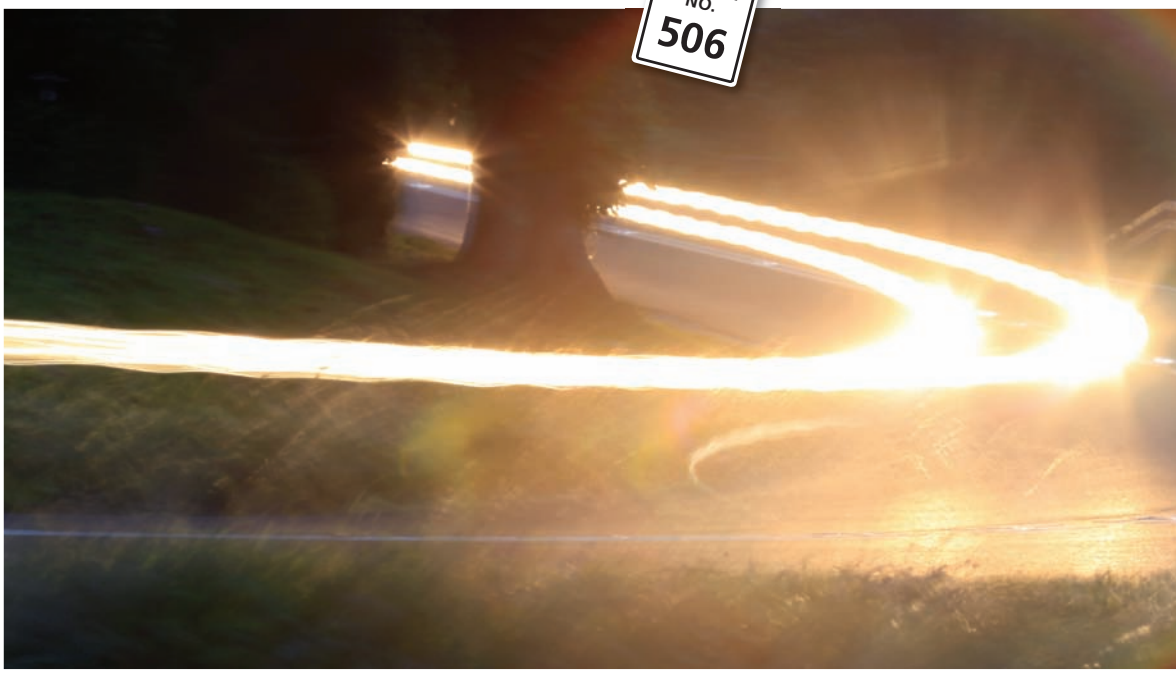
"The fact that Luleå University has been part of the project from the beginning means that they have conducted a great deal of analysis into how the solar roadstuds should function, be installed, and what features are in line for the future," Hansen continues.

Geveko ITS has drawn up a number of parameters to be assessed when selecting the right solar product.

Run-time evaluation

The first is operational time. When road owners decide to use solar roadstuds, they're not just looking for a simple light device. Crucial product features to their performance on roads and cycle paths are evaluated against the user experience of motorists and cyclists. A key performance parameter is the time it can remain lit up without sourcing new energy (sunlight) – what's known as operational time. In most areas of the world, sunlight is in short supply in the darker periods of the year, so there's always the risk of the stud not lighting when it is supposed to. Other products in the sector only include a luminescent material, although it's important to note that with such products, the operational time can be very limited.

Sub-zero temperatures also affect operational time, leading to many batteries not being able to charge at all. Partial sun can also be a problem for some studs, as the solar cells will only charge if they are covered fully by sunlight. All in all, these conditions can lead to operational times of anything between 24-800 hours – and even at 800 hours you can't guarantee that they'll emit light when they are supposed to.

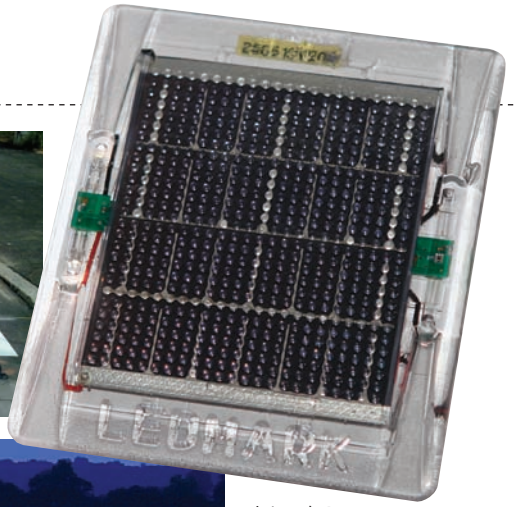


(Above) **Life-saving visibility enhancements at dangerous rural bends** (Left) **Geveko ITS has developed a system that makes it safer for the pedestrian as well as for the driver**

Need to know?

When choosing a solar roadstud, it is wise to seek advice from an established expert

- Why not all solar roadstuds are the same
- Four key parameters should be assessed when choosing a product: operational time; physical characteristics and instalation; built-in intelligence; and performance and warranty
- How cooperation with a university in Sweden is bearing important fruits for one commercial player
- Why experience – in both research and manufacturing – counts for a great deal



(Above) **The LED-Mark** (Above Left) **Installation and maintenance is much quicker than hardwired solutions** (Left) **Solar roadstuds are ideal for rural locations where power provision can be problematic**

Importance of installation

The second paramater relates to physical characteristics and installation. Of course, solar roadstuds don't require any cabling and are therefore considerably cheaper than hardwired roadstuds, which involve extensive installation and maintenance. Solar roadstuds cost around one-tenth of the installation and one-third of the running costs when compared to threaded technologies. On top of this, they are CO_2-neutral in operation and are a 'green' way to enhance traffic safety without having to increase budgets.

But what other physical parameters are important? Many roadstuds have been known to be quite large, making mounting time consuming and costly, while increasing the risk of the studs being damaged – for example, by snow plows. The reason for this is they typically use very large power sources (batteries), although today it is possible to use the same-sized batteries as a regular cell phone. Road owners should consider size carefully before choosing a solar roadstud as a large roadstud – or one that is poorly designed – is susceptible to damage or being dislodged by a snow plow. A thin solar roadstud manufactured from a flexible material is easy to mount, so consequently reduces application time and the need for securing the workzone. Furthermore, thin roadstuds can be mounted onto bridges and similar infrastructure. Additionally, some roadstuds are mounted simply using a hammer, so road owners must consider them as equally easy to remove – and prone to theft.

Intelligent approach

A third parameter to consider is built-in intelligence. Solar roadstuds do not typically include any intelligence at all, although it should be a consideration for road owners if they want to improve traffic safety by being able to detect traffic, guide motorists and cyclists and communicate with traffic information systems.

"We have built an application at the Luleå University where we have installed dynamic traffic guidance that detects when a car is approaching the roundabout and starts a running light to make sure the motorists pass the roundabout in the right way. We are also able to control the way the solar roadstuds light and in doing so also improve the interaction with motorists in the future," Hansen continues.

The final parameter is performance and warranty. A nickel's worth of free advice in this regard is to ask any supplier details of its track record in the field, but be careful not just to evaluate the performance based on generic parameters or size of the company itself. Not many suppliers have the necessary years of successful experience with solar roadstuds, while very few actually manufacture the solar roadstuds themselves. Be sure to liaise with a supplier that develops and manufactures, as this will be the optimum partner for developing new features – and ask for the specific warranties of the products. Do not forget to include performance parameters such as operational time, size, mounting, security against theft, etc.

"It is essential to familiarize yourself with the technical parameters of a solar roadstud if you want to be sure to make the right choice," Hansen concludes.

Contact

Geveko ITS
info@gevekoits.dk
+45 24 29 56 99
www.gevekoits.dk

Non-invasive pavement condition sensors

READER ENQUIRY NO. 507

Technically we have had the ability to measure atmospheric data for almost three centuries, but the ability to measure conditions on the road surface is a little more than three decades old. The measurement of weather information and road conditions continues to evolve. Until relatively recently, the only way to get accurate information was through the use of an invasive pavement condition sensor. Just a few years ago the first non-invasive sensors began hitting the market, yet there was one drawback – they couldn't give you all the information provided by an invasive sensor. However, that has now changed.

With the introduction of Lufft's NIRS31, a non-invasive pavement condition sensor, all of the parameters that an invasive sensor can measure can now be measured by a non-invasive sensor. This includes but is not limited to temperature, water depth, pavement status, friction, and for the first time, freeze point.

With this added capability, Lufft is now fully able to provide road conditions without the need to install equipment into the pavement. This increases the safety for our people in the field, but also reduces or eliminates impacts to traffic flow.

So how does the system measure so accurately? It uses an optical spectrometer method. The surface is illuminated with an infrared light that is undetectable to the human eye. The reflections off the surface are sent through a series of four filters. The measurement area is up to 2.5ft in diameter, providing a much larger sample size than with traditional in-pavement sensors. The benefit of this method is improved long-term reliability and more accurate data.

(Above) **The NIRS31 is a non-invasive pavement condition sensor** (Right) **It is easily installed at a number of locations where space is a constraint – including bridges and tunnels**

Need to know?

Non-intrusive sensors with integrated microprocessors for road condition monitoring

- Ideal for the measurement of surface conditions such as wetness, ice, snow or frost
- Optical/spectroscopical measurement system works on the basis that water absorbs certain wavelengths differently
- Ideal for microclimates, which require frequent asphalt reconstruction
- Measurement of ice percentage in water and determination of freeze temperature
- Measurement of friction
- Fully integrated surface temperature measurement (pyrometer) an option

What is the benefit to the customer? Because the sensor is looking top-down, the NIRS31 is measuring exactly what the tire 'sees'. In addition, the user will have the full data set they need, such as freeze point, to make the proper maintenance decisions for their roadway. Another key factor is the ability for the sensor to self-calibrate, which is a major development in sensor technology as it reduces not only maintenance time, but also the need to physically access the sensor.

Where can the sensor be placed? Most people are familiar with the 30ft fold-over tower that is standard in this industry, to which the NIRS31 can easily mount. But it can also easily mount to existing structures such as bridges, light poles, overhead signage, etc. Typically the NIRS31 will be about 25-30ft in height and no more than 50ft from the road surface.

Long-term aim

It is not enough to just have a solid sensor technology – maintenance and survivability are key factors to the cost of ownership. The design of the NIRS31 makes it easy to mount and self-calibrate, and it is able to be upgraded remotely. The sensor can easily be configured as a standalone sensor, without an RPU, or as part of a network. This is all accomplished with the use of Lufft's UMB technology.

Weather conditions have a big impact on road traffic management

The UMB system is a technology for recording environmental data. Whether in the form of a standard weather station or a standalone sensor, the modular system excels as a result of easy commissioning, firmware updates, and data transfer over multiple communication methods. With a direct connection to the modem, there is no longer a need to have an expensive RPU in the field. Instead, you just connect your sensor directly to a modem and have the sensor report back to the server for data storage.

The NIRS31 provides solutions for issues that, until now, have been too difficult or costly to implement. Such a non-invasive sensor can literally replace a passive in-pavement sensor; it not only gives everything the invasive sensor measures but also provides additional data points, such as friction. After being available now for the past two winter seasons, the NIRS31 has demonstrated its accuracy and durability in some of the most harsh climates on the planet. The ability to remotely measure the key road surface criteria has been addressed with the NIRS31.

Contact

Lufft
mike.corbett@lufft.com
+1 919 556 0818
www.lufft.com

misener_james@bah.com

From time to time I have argued that vehicle automation is not on the cards, at least in the foreseeable future. The human driver has a remarkably low false alarm rate. Add to that the number and complexity of functions and activities needed for vehicle automation and especially the reliance on sensors and algorithms. Automated vehicles, while good at mundane tasks, are often stymied by conditions that may be even just slightly off-kilter. In comparing and contrasting human driving versus automation, automation generally loses unless roadway conditions are carefully groomed or the driver is impaired or drowsy.

I was therefore resolute and simply not impressed with all those demonstrations – and even the ones I helped develop – or even the winning feats of the DARPA Grand and Urban Challenges. I regarded as stunts those cross-continent treks where the preponderance of the driving is conducted by the vehicle. Even brilliant Google engineers with their mapping prowess and a fleet of autonomous vehicles did not impress me. I yawned. "Leave the driving to me," I thought, said and wrote. Um, may I now change my mind? Two recent events have caused me to scratch my head and recalibrate my timelines. Perhaps we can see a future where real autonomous vehicles travel on our roads.

To begin, last year I read with fascination about Professor Alberto Broggi's 8,000-mile Rome to Shanghai automated vehicle trip. I was fascinated that a researcher can experimentally validate high operational reliability under a plethora of conditions. Then recently I read about the recent HAVEit final event in Sweden and in particular a Volkswagen that during a short interval performed all-speed adaptive cruise control and forward collision warning at the same time as lane keeping. This allows the driver to take his hands off the wheel and foot off the accelerator or brake.

This second event piqued my memory, which is itself quite a feat. I can recall in the late 1990s suggesting to the Vehicle-Highway Automation Committee of the TRB that we should explore as part of a research problem statement the 'do nothing' path to automation. The hypothesis was what if the inexorable advancement of technologies leads to automation, and it was suddenly foisted upon an unaware, ill-prepared society. I feared that drivers would become less vigilant, trusting what they perceived to be a complete but really an incomplete system of braking, throttling and steering. Eyelids would become heavy, the newspaper would become alluring and crashes would happen.

Now, the stage for change has been set. Professor Broggi has shown that real-world system reliability with automated vehicles may be possible, and a consortium of auto makers has shown that with some modifications today's systems can combine to at least make automation work for short periods of time. Add to that Google's remarkable strides in road-testing automated vehicles. When these research and market directions collide, will it be literal or figurative? Nowadays, the smart money says that while there may be minor bumps, we may well be on an automated journey.

> Even brilliant Google engineers with their mapping prowess and a fleet of autonomous vehicles did not impress me
>
> **Jim Misener, executive advisor, Booz Allen Hamilton, USA**

Intelligent transport for Melbourne

READER ENQUIRY NO. 508

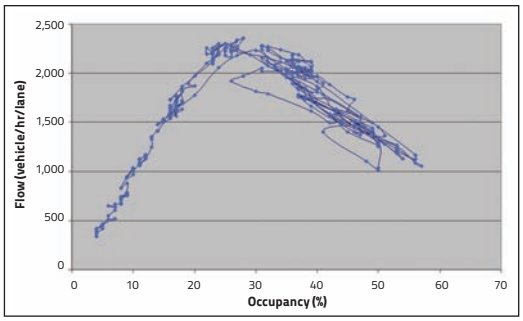
When VicRoads was upgrading its M1 motorway, the Australian road operator wanted to deploy a sophisticated ITS tool. VicRoads decided that the STREAMS system was the right tool to meet its needs. The benefits reaped by rolling out the system include a 30% reduction in accidents and a 42% reduction in travel times during peak periods. Greenhouse gas emissions have been reduced by 11% and the economic benefits are currently estimated at more than AU$2 million (US$2.14 million) per day. The system will soon be extended to other Melbourne motorways and to encompass other functions.

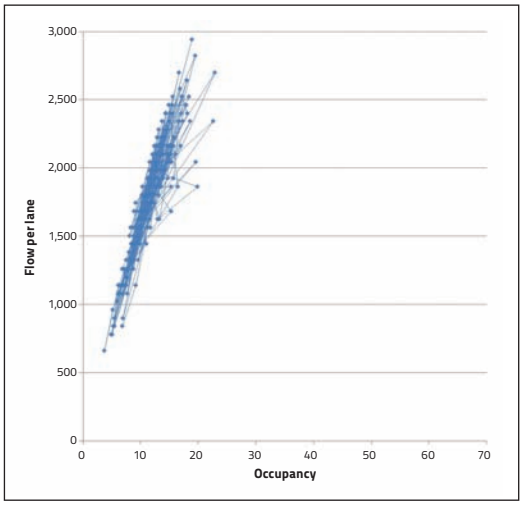
The deployment in Melbourne includes a highly effective implementation of the ALINEA/HERO ramp metering algorithms and rules-based incident response functionality.

STREAMS integrates the following traffic management functionality within one system: motorway management; incident management; traffic signal management; network video management; and traveler information, including parking guidance and real-time passenger information. The user interface is simple, attractive and comprehensive, which helps to reduce management costs.

All development has been conducted using ISO/IEEE standards and the software is robust. There have been no unplanned outages caused by the software for a number of years. The software is modular with easily replaceable services and algorithms. It is also scalable from small towns to large cities.

All infrastructure managed is located in the underlying geographic information system (GIS). This reduces the amount of configuration data required and improves the accuracy. The system has been designed to be interoperable and ISO/IETF interfaces exist for many other systems. Security is provided on all access points – field processors (outstations), servers and workstations.





Top graph shows flow breakdown with previous system. Bottom graph shows STREAMS ALINEA/HERO ramp metering preventing flow breakdown

Need to know?

Keeping traffic moving – and saving vast amounts of money – in Melbourne, Australia

- The success story resulting from the deployment of an advanced ITS tool on the M1 motorway
- Now that huge reductions in accident and congestion have been seen on this motorway, the system will be rolled out to other locations
- Automatic incident response based on engineering rules and GIS

Incident response

Pre-defined plans are usually used for incident response and installations can typically have more than 20,000 primary incident response plans. More plans are required if secondary incident responses are addressed. This is expensive to develop and maintain. Policy changes are expensive because large numbers of plans can be affected. Unfortunately, real incidents often don't match the particular circumstances and a mix of pre-defined response plans and manual interventions often occur. It can take up to 15 minutes to implement all the required controls for major incidents.

STREAMS generates incident response plans automatically within seconds. This is done using a small number of fundamental traffic engineering rules and the GIS. Secondary incident responses are also handled automatically. This approach produces consistent responses with a major reduction in traffic management center workload. Policy changes can also be implemented simply and quickly by simple changes to a rule. The policy change becomes effective immediately.

Traffic management systems generate large quantities of data and this can mask management information. STREAMS' Business Intelligence tool transforms this data into management information. Managers are able to slice and dice information easily and perform 'what if?' scenarios.

Control data is typically sub-optimal in many current traffic management systems. This can happen when traffic engineering resources are limited and results in sub-optimal performance. A revolution in mathematical optimization techniques promises to revolutionize performance. Transmax is developing optimization within STREAMS that will both reduce the amount of control data required and improve performance. It will adjust to incidents automatically.

Contact

Transmax
john.lees@transmax.com.au
+617 3355 8701
www.transmax.com.au

Tunnel scheme cutting travel times

How much is it worth to the average driver to save over an hour's driving time every day? How much is it worth to a traffic-clogged city to reduce congestion along the only main downtown artery during peak rush hours?

Evidently, it's worth a lot – and the Carmel tunnels provided the city of Haifa, Israel with the answer.

Haifa is Israel's third largest city, with a population of over half a million residents spread out on either side of the Carmel mountain range and along the Mediterranean coast. A narrow local road leading through the heart of the downtown business district was the traditional route to get from one end of the city to the other. The other commuter option was to drive up and over the mountain, via local winding roads, which also created traffic jams through several residential neighborhoods. During rush hour, commute time through the city was an average of 45 minutes, and made the downtown port area fairly impassable for hours each day.

(Left) **Toll stations outside the tunnels** (Below left) **An ALPR camera in action**

Need to know?

The story of the Carmel tunnel project – one of the largest ever schemes of its kind in Israel

- The congestion headaches caused by the prior routing have been alleviated by the building of a new tunnel system
- The financial business model demands high levels of billing and enforcement of tolls to be self-supporting
- How ALPR assists in maximizing revenues – and greatly contributes to the sustainability of the project

The solution was the Carmel tunnel project, completed less than a year ago, which runs east-west right through the mountain and cuts travel time down from 30-50 minutes each way to 6-8 minutes.

This is the second largest BOT project in the Middle East, and has over 6km of tunnels running up to 200m beneath quiet residential neighborhoods. The tunnels have three entry/exit points, at the east end, mid-point and west end of the tunnels. Because of this, exit points need to be monitored on exit for correct billing to occur.

As with most toll bridges and tunnels, this project was intended to be self supporting over time and produce the revenues necessary for that task. In order to ensure optimal revenues, the billing and enforcement system must work in unison, for minimum leakage and maximum income.

Tunnel technologies

Several complementary technologies, designed by Indra Systems of Spain, ensure both high collection rates and smooth traffic flow, as throughput must not suffer as a result of accurate collection. The tolls outside the tunnels have well-marked lanes for pre-registered drivers and these lanes have an open gate for moderate free-flow access into and out of the tunnels. Unregistered drivers must stop at the booth to pay, and their plates are stored in a database and cross-checked on exit to make sure the correct amount was paid. Higher rates for non-registered vehicles encourages drivers to sign up, so that over time, the tolls will become almost entirely free-flow.

A key component of the tunnel operations is LPR technology provided by Hi-Tech Solutions, which is a core element of the billing administration process. Plates are read at the tunnel entrance and again upon exit. If a vehicle enters as a registered driver, but the vehicle is not actually registered, the system picks this up and bills them to their home address. Repeat offenders can be identified and fined in conjunction with local laws.

Because the tunnels run east-west in this sunny climate, there are hours each day where direct sun glare created a challenge for ordinary LPR. The HTS team devised innovative solutions to overcome these difficulties.

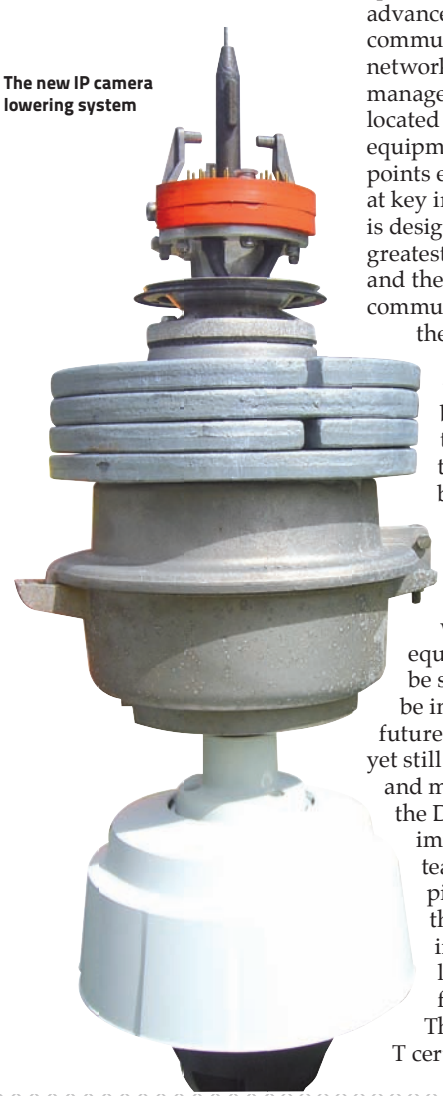
On the one-year anniversary of its opening, the Carmel tunnels' benefits include reduced travel time, less inner-city traffic downtown, reduced emissions in the city and of course fewer fuel costs for the driver. And with less congestion there is less pollution, meaning this is a win-win that has left everyone traveling faster and also breathing easier.

Contact

HTS HiTech Solutions
+972 3 9634601
info@htsol.com
www.htsol.com

I-93 moves with the times

The New Hampshire Department of Transportation (NHDOT) has undertaken one of its most ambitious roadway programs to date – widening and providing safety improvements along a 20-mile-long section of I-93 from Manchester to the Massachusetts state line. The +US$500 million project includes the addition of two travel lanes in each direction and the replacement or rehabilitation of 43 bridges, as well as other improvements that will be completed through more than 20 separate contracts through the year 2020. ITS is an integral part of the overall safety improvements along the corridor.



The new IP camera lowering system

Corridor improvements

In the fall of 2009, NHDOT advertised its first corridor-wide ITS deployment along this stretch of I-93. In spring 2010, the team of Vanasse Hangen Brustlin (VHB), Green Mountain Communications, and Liddell Brothers was awarded a US$3.8 million design-build (D/B) contract to install overhead dynamic message signs (DMS), CCTV cameras, and variable speed limit signs (VSLS). These advanced ITS components will communicate over a wireless network to the NHDOT traffic management center (TMC) located in Concord. The equipment, located at strategic points entering the corridor and at key interchanges throughout, is designed to provide the greatest benefits to motorists and the DOT. The wireless communications system uses the CCTV poles and leased space on existing cell towers to communicate between devices along the corridor and span the 13-mile distance between the TMC and the I-93 project.

One of the most challenging design aspects for VHB was locating the ITS equipment, which needed to be sited where it would not be impacted by ongoing and future roadway construction, yet still meet the operational and maintenance needs of the DOT while minimizing impacts to traffic. The D/B team selected several pieces of equipment that met these criteria, including the IP camera lowering device (CLD) from MG Squared (MG^2). The CLD is Cat 5 100BASE-T certified and will maintain the quality of the Ethernet signal across the lowering device disconnect block from an Axis IP camera assembly. With the CLD, there is greater flexibility in the placement of camera poles as they no longer need to be accessed via bucket truck for regular maintenance. This enabled VHB to design the poles outside of future construction limits.

The CLD also allows for the installation of taller camera poles – designed at 60 and 90ft heights – maximizing the views along the rolling terrain of the corridor and providing sufficient heights for the wireless radios above the tree line to communicate with other sites. The use of the (MG^2) camera lowering devices makes camera maintenance quicker, safer, easier, and less expensive. According to Denise Markow, NHDOT's TMC manager, "The ability to quickly lower the new CCTV cameras will provide an efficient, proactive means to provide preventative maintenance as well as a

READER ENQUIRY NO. 510

(Main image) **The new dual VSLS** (Left) **Cameras monitor a road weightstation**

Need to know?

Camera lowering devices are among the technologies keeping traffic moving on New Hampshire DOT's I-93

- Distinct benefits in both the design and maintenance of ITS and security surveillance systems
- Innovative system designed to lower ITS devices to ground-level for routine maintenance at the heart of safer operations
- Eliminates the need for costly bucket trucks, lane closures, and design constraints regarding pole height and location

way to diagnose technical issues in a timely manner."

The full-matrix walk-in enclosure DMS provided by Daktronics also help minimize traffic impacts during maintenance. The DMS are designed on cantilever structures over the travel lanes with catwalks that are accessible from the edge of roadway with a ladder. Once inside the DMS, maintenance personnel can work on the signs without impacting traffic or being affected by outside weather conditions. The VSLS are one of the most unique aspects of this project. As New Hampshire law requires speed limit signs on Interstate roadways to post both the speed limit as well as the minimum speed, the VSLS employ a special design –created by Daktronics for this project – that electronically display both speeds on a single sign.

Informed choices

With construction nearly complete and testing under way, NHDOT has the makings of an ITS network along this vital corridor that will keep I-93 moving. The equipment in place will allow the TMC to monitor current and future construction activities and roadway incidents. It will also provide motorists up-to-date travel and construction information, and adjust speed limits as needed to improve roadway safety in the event of accidents or inclement weather conditions. "NHDOT is excited about bringing innovative technology to its roadways," said Denise Markow, in anticipation of the project completion. "The ability to monitor and react to roadway incidents and conditions in real-time will allow us to better manage the growing traffic along our corridors."

Contact

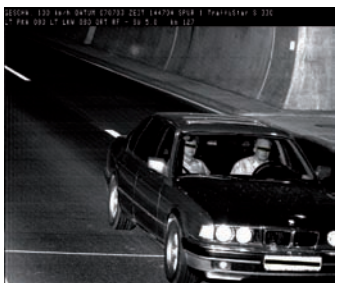
VHB
+1 401 272 8100
rhartman@vhb.com
www.loweringsystems.com

Traffic cameras without the flash

Germany's longest motorway tunnel, the Rennsteig Tunnel on Thüringen's wooded BAB (Federal Motorway) 71, is 8km long. It is also one of the safest structures of its kind; due in no small part to the innovative speed enforcement system that is deployed in the tunnel and surrounding area.

The Thüringen Ministry of the Interior requested that eight speed measurement cross-sections were planned for a 19km section of road – four in each direction, of which three were in tunnels and one was along a mountain ridge. Each measurement cross-section consists of two TraffiStar S 330 systems with digital Robot SmartCameras, piezoelectrical sensors, intelligent piezo pre-amplifiers (IPPs) and the specially designed BlackFlash flash system. Each of the 16 networked measurement systems is installed to monitor compliance with the applicable maximum speed limit in conjunction with variable message signs (VMS).

Accidents in road tunnels often result in serious human and property damage. In this context, the horrific fire in the Mont Blanc Tunnel is just one tragic example among many. Jenoptik Robot technology enables better traffic safety in tunnels to be achieved in two ways. Firstly, drivers observe the maximum permitted speeds because the enforcement systems are in continuous operation. Secondly, the TraffiStar S 330 system is the perfect solution to a well-known problem for jurisdictions employing frontal photography for speed enforcement in tunnels; the increased risk of accidents due to visually distracting flashes. The wavelength of the BlackFlash technology is almost in the infrared spectrum and it creates a focused light that is invisible to drivers yet bright enough to illuminate the driver and the surrounding area, including license plates. Together with the camera's infrared-sensitive CCD and software that was specially created to suit the BlackFlash technology, it is possible to record images of speed violations without distracting drivers, and ensure reliable identification of drivers and license plates for violation enforcement.

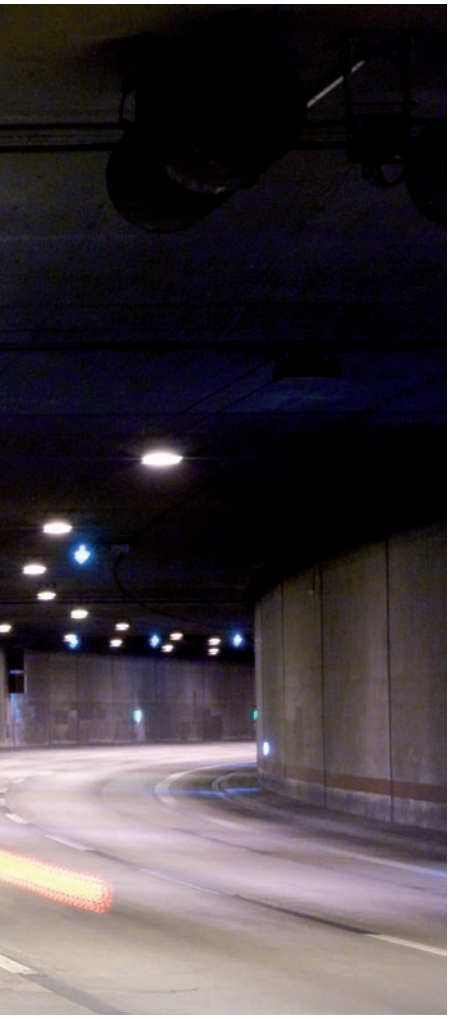


The BlackFlash system enables clear photos to be taken in dark environments

Penalty processing

The assessment of the recorded speed violation takes place 150km away from the measurement locations, in the central penalty processing center in Artern. Using digital photo technology it is now possible to include all information necessary for processing – driver's face, license plate, location, date and time – along with the photo as a computer file, and transfer it to the Jenoptik Robot TraffiDesk II assessment system in Artern via the police network, in a matter of seconds. Excluding the assessment of the image itself, all processes – from image capture to the arrival of the penalty process in the post – are completely automated. They do not require a single employee to handle the penalty notice.

In the first four months following the opening of the monitored section of the BAB 71, more than 60,000 violations were recorded. After that point the figure dropped significantly as the effectiveness of the



measurement systems in the BAB 71 Thüringen tunnel chain ensured that increasing numbers of road users began to observe the maximum speed limits.

The successful implementation of the pilot project in Thüringen had a remarkable effect at the national level. In large part due to the positive experiences on the BAB 71, TraffiStar S 330 measurement cross-sections have been installed to increase tunnel safety in Munich, Dusseldorf, Berlin and in five other major German cities.

They meet the demanding requirements of deployments in the field and, thanks to the modular measurement system, offer intelligent adaptation possibilities for the special requirements in tunnels, as well as exemplary operational safety in addition to an impressive cost/benefit ratio.

In addition to its use in tunnels, the TraffiStar S 330 speed enforcement system is of course also intended for outdoor use in uncovered locations, in particular on federal motorways or stretches of roads with particularly high accident risks, for which 24/7 monitoring is vital.

While the BlackFlash system can be used in tunnels, outside use requires that the area be lit with conventional xenon flash technology due to constantly changing light levels and more diverse weather conditions.

Robust in-road sensors

The measurement system uses piezoelectric sensors both in tunnels and outside. The crystals in these sensors are hermetically sealed against external influences. They are surrounded by an extremely robust brass material, ensuring a long life even on sections of road with high volumes of traffic. Their vandal-resistant installation in the road surface is done using a specially developed sealing compound that creates an internal bond to the asphalt and is noted for its extreme edge strength. The type of sensor, the sealing compound used and the care taken in the installation guarantee that the system will provide reliable measurement results for many years.

A measurement field consists of three sensors. When a vehicle passes over the field, three individual measurements are made using the time-over-distance principle. If these corroborate and if the final measurement result exceeds the threshold photo trigger limit, a pin-sharp evidence photo is taken immediately. Since no assignment error is possible, each measurement is permissible as evidence in court.

Specialist subject

If necessary, a certified specialist can carry out simple plausibility controls using the measurement photo. This first involves the calculation of the distance between the front wheels of the vehicle measured and the final sensor, by means of a photogrammetric analysis. The measurement photos preceding and following the incident being analyzed are also included in the examination process and the specialist calculates the distance between the front wheels of the vehicles measured and the final sensor. The preceding and subsequent measurement photos generally show vehicles with differing speeds, meaning that the distances between the front wheels and the sensors also differ. Comparing these differing distances to the speeds measured allows the specific photo delay for that measurement location to be calculated in a subsequent step. This then forms the basis for a conclusive plausibility control of the measured speed in further specialist analyses of the incident under examination.

The next important TraffiStar S 330 project will be rolled out later this year on the notorious BAB 2 in Lower Saxony. Two more counties are installing one measurement cross-section in each direction with connections to the VMS at that location, including additional cameras for simultaneous rear photography so that speeding motorcycle riders can also be recorded for violation enforcement. ○

Need to know?

READER ENQUIRY NO. 511

The inside story of a successful pilot speed enforcement project that had a positive impact on German roads at a national level

- Keeping tunnels safe is an ongoing challenge: tackling inappropriate speeding can greatly contribute to improving safety
- Removing the issue of distracting flashes from speed cameras through the use of a sophisticated new technology
- How the pilot project brought about a positive change in driver behavior, and led to further deployments of the technology

TraffiStar units deployed inside the Rennsteig Tunnel in Germany

Contact

Jenoptik Traffic Solutions
+49 2173 3940 0
info.vs@jenoptik.com
www.jenoptik.com/ts

Pennsylvania enters the fast lane of highway monitoring

The very first turnpike in the USA, the Pennsylvania Turnpike, was created in the Keystone State in 1940. Since then, the 532-mile roadway has been upgraded, widened and lengthened many times to manage the 188 million vehicles that travel through Pennsylvania each year.

The Pennsylvania Turnpike Commission (PTC) has worked hard to make travel faster and safer for a growing constituency of travelers while helping neighboring towns and counties during potential disasters.

The impact of digital and Internet Protocol (IP) network technology has significantly altered the way traffic is managed. In fact, over the past few years, the Pennsylvania Turnpike has extended the implementation of ITS to better serve the traveling public. The PTC maintains a 24-hour-a-day, 365-day-a-year Traffic Operations Center located in the state's capital of Harrisburg.

Serving as the hub of all Turnpike communications, the Operations Center continuously monitors turnpike activities via the Commonwealth's PA-STARNet – an extensive, statewide IP network that is the foundation of the state's public safety radio system. Roadway conditions, construction status, and weather conditions are all monitored at the center, which also serves as the focal point for all turnpike incident management. Once the Center is notified of an incident, personnel immediately respond by dispatching the appropriate first responders and by issuing traveler alerts.

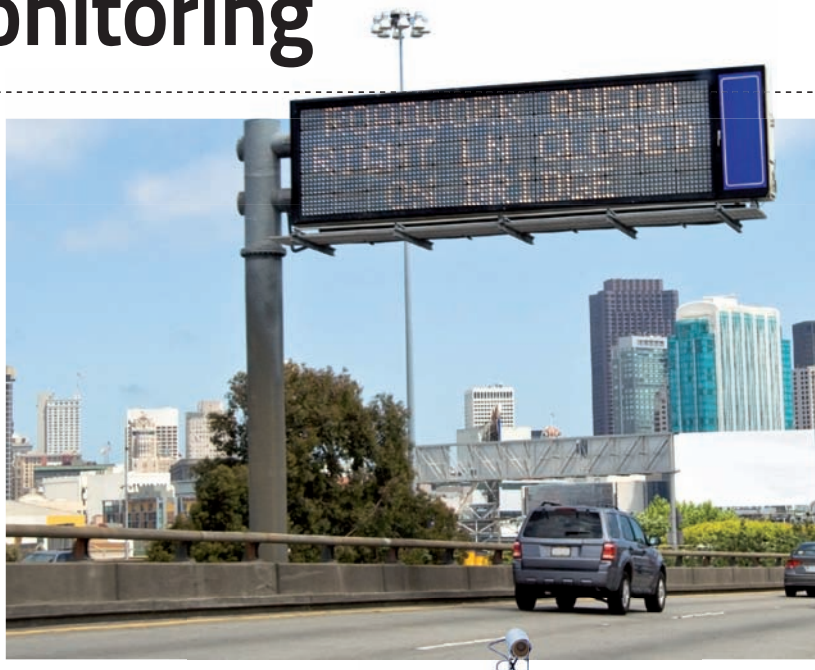
The Center relies on a variety of incident management communications tools such as fixed and mobile VMS and radio broadcasts about weather and other emergency situations that might affect the turnpike. This information is also available via touch-tone telephone, cellular phone and online.

To detect incidents, 225 dedicated state police officers are employed as well as a fleet of first-responder vehicles patroling the turnpike. Cell phone call-in numbers are also provided for motorists.

Need to know?

Providing seamless communications for improved efficiency and safety on the Pennsylvania Turnpike

- Cost-effectively extending private WAN capabilities to areas where installing fiber was deemed previously too difficult
- How VIDA Broadband will automatically reconfigure to provide optimum throughput for each ITS device on the network
- Offers scalability from a simple data backhaul implementation to a multi-application, wide-area deployment



(Above) **The PTC uses VMS to provide traveler infromation** (Right) **Cameras at intersections keep a close eye on traffic**

Finding solutions

One way to automate the real-time visual monitoring of the roadway is through remote, weather-resistant video cameras and related sensing devices that are connected to the existing LAN/WAN network to supply a continuous feed to the Operations Center. However, when setting up this technology on the turnpike, workers found that many necessary camera locations were far from accessible power lines.

Furthermore, LAN/WAN connectivity via landlines (either T1 or fiber-optic) was either non-existent or too expensive to consider. Additionally, although batteries would suffice for operating the cameras and wireless components, keeping them charged was a problem and solar panels alone were deemed insufficient for reliable power in the northeast climate.

As a result, the PTC worked with IdaTech, a manufacturer of backup fuel-cell systems, to develop a hybrid solar/fuel-cell solution that provides reliable remote power to charge the batteries in any weather. With this solution, the PTC has a reliable source of power that can run for about two or three months, depending on cloud cover and the need to augment the solar panels, on a single tank of fuel.

The PTC found a solution to the wireless transmission of the video and data in the Harris VIDA network system. Although a number of systems rely on WiFi or proprietary protocols, VIDA uses broadband for mission-critical use, which reduces the problems of interference and provides the guaranteed QoS (Quality of Service) that the PTC needs.

When assembled as a unit, the standalone remote wireless video system – known as a POP (Point Of Placement) stand – is compact and easily deployed. This technology automatically alerts those in the Operations

READER ENQUIRY NO. 512

Center when traffic slows to about 20mph. The real-time images allow workers to see what the problem is and ultimately will help the center in assessing the kind of response that may be needed. In addition, a short fiber-optic cable monitors an adjacent traffic alert sign that notifies travelers to tune in to the 1640 AM band on their radio for more information.

The capabilities of information sharing between an expanded ITS 4.9GHz network and future public safety broadband networks across municipalities, states and even regions is an intriguing possibility. As digital and IP technologies improve, the PTC will continue to a dapt them to ensure critical information is shared among the state and local first responders to ensure the safety of travelers and the public at large.

Contact

Harris Corporation
beinsig@harris.com
+1 321 727 9207
www.harris.com

Adrian **Walsh**

awalsh@roadsafe.com

As casualty rates fall in many European countries – in the UK, for example, the latest figures show a further 11% fall in car passengers killed or seriously injured – the impact of technology is becoming clear.

The new Euro NCAP protocols reflect this welcome trend and now reward innovation in addition to scoring against the familiar crash test ratings. The overall safety rating system introduced two years ago is composed of scores in four areas – adult protection, child protection, pedestrian protection and safety assist. The underlying tests are identical to those before 2009, apart from the addition of a test for whiplash neck injury protection in rear impacts. Scores also reflect the fitment of seatbelt reminders, speed limiters, and the standard fitment of electronic stability control.

As a way of encouraging manufacturers to showcase new innovative technologies, the Advanced Rewards are made for safety technologies that demonstrate a scientifically proven safety benefit for consumers and society. Euro NCAP aims to provide an incentive to OEMs to accelerate the standard fitment of important safety equipment across their model ranges and help the car buyer to make the right purchase decision.

We can expect further casualty reductions as increasingly more cars enter the market with these crash-avoidance technologies. Euro NCAP recognizes that the availability of these advanced safety systems can further improve a car's safety beyond the level rated crash tests.

The independent safety testing organization says that many of these technologies focus on avoiding the crash by informing, advising and alerting drivers about dangerous situations and by assisting them to avoid a crash. Some technologies optimally prepare the vehicle's safety systems just milliseconds before a crash in order to provide the best possible protection, while others save crucial minutes for emergency services to arrive at the accident scene, helping medical personnel to deliver the best support given the circumstances.

Advanced technologies define today's frontier in the development of safer cars. Unfortunately, most car buyers are unaware of the potential of these technologies or are confused about how exactly these might work. A recent survey conducted as part of the eSafety Challenge showed a surprising ignorance among consumers, with marked differences in awareness levels between systems and between countries. For instance, 68% of Spanish respondents are aware of the advanced emergency braking, while in France awareness was only 38%. In the case of the most significant life-saving technology, ESC, 89% of those interviewed in Germany were aware of the technology but in the UK it was only 41%.

The encouragement being offered by EuroNCAP for innovations such as the Mazda Rear Vehicle Monitoring System, which has won the latest Advanced Reward, is welcome. The system detects and warns the driver of an approaching vehicle and helps to avoid common lane change-related crashes involving two or more vehicles. But it is certain that such innovations will be with us soon in such numbers that we will thank the designers of these eSafety technologies for saving countless lives.

> As a way of encouraging manufacturers to showcase new innovative technologies, the Advanced Rewards are made for safety technologies that demonstrate a scientifically proven safety benefit for consumers and society
>
> **Adrian Walsh, director, Roadsafe, UK**

Automatic calibration for WIM

One of the important aspects of a weigh-in-motion (WIM) system is ensuring that the WIM scale reading is in agreement with the static scale reading. The WIM scale is used to measure the weight of a vehicle traveling at normal highway speeds and if the vehicle exceeds the programmed weight value for that vehicle class, it will be directed to enter a weighstation and be statically weighed.

WIM scale calibration is used to ensure that the estimation of the static weight produced by the WIM scale is as close to the static scale weight as possible. The calibration offsets the effects of vehicle dynamics, vehicle speed, site conditions, and pavement conditions. These factors can influence the weight estimated by the WIM system.

Traditionally, and still today, other WIM manufacturers' calibration processes require significant manual intervention, which begins with a concerted effort to ensure that proper traffic management strategies are in place. Then, subject trucks that cross the WIM scales must be visually identified and their WIM weight manually recorded. The identified truck is then directed to the static scale, weighed, and static weight is manually recorded. At this point, the manually recorded WIM and static weights are compared (ASTM E 1318-09 states the gross weight on FHWA Class 9 vehicles to be within ± 6% at the 95% level of confidence) and the calibration factor calculated. This factor is then manually entered in the WIM system to correct future measurements. As this process is time consuming and costly, enforcement agencies may not perform these calibrations on a routine basis, which could pose serious problems for the enforcement officers. They might, for instance, send a potential violator to the bypass lane when it should have been directed to the static scale.

Need to know?

An automatic and low-cost method for checking the accuracy and adjusting the calibration factors of a WIM scale

- New innovation provides WIM scale auto calibration via a link between the static and WIM scale electronics
- Automatically associates the WIM scale weight estimate and static weight of each vehicle and stores the readings for future use
- Calibration factor updates can be performed on a calendar basis or upon collection of some predetermined number of comparative vehicle weight readings

(Above) **Screenshot of WIM software** (Left) **Improving WIM processes leads to greater efficiency at weighstations**

READER ENQUIRY NO. 513

New entry

The latest WIM technology development from Mettler Toledo incorporates an auto calibration feature that removes manual intervention and performs the calibration automatically and frequently. Electronically connecting the WIM scale to a calibrated and verified static scale allows WIM scale data to be recorded and compared to static scale data on vehicles that are directed to the static scale. This electronically collected WIM and static scale data is stored in the static scale computer and becomes part of the vehicle's data record. Once an adequate vehicle record sample size (minimum 50) is reached, the static scale computer automatically calculates the percentage difference and transmits a new calibration factor to the WIM scales. The comparisons can be based on the steering, axle, and/or gross weights.

By automatically calibrating the WIM scale, the reluctance of agencies to perform costly manual WIM site calibration is removed, providing the agency with a higher level of confidence when a violator is detected. The overall accuracy of the scale is also improved, even beyond ASTM Type III requirements. As the table to the left shows, the benefits of auto calibration speak for themselves.

Axles	ASTM E 1318-09 Type III performance	With auto calibration feature
Gross	6%	3.5%
Drive Tandem	10%	4.5%
Trailer Tandem	10%	6.5%
Steering	15%	7%

Comparing ASTM Type III accuracies with those achieved from Mettler Toledo's auto calibration feature

Contact

Mettler Toledo
bob.susor@mt.com
+1 614 438 4823
www.mt.com/wim

Accurate marking maintenance

Road markings and retroreflective raised pavement markers (RRPMs) are important tools in securing efficient and safe traffic flow, and ensuring high visibility of both is an important task for those involved in road maintenance. This is achieved by periodically measuring the retroreflection with a retroreflectometer, enabling road owners to plan maintenance and replacement of markings and RRPMs. Visibility is characterized by their optical retroreflection properties.

Until recently, measurements of retroreflection were mostly conducted with handheld instruments such as DELTA's LTL-X. Despite the accuracy and ease of use of such systems for conducting a limited number of measurements, they are not the best option for monitoring over long distances and heavily trafficked roads. The retroreflection can vary greatly even over short distances and on bends, where visibility is especially important.

Furthermore, roads sometimes have to be partly closed off for measurements to be taken. But with increasing traffic, there has been a growing demand for mobile systems that can monitor retroreflective properties at highway speeds.

Existing mobile retrometers on the market have accuracy limitations. Tests performed by research laboratories comparing handheld and mobile retroreflectometers have shown measurement variations of up to 50%. International standard organizations such as CEN and ASTM have realized this and have established working groups to create standards for mobile retroreflectometers, in order to be able to describe instrument properties and performance criteria. The limited accuracy of existing mobile retrometers is caused mainly by factors such as vehicle movement and changes in wind pressure and car load relative to the road surface. This movement changes the geometry of the measurements. This is why mobile retrometers have until now been used only for screening purposes.

READER ENQUIRY NO. 514

(Left) **LTL-M's in-vehicle display** (Below left) **Measuring at highway speeds**

Need to know?

The latest generation of road marking equipment and the benefits it brings to road operators

- Responding to the industry demand for mobile systems that can work at highway speeds
- One vendor has devised a new range of mobile retroreflectometers
- The system provides information on how a driver would see the road markings in his headlights at night
- Can measure white and yellow markings without the need for recalibration

The next generation

DELTA has recently introduced a new generation of mobile retroreflectometers, LTL-M. Highly accurate, they are very easy to mount, calibrate, and operate. LTL-M uses a Xenon flash system, fast digital camera technology and digital image processing. In independent tests it has been shown to work with an accuracy comparable to handheld instruments, i.e. with repeatability of ±3% and reproducibility of ±5%.

LTL-M measures the detailed cross-sectional retroreflection of markings. Many markings have strong transversal variation, so a measurement made with a handheld instrument with a 4-5cm-wide measurement field in the center does not represent the true visibility. In other words, LTL-M provides information on how a driver would see the markings in a vehicle's headlights at night. The system measures the daylight contrast between the road surface and the marking. It also offers detection of missing or non-working RRPMs. Additionally, it measures white and yellow markings without the need for any recalibration.

Measurement data may be exported to GIS for mapping of markings and RRPM properties. Based on yearly monitoring combined with data such as traffic density, accident locations, and weather conditions, it will be possible to develop models that can be used for planning of maintenance, optimizing safety, and costs. It can also be integrated with existing road survey systems, as has been done with ARRB's Hawkeye platform.

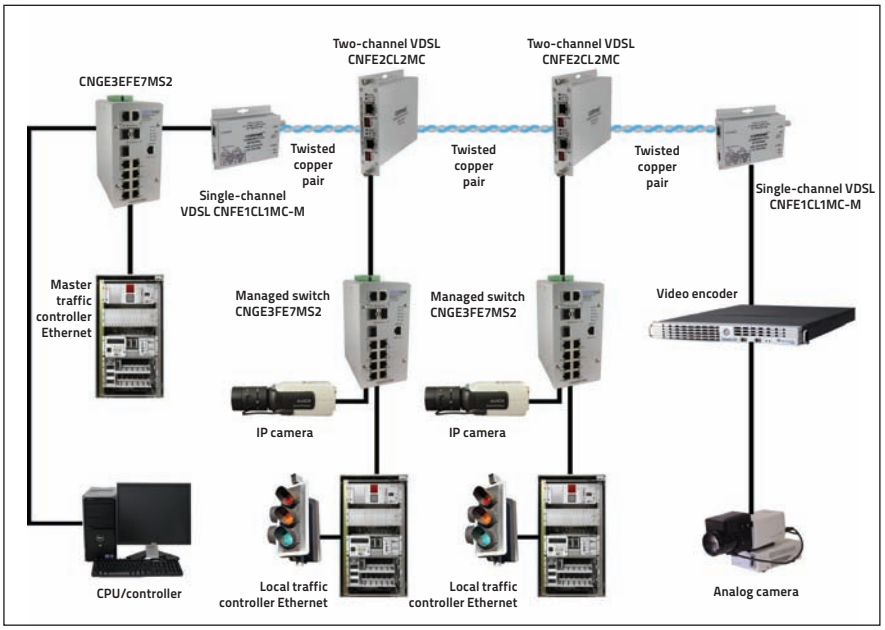
Contact

DELTA
+45 72 19 46 30
roadsensors@delta.dk
www.roadsensors.com

Use what's already in the ground

When designing for the renovation of an existing ITS network that will use Ethernet as the signal transmission protocol for the traffic signalization and surveillance system, employing installed fiber is a very cost-effective option. As many DOTs turn to Ethernet-based transmission, combining data transmission, video detection and CCTV on a network places bandwidth demands on the medium selected. Although parameters for these devices can be adjusted to conserve bandwidth, the use of optical fiber as the transmission media offers the best combination of performance, flexibility and overall value. With fiber-optic transmission, Ethernet-over-optical fiber offers significant benefits, including extended distance, EFI/RFI immunity, and the capacity to support nearly unlimited bandwidth.

If you are adding an existing legacy network (traffic controllers with RS-232 serial data) to a fiber network, this can be achieved simply by daisy chaining the fiber down the road in a drop-and-repeat manner. The traditional approach uses two-fiber, daisy chained from location to location with a fiber modem. If fiber availability is an issue, a single-fiber modem using wavelength division multiplexing can also solve the problem. The FDX55 series from ComNet is designed to solve this challenge.



Ethernet-based traffic control systems using existing copper cabling

Need to know?

The competitive advantages available to engineers when designing the transmission portion of any project

- Why choosing the right transmission media can prevent escalating costs, while not understanding the available options can jeopardize installation budget
- Detailing how advance thought and planning can eliminate potential expansion challenges in the future
- The solutions that can be used to your advantage once you know 'what's in the ground'

Transmission transition

If fiber-optic cable has been installed in the existing ITS network and it is currently supporting serial data, the transition to an Ethernet-based ITS system is accomplished quite easily. It is possible to call upon the existing fiber as the transmission media so all that is required is sourcing the correct Ethernet product and switching out the equipment on either end of the fiber. Changing the hardware from a fiber-optic data modem to an Ethernet switch can be as easy as plug and play.

Ethernet networks inherently require programming and experienced network personnel to operate efficiently. So partnering with a company that offers system design assistance is a great help. Here, ComNet offers free design-center services to assist engineers in the design, implementation and selection of transmission equipment.

Should expansion of an existing ITS network or a new deployment be required, it is cost effective to install fiber-optic cables. At this point there isn't really much difference in the cost of the media – be it fiber optic or copper cable. By using fiber-optic transmission, the integrator virtually future-proofs the network. As a result of the exceptional bandwidth offered by single-mode fiber-optic cables, future bandwidth usage obstacles are easily overcome.

Optical fiber has the distance advantage over common Cat 5, 5e, 6 and 7 cables. Network cables are limited to 100m while fiber can extend to distances up to 2km over multimode optical fiber and up to 120km over single-mode fiber, depending on the optic being used in the selected managed switch, unmanaged switch or media converter.

Misconception

In many conventional traffic signalization and analog surveillance systems that are making the transition to an IP, the common misconception is that the existing video coaxial cables and data twisted pair wiring have to be removed or abandoned as they are incapable of supporting Ethernet data and optical fiber, or network copper cables must be installed. A major cost contributor to any Ethernet-based system is the cost to install new transmission media. But there is a way to gain an advantage. A complete line of Ethernet-over-VDSL (EoVDSL) products offered by ComNet allows 10/100Mbps Ethernet data to be transmitted over existing twisted-pair cables or 75Ω coaxial cables, after having replaced the existing analog camera or traffic controller at the remote location to a similar IP-based device. The integrator

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installs the Ethernet-over-copper product on the coaxial cable or twisted pair and another Ethernet-over-copper product at the other end of the cable at the head-end management location. Ethernet signals can now be transmitted using the twisted pair or coaxial cable as the medium.

Another option to create a network on existing copper twisted pair or coax is using a two-channel VDSL product, such as ComNet's VDSLMS2, with an Ethernet switch, allowing you to effectively daisy chain controllers in multiple drop-and-repeat locations along the copper network. Bandwidth must be considered carefully. There are also other uses of existing copper, including adding an IP camera or a controller to a location that can be several miles from the head-end by using a two-channel VDSL unit, such as a ComNet CNFE2CL2MC, as a repeater in the consecutive traffic cabinets as opposed to adding or using existing optical fiber. These Ethernet EoVSL modems provide a distinct distance advantage over standard network cables. TheConnecticut-based company's Ethernet-over-copper devices allow distances up to 3,000m over twisted pair or 500m over 75Ω coaxial cables. The use of such devices is so cost-effective that in many ITS expansion projects, Ethernet over copper is a viable option given the cost of installing new media for the Ethernet ITS network. Even though these Ethernet-over-copper products perform very well, if an ITS project expansion becomes apparent, a move to fiber-optic transmission becomes a more cost-effective choice and offers greater bandwidth and performance benefits than installing new copper cabling.

If the network requirement is to use Power over Ethernet (PoE), ComNet offers media converters as well as managed and unmanaged devices for virtually every application and power choice. A new variant where coaxial cable is being used as the Ethernet transmission medium has been developed by ComNet and allows PoE to be conducted through a coaxial cable. This model now provides both Ethernet data and operating power for the PoE IP camera, and the ComNet device can be transported from the head-end through the coaxial cable for distances of up to 230m. This type of product eliminates the cost of the medium and the labor to install it, as well as the cost to install or deploy power at the field location. The perfect application for this type of product is where an existing analog camera is being used in a field location and an upgrade to IP is required. In this application, power for both the IP network and ComNet device is supplied over the coaxial cable from the head-end, while the Ethernet signal can be transmitted over the same coaxial cable from the field location to the head-end.

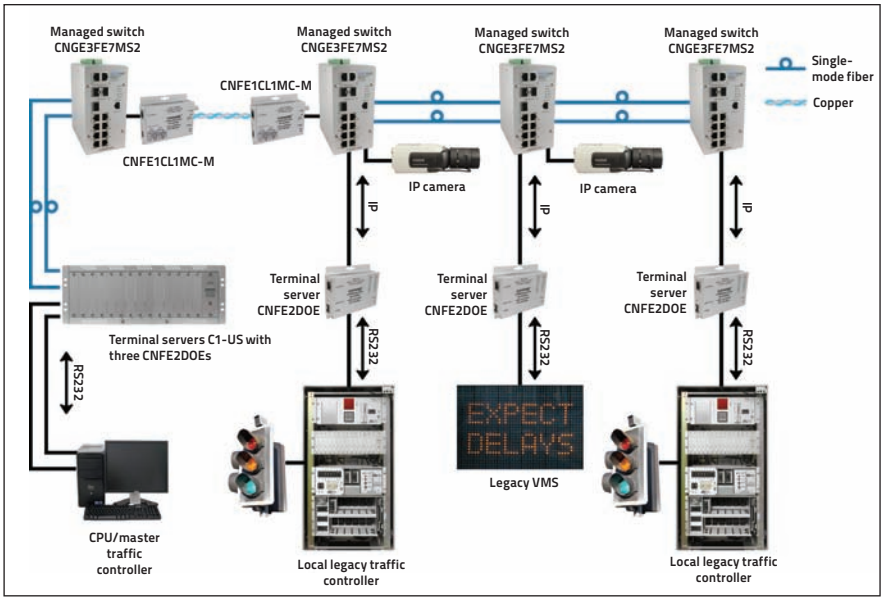
A simple approach

Many municipalities and local DOTs do not have access to an IT department or CCNA-certified network technician and avoid implementing an Ethernet network for their traffic signalization and surveillance due to anticipated complexities. A simple approach that requires little knowledge of networking and no programming is therefore beneficial. If you're thinking about creating a network using optical fiber as the medium, or you believe programming and maintaining managed Ethernet switches are an issue, ComNet offers another device with some network management capabilities that enables the user to add IP video and other Ethernet devices without the threat of flooding the network by simply flipping a switch on the device. This is a low-cost and simple way to add to your network without adding expensive switches and programming knowledge.

One of the many benefits of Ethernet is interoperability between types of media material. It is common to find systems that use wireless, copper and optical transmission media. Many essential pieces of hardware such as switches and media converters can use Small Form-Factor Pluggable (SFP) optical interfaces in their deployment that allow the switch to transport Ethernet over different media such as copper, or multimode and single-mode optical fiber, while accommodating different fiber connector types and transmission distances.

The SFPs also offer the network administrator great flexibility with the design without having to change hardware every time the medium changes.

By choosing the correct signal transmission infrastructure, successful integration companies can deliver a performance and price benefit that offers an advantage in winning the project and driving it to completion.



Mixed circuit-based (Ethernet/RS232) traffic control system using fiber-optic and existing copper cabling

Contact

ComNet
+1 203 796 5300
sales@comnet.net
www.comnet.net

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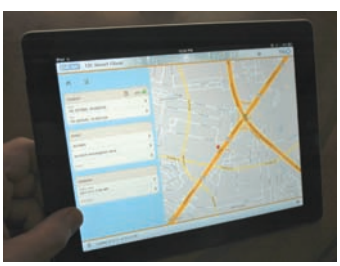
The connected vehicle: increasing safety with Local Hazard Warnings

When will the connected vehicle arrive? For many, it already has. The real answer depends on how narrowly you define the connected vehicle. If, for you, the vehicle must be completely connected to the infrastructure, collecting and distributing information from vehicle systems, road, network and weather conditions, then we have further to travel. But if you define a connected vehicle as one that uses real-time information to assist drivers in operating their vehicles more safely and efficiently, then we've already arrived.

In Germany, BMW and GEWI have been working on a research project called DIANA2, which will be made available as a commercial service in 2012. DIANA2 will generate Local Hazard Warning (LHW) messages from roadwork vehicles to generate alerts for drivers. The goal of the project is to increase the level of roadway safety by providing advance notice to drivers of unexpected events on the road ahead, allowing them to properly respond to the hazard.

The LHW system provides visual and/or audible messages warning drivers about dangerous situations that are present further ahead on their specific driving route. The warnings cover a wide range of hazardous conditions, including accidents, debris on the roadway, lane closures, reduced vision due to weather, slippery driving conditions, emergency vehicles, and more. Alerts will generally be available on roadways with a speed limit of 60km/h or greater.



LHW data can also be entered into an iPad for later in-vehicle display

Two-way communications

This LHW is achieved by using the TPEG protocol, which allows for two-way communications with the vehicle as well as much more precise location and presentation of incidents to the driver. TPEG also provides for a much broader range of traffic- and travel-related content to be presented to the driver than had been possible with its predecessor, RDS-TMC.

The LHW message is generated by a trailer, work vehicle, or device equipped with GPS and a GPRS module that sends the current position and state of the display panel (arrows, lights, etc.) to the traffic control center.

The information is coded as a TPEG message and sent via a TPEG-over-HTTP service directly to the vehicle, where it is rendered for display by the in-dash navigation device.

This means that well in advance of encountering this unexpected hazard, the driver will receive a visual as well as auditory alert that increases in frequency as the hazard draws nearer.

Visitors to the 18th World Congress on ITS in Orlando (October 16-20) will also have an opportunity to view this technology first hand. BMW and GEWI will be hosting demonstration rides during the Interactive Technology Showcase, in the parking lot next to the convention center.

LHW offers a promise of safer roadways by providing actionable information to the driver in advance of a situation on the roadway that will require a maneuver by the driver.

LHW is just one of the services made possible by TPEG. Several applications have been standardized or are under development, including parking information (PKI), traffic flow and prediction (TFP), congestion and travel time (CTT), weather (WEA), road traffic message (RTM), public transport information (PTI) and traffic event compact (TEC) – the standard in which LHW has been developed. Each of these offers an opportunity for additional improvements in safety and convenience for drivers. And, as the TPEG protocol is extendible, the future likely holds more applications to benefit the driver as traffic technology continues to evolve.

So, whether your definition of connected vehicles accepts that they are here today or are just around the corner, it is clear that the safety and convenience benefits for drivers are within reach. For some, that reach is as close as their dashboard.

READER ENQUIRY NO. 516

The driver receives LHW messages on the in-dash navigation device

Need to know?

GEWI will show its new Local Hazard Warnings (LHW) system at the ITS World Congress

- Explaining how connected vehicles can improve road safety by alerting drivers of Local Hazard Warnings
- How next-generation navigation devices using the TPEG protocol can deliver a much richer dataset to drivers, resulting in a safer driving experience
- Analyzing GEWI's involvement in the LHW project with BMW, which could be offered commercially in 2012

Contact

GEWI North America
+1 281 207 5454
jim.oneill@gewi.com
www.gewi.com

Engineering a better network

READER ENQUIRY NO. 517

One of the challenges faced by traffic engineers is how to create a reliable and secure communication network. The objective is to reach out to all traffic cabinets and field devices without breaking the bank or being left with an outdated system by the time it's fully operational – simple, right? Unfortunately it's not, but it is achievable by gradually expanding the network with the use of new and existing infrastructure.

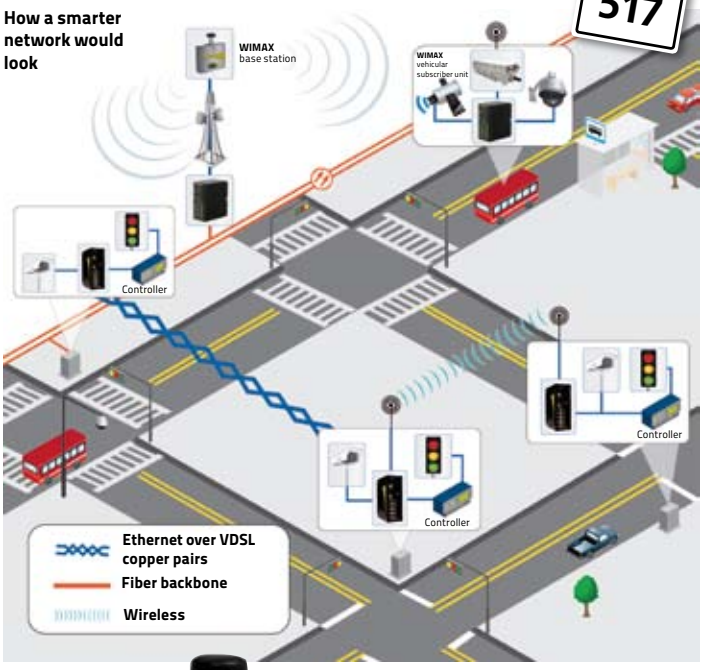
Transportation authorities will commonly deploy a fiber ring along critical corridors, providing connectivity back to the traffic management center (TMC). This will serve as a high capacity and multiservice backbone that will support their data needs. In a perfect world, fiber would reach all field devices providing virtually endless capacity with immunity to surges and EMI. Unfortunately this is not practical and the sheer cost of trenching and running new conduit would see it stopped dead in its tracks, not to mention the impact on daily commuters. However, neglecting those areas would still require technicians to constantly visit cabinets for configuration updates and changes to timing plans.

With that said, a combination of wireless and wireline solutions is key to a cost-effective and future-proof solution. It will provide traffic engineers with the real-time connectivity they need to tackle issues such as traffic congestion, transit prioritization and maintenance in a safe and efficient manner.

The integration of Ethernet over VDSL to service ancillary intersections injects new life into existing copper cable and eliminates the need for new construction, thus reducing deployment costs. It turns that cumbersome, temperamental old 9600 baud connection into a low latency, high-speed broadband connection. When in place, it will provide the TMC with the ability to communicate with intersections beyond the main corridor. It will also provide the needed capacity to implement adaptive algorithms for congestion management and stream video data, adding another pair of 'eyes' in the field.

For troublesome locations that can't be easily reached, WiFi with advanced cyber security features can extend network coverage to eliminate the 'last mile' conundrum at a low cost. A secure wireless link is created that connects a distant intersection back to the main network. The addition of WiFi can also create a local hot spot for maintenance workers so that there is no need to leave their vehicle when inspecting devices. As the network expands and fiber is run to these locations, the wireless equipment is versatile and can easily be redeployed elsewhere.

How a smarter network would look



(Right) **RuggedCom's RX1512 unit** (Below) **Win7200 base station**

The merits of WiMax

As applications go mobile, a solution is needed that can extend the network and easily integrate into the existing system – enter WiMax, the high capacity and utility-grade private network. There are no recurring costs of ownership and it is available in a variety of frequencies, so it will be unaffected by interference from other networks. Examples of WiMax applications include transit priority and telematics. For transit priority, WiMax would be used on the most traveled corridors, providing real-time connectivity to buses as they navigate through the city. Meanwhile, telematics keep drivers aware of roadway conditions and are in constant communication with dispatch. WiMax can also be used for

Need to know?

Assessing how to maximize ITS communications infrastructure

- Why it pays to take some expert advice when considering how to improve communication networks
- How Ethernet over VDSL is breathing new life into aging systems
- Using WiFi at inaccessible locations and WiMax for mobile solutions
- The benefits of buying all hardware from a single manufacturer

backhauling data over long distances, including connectivity to distant offices or TMCs.

The integration of these three solutions would give authorities the means to efficiently manage their roadways with little to no disruption to commuters and room for future growth.

When making a final hardware choice, examine all options, whether they are from a variety of vendors or a single source. Procuring a complete, single vendor solution has its advantages. All components are guaranteed to work seamlessly with one another, support headaches are significantly reduced and networking management can be done with a single piece of software.

Contact

RuggedCom
seanfraser@ruggedcom.com
+1 905 482 4793
www.ruggedcom.com

bg@berngrush.com

If Rachel Botsman and Roo Rogers are right in their recent book *What's Mine is Yours: The Rise of Collaborative Consumption*, we can expect a rise in peer-to-peer car sharing. P2P car sharing turns any owner of an automobile into a single-vehicle car rental company, with reservation services provided online. Right now one of the US operators, RelayRides from San Franscisco, installs technology to lock and unlock the vehicle using a near-field communication card that the renter-member keeps in her purse, meaning that key exchange does not require owner attention. That's a start.

Traditional car-share operations such as ZipCar lower automobile ownership, reduce demand for parking space, reduce automotive miles traveled, and likely reduce traffic congestion in peak times. P2P car sharing offers all these things – and more. VMT supply can be increased dramatically without investing in more vehicles, car owners can have their neighbors make their car payments for them, it can make a greater variety of vehicle sizes and types available to a car share renter, and the vehicle storage depot problem mostly goes away.

While traditional car sharing has economic incentives for people who only need occasional access to a vehicle, P2P car sharing has economic incentives for car owners. This is disruptive, making it something to watch.

The key to P2P car sharing work is trust. You need to trust that my car will be clean, safe and operational and I need to trust that you will respect my property. Trusting strangers from whom you might buy something is well managed with online purchasing from auction sites such as eBay or the used book jobbers that trade on Amazon. If you rent your car online – as you would if you were a car owner in a P2P car share transaction – your reputation (well, your car's reputation) will be gleaned from your users by the site that manages the transaction. But what about the renter's reputation? After all, you will not want your car to be subject to automatic speeding or red-light tickets and parking fines. How will you know if a renter abuses your accelerator or clutch?

There's other things such as insurance and perhaps wanting a different rate from someone who uses your car to drive a hundred highway miles versus someone just driving a few miles to visit his auntie.

Telemetrics systems can address all of this. An in-car meter that measures speed, braking and steering could automatically establish a driver's reputation for the car owner. While there is no need to track the driver, the driver-style can be calculated as a reputation factor and the car owner can decline or accept further rental requests based on that reputation. While we are at it, the same meter can manage distance traveled, usage-based insurance, even parking payment, bridge or tunnel tolls, and so on.

What is now possible is for P2P car share operators to equip a member's vehicle with a meter sufficient to calculate the entire trip cost on an equitable usage basis for automatic billing and permit the owner to select driver style thresholds, so that she need not be concerned with any of these issues. Collaborative telemetrics could make P2P car sharing the 'killer app' of 21st century automobility.

> Peer-to-peer car sharing turns any owner of an automobile into a single-vehicle car rental company, with reservation services provided online
>
> **Bern Grush, principal, Bern Grush Associates, Canada**

Engineering a better network

READER ENQUIRY NO. 517

One of the challenges faced by traffic engineers is how to create a reliable and secure communication network. The objective is to reach out to all traffic cabinets and field devices without breaking the bank or being left with an outdated system by the time it's fully operational – simple, right? Unfortunately it's not, but it is achievable by gradually expanding the network with the use of new and existing infrastructure.

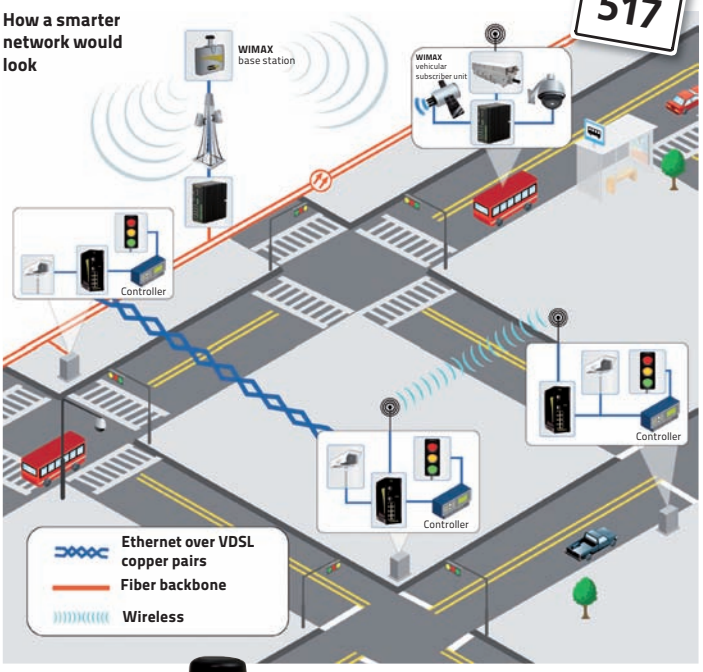
Transportation authorities will commonly deploy a fiber ring along critical corridors, providing connectivity back to the traffic management center (TMC). This will serve as a high capacity and multiservice backbone that will support their data needs. In a perfect world, fiber would reach all field devices providing virtually endless capacity with immunity to surges and EMI. Unfortunately this is not practical and the sheer cost of trenching and running new conduit would see it stopped dead in its tracks, not to mention the impact on daily commuters. However, neglecting those areas would still require technicians to constantly visit cabinets for configuration updates and changes to timing plans.

With that said, a combination of wireless and wireline solutions is key to a cost-effective and future-proof solution. It will provide traffic engineers with the real-time connectivity they need to tackle issues such as traffic congestion, transit prioritization and maintenance in a safe and efficient manner.

The integration of Ethernet over VDSL to service ancillary intersections injects new life into existing copper cable and eliminates the need for new construction, thus reducing deployment costs. It turns that cumbersome, temperamental old 9600 baud connection into a low latency, high-speed broadband connection. When in place, it will provide the TMC with the ability to communicate with intersections beyond the main corridor. It will also provide the needed capacity to implement adaptive algorithms for congestion management and stream video data, adding another pair of 'eyes' in the field.

For troublesome locations that can't be easily reached, WiFi with advanced cyber security features can extend network coverage to eliminate the 'last mile' conundrum at a low cost. A secure wireless link is created that connects a distant intersection back to the main network. The addition of WiFi can also create a local hot spot for maintenance workers so that there is no need to leave their vehicle when inspecting devices. As the network expands and fiber is run to these locations, the wireless equipment is versatile and can easily be redeployed elsewhere.

How a smarter network would look



(Above) **RuggedCom's RX1512 unit** (Left) **Win7200 base station**

The merits of WiMax

As applications go mobile, a solution is needed that can extend the network and easily integrate into the existing system – enter WiMax, the high capacity and utility-grade private network. There are no recurring costs of ownership and it is available in a variety of frequencies, so it will be unaffected by interference from other networks. Examples of WiMax applications include transit priority and telematics. For transit priority, WiMax would be used on the most traveled corridors, providing real-time connectivity to buses as they navigate through the city. Meanwhile, telematics keep drivers aware of roadway conditions and are in constant communication with dispatch. WiMax can also be used for

Need to know?

Assessing how to maximize ITS communications infrastructure

- Why it pays to take some expert advice when considering how to improve communication networks
- How Ethernet over VDSL is breathing new life into aging systems
- Using WiFi at inaccessible locations and WiMax for mobile solutions
- The benefits of buying all hardware from a single manufacturer

backhauling data over long distances, including connectivity to distant offices or TMCs.

The integration of these three solutions would give authorities the means to efficiently manage their roadways with little to no disruption to commuters and room for future growth.

When making a final hardware choice, examine all options, whether they are from a variety of vendors or a single source. Procuring a complete, single vendor solution has its advantages. All components are guaranteed to work seamlessly with one another, support headaches are significantly reduced and networking management can be done with a single piece of software.

Contact

RuggedCom
scottbenzie@ruggedcom.com
+1 905 482 7217
www.ruggedcom.com

bg@berngrush.com

If Rachel Botsman and Roo Rogers are right in their recent book *What's Mine is Yours: The Rise of Collaborative Consumption*, we can expect a rise in peer-to-peer car sharing. P2P car sharing turns any owner of an automobile into a single-vehicle car rental company, with reservation services provided online. Right now one of the US operators, RelayRides from San Franscisco, installs technology to lock and unlock the vehicle using a near-field communication card that the renter-member keeps in her purse, meaning that key exchange does not require owner attention. That's a start.

Traditional car-share operations such as ZipCar lower automobile ownership, reduce demand for parking space, reduce automotive miles traveled, and likely reduce traffic congestion in peak times. P2P car sharing offers all these things – and more. VMT supply can be increased dramatically without investing in more vehicles, car owners can have their neighbors make their car payments for them, it can make a greater variety of vehicle sizes and types available to a car share renter, and the vehicle storage depot problem mostly goes away.

While traditional car sharing has economic incentives for people who only need occasional access to a vehicle, P2P car sharing has economic incentives for car owners. This is disruptive, making it something to watch.

The key to P2P car sharing work is trust. You need to trust that my car will be clean, safe and operational and I need to trust that you will respect my property. Trusting strangers from whom you might buy something is well managed with online purchasing from auction sites such as eBay or the used book jobbers that trade on Amazon. If you rent your car online – as you would if you were a car owner in a P2P car share transaction – your reputation (well, your car's reputation) will be gleaned from your users by the site that manages the transaction. But what about the renter's reputation? After all, you will not want your car to be subject to automatic speeding or red-light tickets and parking fines. How will you know if a renter abuses your accelerator or clutch?

There's other things such as insurance and perhaps wanting a different rate from someone who uses your car to drive a hundred highway miles versus someone just driving a few miles to visit his auntie.

Telemetrics systems can address all of this. An in-car meter that measures speed, braking and steering could automatically establish a driver's reputation for the car owner. While there is no need to track the driver, the driver-style can be calculated as a reputation factor and the car owner can decline or accept further rental requests based on that reputation. While we are at it, the same meter can manage distance traveled, usage-based insurance, even parking payment, bridge or tunnel tolls, and so on.

What is now possible is for P2P car share operators to equip a member's vehicle with a meter sufficient to calculate the entire trip cost on an equitable usage basis for automatic billing and permit the owner to select driver style thresholds, so that she need not be concerned with any of these issues. Collaborative telemetrics could make P2P car sharing the 'killer app' of 21st century automobility.

> Peer-to-peer car sharing turns any owner of an automobile into a single-vehicle car rental company, with reservation services provided online
>
> **Bern Grush, principal, Bern Grush Associates, Canada**

A world of opportunities from AET

What happens when the road is tolled and there are no toll booths anywhere in sight for the motorist to pay the toll. A world of new opportunities emerges, that's what. In 2009, the Golden Ears Bridge (GEB) brought All Electronic Toll (AET) collection to British Columbia, and in doing so turned the anonymous cash user of yesterday into the pay-as-you-go customer of today. This shift in the operator-customer relationship has far-reaching impacts for the transportation industry in British Columbia… and North America as a whole. AET offers new and exciting opportunities for innovation.

Tolling has evolved from the days of manual collection of tokens, tickets, and cash to innovative technologies that place customer convenience as a top priority. Automatic vehicle classification (AVC) based on lasers and/or loops, multi-protocol automatic vehicle identification (AVI) systems, license plate reader (LPR) systems, vehicle signature recognition (VSR), and optical character recognition (OCR) are just some of the systems used to implement an AET system.

These technologies allow very high-speed capture of transponders, license plate images, vehicle identification and classification so that the motorist can drive the tollway and pay their tolls at highway speeds without any interference.

British Columbians were accustomed to paying tolls in the traditional manner at the toll booths from yesteryear – the Coquihalla Highway, the section of Highway 5 south of Kamloops, British Columbia, for example, was tolled until 2008. However, the introduction of AET on the Golden Ears Bridge facilitated a seismic shift in the local tolling culture in BC, as not only was it the first tollway in a densely populated urban area, it also represented a fast-track bringing British Columbians into the future of the transportation industry.

Components of AET

The AVC, AVI, LPR, and OCR within the GEB's AET system accurately identify and record vehicles for the purpose of toll collection processing. Each vehicle crossing is given a 3D measurement by the lasers and then captured 24 times by the 40 cameras hanging from the gantry. If a transponder is present in the vehicle, it will be read and attached to the transaction before being sent to the back office for processing.

Once the transaction has reached the back office, transaction management will then identify the customer and account via the transponder or OCR read, and apply a toll fee based on the size classification of the vehicle and the registration type of the customer. If a vehicle does not exist in the database, owner information is obtained via a direct link to ICBC (Insurance Company of British Columbia), which manages all vehicle licensing for the province. A similar AET solution will be implemented on the Port Mann Highway 1 project in 2012.

A variety of technologies, including ALPR cameras, is used to identify and classify vehicles

Exceeding requirements

The system, designed, implemented, and operated by VFlow – a consortium made up of Egis Projects, CSSI, and Sanef) – has exceeded all contractual requirements in performance accuracy, including 99.9% identification of vehicle presence, 97% vehicle classification and 99.5% transponder identification. In

READER ENQUIRY NO. 518

Need to know?

AET is paying dividends for users on the Golden Ears Bridge, although the best is yet to come for the toll operator

- How the identification technologies inherent in AET allow toll authorities to know their customers – and the benefits this knowledge brings
- Reduces the time to cross the Fraser River by 20 to 30 minutes
- Designed to manage 50 million annual transactions, the system is scaleable to incorporate additional gantries
- TransLink, the toll operator of the Golden Ears Bridge, recorded approximately 850,000 bridge crossings in June 2011

ETC allows users to pay their tolls without needing to stop at booths

two years, it has recorded over 1.5 million unique vehicles among 900,000 customers, sending out five million statements in the process.

Know your customers

The customers of the GEB are concentrated in Metro Vancouver, within 50km of the bridge, although they range as far afield as Ontario, California, and even Mexico. Some of these customers are daily commuters, while others travel more infrequently during evenings and weekends. Some customers drive one car during the week and another at the weekend. Some just hop across for a specific reason while others go just one way as a detour.

We know more than ever before about the previously anonymous cash user. We know where they live, what vehicles they drive, and when they drive them. But more than that, we also know when and how they like to interact with us – whether it's in person, on the phone, through the interactive voice response (IVR) or via the website (www.translink.ca). We know if they prefer to pay cash, debit, credit or via online banking for their services. We know whether they prefer to pay up-front or after services have been rendered. We know exactly who the good debtors are, as well as the bad ones. And we know how all these parameters interact with each other, allowing us to clearly define our customer base on whatever level we choose. In short, we know our customers.

The impact of truly knowing your customers is well known by other service industries. Financial institutions, communication service providers, and intelligent device manufacturers – to name but three – have been using in-depth knowledge of their customers for years in order to provide a whole range of goods and services unimaginable just a few decades ago. The extent and breadth of services on offer from these industries is just mind-blowing. And now, with AET, the transportation industry can obtain their share of the market.

AET within the bigger picture

There are many opportunities available to the transportation industry as a result of the introduction of AET. Consider, for instance, targeted marketing, smart applications, travel information, value-pricing, and remote account management. Also consider congestion management, tolling interoperability and fleet integration, merchant services, collections, parking, taxi, ferry, and airport integration. And if that's not enough, have a think about law and DMV enforcement, address verification, certification and testing, and unbankable customer management.

Such opportunities have created an attractive new market for interested parties. Recognized leaders from across the service spectrum want their share of the transportation market and they're bringing with them vast resources and expertise. This market competition should be great for the industry. It will enable us to evolve and develop and reach new heights previously unimagined. The future of the transportation industry has arrived.

Contact

Egis Projects
+33 1 30 48 48 09
contact.egis-projects@egis.fr
www.egis-projects.com

One size does not fit all in road weather

Nearly 40 years ago, one of the first ITS concepts moved from the design table to reality – road weather information stations (RWIS). The technology has since been a major part of the decision process of many road maintenance authorities. Innovations over the years have continued to improve the effectiveness of RWIS and many other maintenance tools used by decision-makers. The advent of the information age created an overload of information in so many critical jobs. To make matters worse for road authorities, many have begun losing experienced supervisors that had this decision-making experience in their head. What has resulted is a need for more comprehensive maintenance decision support systems, known today as MDSS.

Maintenance decision support is not a new concept, depending on how it is defined. RWIS, pavement forecasts, thermal mapping, weather radar, and radio reports from the field are all a form of weather decision support. Decision support is any technology that aids in the decision-making process. The simplest and most basic form of decision support is watching the weather forecast on the television. Simple and easy to understand, it does provide some support in making a decision, but not to the level we can achieve today. Solutions now go much beyond the basic TV forecast. Today, these MDSS solutions can include roadway treatment recommendations based on the operations of the agency. Around the world, these agencies use solutions such as this as a guide to aid their own decision-making. The system must know current road conditions, forecast weather conditions, and current activity of the agency to provide the recommendation in real-time throughout an event. The solution works alongside the decision-maker, disseminating the information coming in from various sources and providing tactical focus. MDSS is meant only to be a tool, and does not replace the decision-maker, because only the human brain can truly make consistent, accurate decisions. The MDSS is also not used as a policy-maker, or as a 'follow it or else' mentality, ensuring the final decision rests in the hands of the supervisor.

Need to know?

Introducing a new service for more efficient and timely decision-making to improve winter road maintenance

- Enables collection, quality control and archiving of data, customized forecasting, and display of information collected from various sources, such as RWIS, radar and satellite
- RoadDSS offers a number of interface levels so that users can choose the service most closely suited to their operations
- Adds new functionality and combines Vaisala's existing winter road maintenance products into one solution

RoadDSS Navigator software from Vaisala

True problem solver

Aside from the weather, the economy seems to be about all anyone is talking about these days. Reducing budgets has become a major objective and goal of many agencies. When the conversation within an agency turns to trimming the budget, one of the first things to fall victim to any slashing are tools used to manage winter weather. A paid weather forecast is an excellent example. 'Why do you need to pay for a forecast when there are free ones all over the internet?' is something repeated by agencies around the world. Alternatively, maybe it is a pavement temperature sensor in a truck: 'can't you make this old one work another year?'

Without information on their usefulness, these tools will fall out of their budget. And when winter arrives, what will they do? The irony of the entire situation is that these tools were created – and have been proven repeatedly – to save money. It is like destroying the lifeboats and floatation devices on a sinking ship, and wondering how you are going to survive. The key to remember is these tools actually save as much as 10 times the amount of money they cost.

During the past 40 years of road weather solution development, there has been one consistent theme – there is not

READER ENQUIRY NO. 519

Being prepared for extreme weather is key to keeping traffic moving

one tool that provides the 'end all' answer. Each agency may have different requirements, political and social environments, climates, and different demands placed on them, and they may be neighbors. These differences cause agencies to have unique needs to solve their problems. Thus, how does a single MDSS solution make any sense?

Experience counts

One expert in the industry that has led many of the advances in technology is Vaisala. A world-leading authority in weather sensor technology for the roadway since the beginning, the company is now turning its attention to the software side of decision support. Software is nothing new for Vaisala either; the company has years of experience with ICE and SCAN (formerly Surface Systems) software solutions for much of the past 30 years. "At Vaisala, we are always trying to understand the needs of our customers, and right now we see a need for better decision support options," explains Paul Bridge, roads offering manager. This vision has led Vaisala to develop the RoadDSS Software Suite – a unique approach because it is not just one software solution, but several levels of software combined under one product umbrella. The advantage of this is it allows the customer to tailor a solution that fits their needs. Even within an agency, they can select different levels of software depending on the type of job responsibility and level of decision-making. The first tier of the product is simpler to use, thus requiring less time for training and integration into the decision process. The higher levels involve more data such as combining weather radar and road conditions in a single display. This combination makes decisions easier because more of the information is combined together, and reduces the cost of having multiple systems. The highest level of the product offering involves the RoadDSS providing treatment recommendation based on the agency's own needs and policies.

"We are truly excited about this tiered software approach," Bridge concludes. "RoadDSS does not try to meet the needs of all users through a single platform: instead it allows our customers to tailor a solution to meet their exact needs." ○

Contact

Vaisala
+1 877 824 7252
jon.tarleton@vaisala.com
www.vaisala.com

Township reaps benefits of new ITS

Cranberry Township in the USA is one of the most accessible areas of western Pennsylvania, the rural-style road network of which and the transportation it provides being a vital component of the city of Pittsburgh and the state's overall commerce. However, its transportation issues have presented unique challenges resulting from the state of Pennsylvania's restriction on building roadway capacity – i.e. road expansions or constructing new roadways.

Located near the intersection of Route 19 (Perry Highway) and Freedom Road (continues as Route 228 to the east of Route 19), Cranberry manages one of western Pennsylvania's busiest pairs of intersecting corridors – the freeway-centric intersection that provides access to both I-76 (Pennsylvania Turnpike) and I-79, Freedom Road/Route 19 intersection (located directly between I-76 and I-79), which sees as many as 100,000 vehicles each weekday. Additionally, the township owns and maintains approximately 112 miles of roadways that intercept the Western Pennsylvania Transportation Network, serving as collector roads for all types of residential, commercial, and industrial developments.

Need to know?

How the arsenal of ITS tools in Cranberry has expanded in response to growing volumes of traffic and advances in signal technology

- Analyzing how grants, developer partnerships and special business arrangements are advancing traffic management in Cranberry
- Building a system now that will accommodate the growth in traffic anticipated over the next 15 years
- How technology keeps traffic flowing in an era of declining funds for roadway capacity expansions

(Right) **Traffic operations personnel are delighted with the new system** (Below) **The busy Freedom Road/Route 19 intersection**

Cranberry blossoming

Cranberry has witnessed a rise in population from 1,000 residents in its 25-square-mile area in 1950 to more than 28,000 today. This includes a population growth rate near 60% since 1990, largely attributable to the 1989 opening of I-279 north, which cut travel time between Cranberry and Pittsburgh from around 60 to around 30 minutes. In 2010, Westinghouse Electric Company completed its world headquarters move to the township, placing additional transportation pressures on Cranberry and surrounding communities. Expected to create 2,000 jobs in the area, the Westinghouse HQ relocation actually created 5,000. This culmination of growth pressures placed a heavy urban-level traffic burden on the area's country roads.

Cranberry and its partners applied for and won a grant for the purpose of traffic efficiency. With permission from the state of Pennsylvania to use US$600,000 for a new centralized ITS solution, traffic authorities started to formulate an ITS plan.

Seeking to address long-term transportation goals – a 15- to 20-year program that anticipates a population of 50,000 by 2030 – township officials knew that facilitating traffic management through smart technologies would be the only solution as, similar to many other places, building additional roadway

The centralized ITS allows operators to keep a close eye on traffic in Cranberry

READER ENQUIRY NO. 520

capacity is not an option. By deploying a comprehensive ITS solution in 2010, which includes upgrading from a closed-loop system to a centrally based system – Econolite Centracs ATMS, video, LED signals, as well as a more robust fiber-optic Ethernet communications network – Cranberry was able to interconnect 27 out of 52 area signals (39 operated by the township) across four municipalities, with a plan to interconnect 34 by early 2011. This is up from just nine signals operated in 1996, and only four signal zones until 2010 when the new ITS system was deployed.

According to the traffic study conducted by Whitman, Requardt & Associates, along the Route 19 and Freedom Rd/228 corridors weekday evening commutes created the most congestion. Average delays exceeding 13 minutes with a +200% increase in stops per vehicle (versus weekend travel times) were found. Compounded by left-turn cycle failures (whereby a vehicle waits through an entire green phase without passing through the intersection), this caused substantial blocking and traffic spillback problems during morning and evening commutes. Preliminary results of the new ITS system and signal-timing strategy indicate a two-minute decrease in travel time per vehicle. Multiplying this decrease by the 100,000-vehicle volume that these corridors see each day, the initial improvement is substantial. Comprehensive post-project travel-time studies are currently underway, but it is projected to yield at least a 16% improvement in travel times, and as much as a 28% reduction in delays.

Improvements

The centralized system has improved the overall quality of life not only for Cranberry Township constituents but also those beyond the immediate area, as well as for all of the motorists who drive its arterial roadways, through less traffic congestion, vehicle emissions, and travel-time delays while increasing roadway safety and productivity. Moreover, the reduction of vehicle stops, emergency response times, and congestion have helped to restore some of the 'small town feel' that was much of the township's character many years ago.

This project is an excellent example of how ITS systems can be successfully deployed despite the limitations associated with roadway capacity construction, agency size, jurisdictions, and fiscal budgets. The project also highlights the effectiveness of being creative in securing funding. By targeting project-specific information and smart-based technologies funding, substantial benefits can be achieved that are far reaching and that positively affect entire regions, not just the roadway users traveling through the project corridors.

In addition, it should be mentioned that the relative ease of system deployment and effectiveness was in large part due to the partnership with Econolite and Path Master. Understanding the township's ITS objectives, communications infrastructure and previous closed-loop system, Econolite and Path Master took the initiative to work closely with the region's traffic operations personnel and install new equipment and software, as well as integrate the intersections and launch the centralized ATMS. The system training Econolite provided also helped enable a smooth transition to the new system.

Together, the partnerships and ITS deployment in Cranberry helped reinforce the use of smart technologies in transportation to optimize the state's transportation systems. This means instead of building more roads, adding more lanes, and increasing road capacity through construction, it continued the philosophy of leveraging smart technologies to increase efficiencies and optimize existing roadway infrastructure. This ITS philosophy is now a major factor in the state's transportation funding decisions.

Contact

Econolite
+1 714 630 3700
sales@econolite.com
www.econolite.com

Wireless systems for agile networks

Recent advances in wireless technologies have given rise to a number of new possibilities when it comes to data transfer. These latest connection modes have also made it possible to adapt field devices to specific situations, which may have previously required a great deal of networking and wiring in order to generate useful information to management centers.

This wireless evolution is a perfect fit for ITS equipment as the distances covered and the cost of communication and of wiring in power supplies outside of urban areas are particularly high.

In order to deploy a completely wireless ITS product at the roadside, it's necessary not only to employ wireless communications but also to integrate electronics systems that consume low enough levels of energy to be powered by a single solar panel, yet still be at a level high enough technologically to process the data they receive. This is the challenge that Neavia R&D engineers have been focusing on overcoming for some time.

After the commercial success of the company's wireless traffic sensor, EagleVia, Neavia's in-house experts decided to take advantage of the expansion of 3G/GPRS to design a wireless smart webcam for video surveillance. Known as WebLynx – a nod to the agility of this particular feline – when compared with wired cameras, advantages include a gain in implementation time, reduced cost, and a more environmentally friendly product. Without the need for trenching cables and making use of solar energy, it's possible to install devices where there is no power or communication network at all, such as on mountainous roads, bridges, and isolated rural areas.

More than a webcam

Wireless and smart, WebLynx has the capability to understand and process the images that it captures, making it a flexible product that can adapt to a range of customers' needs.

Transmitting images through the air is, of course, still a slower process than transmitting them via a fiber-optic medium, although in some cases it's nevertheless possible to transfer 10 to 100 images a minute, dependent on the picture resolution required. The WebLynx embedded system can also recognize specific events and deliver a video stream in a matter of minutes.

A direct interface with web applications allows data to be managed through client software to make it available at any location. As a result, a wide range of ITS applications can be designed that are accessible to road authorities and workers through TMCs or mobile devices such as smartphones.

Building wireless networks

Traffic and road monitoring network in mountainous areas: Mountainous roads are often a great distance away from communications and power networks so demand special attention from authorities. Featuring very narrow and winding passes, such areas are subjected to fluctuating weather variations more than anywhere else on the road network.

A wireless monitoring network is the ideal fit for such an environment. That said, electric power is an important consideration since you won't generate the same levels of solar power as on flatter ground due to sunshine levels and shorter winter days. Despite this, Neavia's very low-consumption systems have been proven to maintain network operations and transfer video flow continuously. This is best demonstrated on mountain passes in eastern France that are currently being monitored by a WebLynx camera and powered by just a single solar panel.

Traffic surveillance at border crossings: The free movement of vehicles within the Schengen Area – comprising the territories of 25 European countries that implemented the 1985 Schengen Agreement – has led to a consequent buildup of traffic at border crossings. In such areas, it can be beneficial for public authorities to obtain statistics on the nationality of vehicles crossing borders. Via WebLynx, an image stream can be transmitted to provide information about traffic state. Indeed, within the framework of a recent French project, webcams have already been installed on some borders. With a range of compatible lenses, WebLynx does lane monitoring as well as wide areas.

Workzone surveillance: Accidents in workzones have increased in recent years. In response, an advertising campaign was recently launched by the French ministry to raise public awareness about the phenomenon.

Workzones are inherently very mobile and thus demand traffic management solutions that are equally mobile and maneuverable. With this in mind, Neavia has designed a surveillance system that comprises a trailer-mounted WebLynx, the aim of which is to ensure the video surveillance system can move as the workzone itself moves. By watching the evolution of the construction works on the road throughout the day, authorities

READER ENQUIRY NO. 521

Using wireless technologies helps greatly in the design of agile video surveillance networks

Need to know?

The many and varied applications of a new, smart, communicative, and low-consumption webcam

- Comprising an optical block with two lenses, WebLynx is able to switch automatically from a day to a night mode
- Can be used for applications such as workzones or site surveillance, forests or water flood surveillance, and much more
- The way in which WebLynx deals with data helps generate alarms when unusual events occur; it's also able to memorize video sequences or images

can understand driver behavior and consequently deploy the most relevant safety measures. *Analyzing the state of congestion*: Congestion is easily detected via various forms of sensors, although it's still a challenge to sometimes understand how such traffic snarls occur. Video analysis by human operators can complement the information gathered by these sensors to help study vehicle flows, as well as learn about factors that cause congestion in the first place.

Being a wireless product, WebLynx is easily moved from one site to another and can record footage during a determined traffic cycle, for instance a one-week period, before being moved on to another location. This allows just one device to be deployed, with virtually no interruption to traffic when relocating the installation. In addition, a PTZ system allows users to view specific areas of traffic flow.

Traffic management tasks

Accurate travel time prediction: Transportation authorities in the South of France are perennially facing increasing traffic, the result of both commuters and vacationers. Neavia's solution for travel-time prediction combines WebLynx with data-processing techniques to identify a representative sample of vehicles and follow their path on a particular section of road, the result being the ability to predict travel times with supreme levels of accuracy. Congested areas in the South of France are currently being monitored with the tool and qualitative and quantitative information is being generated that is of real benefit for road users and managers.

Detecting wild animals in the road: Accidents involving wild animal crossing roads are not a rare occurrence in the isolated areas of central France. Collisions with animals have in fact become so frequent on rural roads that authorities have set up dedicated detection systems to address the problem.

A wired system is virtually impossible to install in such isolated regions, where there is often no infrastructure at all. Neavia's answer is a detection system using the WebLynx camera coupled with radar and IR sensors. As soon as a moving mass is detected, the behavior of which is different from a vehicle, WebLynx will trigger an alarm and send it either to the local roads management center or to a VMS in order to alert drivers with a message – 'Caution: Wandering Animal'.

Adding WebLynx to the sensor enhances the detection performance and reduces false alarms. Small animals such as rodents or objects moving in the wind don't trigger the alarm, for example. Moreover, as a result of the video footage, it is possible to study animals' behavior by analyzing, for instance, when they vacate wooded areas or which areas they frequent the most. An example of such a system is about to be installed in the alpine areas of France.

Contact

Neavia Technologies
+33 1 45 13 05 90
gilbert.chouity@neavia.com
www.neavia.com

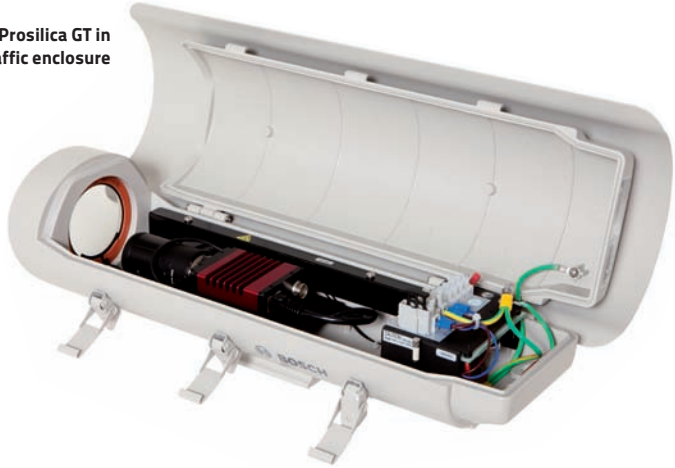
The continuously evolving camera

From open-road bridge tolling and inner-city congestion charging to speed enforcement and incident management, cameras are the essential component. Although analog variants remain widely used, an ongoing transition from analog to digital interface technologies is apparent. Increasing resolution and higher frame rate requirements have surpassed analog interface capabilities, while digital interface cameras can offer this level of performance without significant cost increases. A Camera Link or GigE Vision interface is commonly used for connecting a camera to a PC in demanding traffic applications such as tolling or enforcement. Both technologies provide high bandwidth to facilitate high resolution and fast frame rate transfer of uncompressed, low-latency image data continuously. GigE Vision offers additional benefits such as off-the-shelf Ethernet components for reduced integration costs and long cable lengths up to 100m on a single copper link or more using switches or fiber optics.

AVT's latest camera, the Prosilica GT

From Gigabit Ethernet to GigE Vision

The popular Ethernet networking solution was initially developed by the military and scientific communities to implement a distributed network intended to improve communication efficiency and network reliability. By the early 1990s, internet service providers began to emerge. We have since seen the internet propel Ethernet hardware into every single computer built today, redefining the method and speed of communication. Gradually supplanting Fast Ethernet, Gigabit Ethernet was introduced by 1999 and became very common and economical within several years. Camera companies quickly recognized this technology as an appealing interface for their solutions due to off-the-shelf components, high bandwidth and cable length. In 2006, the Automated Imaging Association (AIA) introduced the GigE Vision standard, which ensures that third-party software, hardware and other off-the-shelf system components interoperate over an Ethernet network for an easy and low-cost solution. Many camera manufacturers are today offering GigE Vision cameras with resolutions ranging from VGA (0.3 megapixel) to 29 megapixel – one of which is Allied Vision Technologies (AVT).



The Prosilica GT in a traffic enclosure

Seeing is believing

Regional demographic changes, the increasing number of vehicles on the road and the ongoing development or modernization of infrastructures are a constant challenge for any ITS integrator. Manufacturers such as Sony and Kodak are racing to develop sensor technologies that help enable these applications through improved sensitivity and better imaging performance. ExView HAD technology from Sony, for instance, became recognized for excellent low-light sensitivity and IR response with the introduction of the ICX285 device. Open-road tolling and congestion charging applications, in particular, became primary users of cameras that employ this sensor, favoring the resolution, aspect ratio and frame rate of the device. Sony has recently added two new devices to the ExView line-up – the ICX674 and ICX694 – which provide the same image quality and sensitivity benefits as the ICX285 while doubling resolution and frame rate.

In parallel, camera vendors battle for market share through early adoption and

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implementation of the sensor while developing new camera capabilities most suitable for the desired target market. AVT, for instance, has recently released the Prosilica GT – a camera family specifically designed for the ITS and outdoor imaging customer.

Remote iris

Existing lens controls such as video auto iris designed for continuous imaging are inadequate for asynchronous triggering often used in tolling and speed enforcement applications. This is because video auto iris lenses – originally designed for analog interface cameras – rely on a continuous video reference signal to change the iris opening. A digital interface camera operates in the digital domain, allowing users to synchronize image capture with real-world events such as a passing vehicle. To address this scenario, Kowa Optimed has developed the P-iris lens control, denoting precise iris control. These lenses allow users to move and freeze the iris at a desired location using a stepper motor. This capability allows asynchronous image capture to be used with digital interface cameras and remote lens control. On bright, sunny days, this can be used to manage blooming and smearing inherent to CCD or shutter inefficiency experienced by CMOS. During cloudy conditions the iris can be opened to minimize exposure time and prevent motion smear images. This enables the camera to achieve a range of camera adjustments without any additional lens components reducing system cost, size and weight.

The cameras are specially tailored for demanding ITS applications

Need to know?

Advances in camera design and technology are allowing traffic engineers to do more with less out on the road

- Why the ITS industry is continuing to embrace digital interface cameras
- How new sensor technologies will improve sensitivity and imaging performance for ITS integrators
- The development of the Prosilica GT family of cameras for ITS and outdoor applications
- How GigE Vision and other digital interface cameras offer higher resolution and faster frame rates

GigE Vision ITS cameras

The Prosilica GT camera family aims to answer many ITS integrators issues: how to capture consistently high-quality images in varying climates and lighting conditions.

The Prosilica GT are GigE Vision-compliant cameras that are able to operate in extreme temperatures from -20°C to 65°C with a ribbed heat sink-style enclosure that ensures conduction cooling of key components and maximizes heat dissipation. A DC auto-iris/P-iris port for motorized lens control supports cooperative management of gain, exposure and iris. The Prosilica GT camera family features Power over Ethernet (PoE), a technology that supplies image data and power across the same Ethernet interface. Models featuring a selection of highly sensitive sensors with resolutions from VGA to six megapixel and frame rates up to 120fps are currently available. All models boast a number of in-camera features including configurable I/O to synchronize the image-capture process with traffic system peripherals, low-latency trigger for timely image capture, and IEEE1588 Precision Time Protocol used to manage clock synchronization of multiple devices across an Ethernet network and much more.

What's next for ITS cameras?

Although ongoing transition from analog to GigE Vision and other digital interfaces is sure to continue, demand for increased resolution and faster frame rates, along with new camera peripherals, is on the rise as well. Camera installation and maintenance costs are motivating integrators to reduce the number of camera installations. In an open-road tolling concept, a single camera could replace multiple lower resolution devices to reduce system complexity, sources of failure and required infrastructure. The replacement camera must offer the same level of performance as the previous system, which means higher resolution and faster frame rates. Growing acceptance of digital camera technology is motivating optical companies to improve existing motorized lens control schemes.

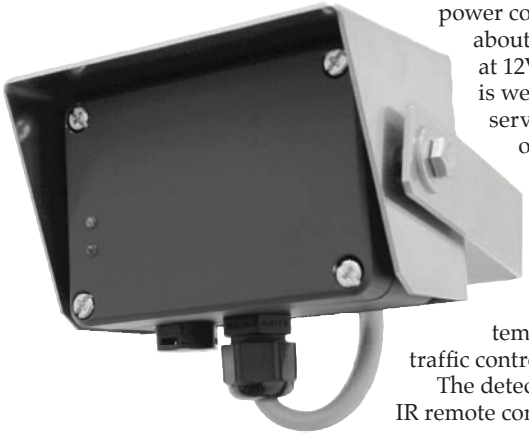
Contact

Allied Vision Technologies
+1 877 872 1394
sales@alliedvisiontec.com
www.alliedvisiontec.com

Next generation of traffic detection

READER ENQUIRY NO. 524

ADEC Technologies has announced the release of a simple short- to medium-range traffic detector. The Doppler radar-based detector stands out through its rather unique accessory. Markus Güntensperger, product manager at ADEC Technologies, comments: "The commissioning interface of any detector often leads to a compromise between longevity and versatility. We felt that neither DIP switches nor additional connectors optimally serve the temporary nature of the commissioning task. A simple IR remote control device does." Besides the novel approach to set application specific parameters via IR remote, the device features a detection range up to 30m (100ft) at an opening angle of 25°. Output is provided via SPDT relays and a feedback LED on the front. It can be powered from a wide range of supplies, accepting 5-60VDC or 24VAC. Combined with the relatively modest power consumption of about 600mW (50mA at 12VDC), the detector is well positioned to serve in a wide range of applications – from grid-powered, permanent installations to battery-powered temporary traffic control systems.



The detector, using the IR remote control, can be configured for various application specific settings. Low-speed thresholds can be set to 4kmh or 8kmh (2.5mph or 5mph). The traffic direction to which the detector triggers can be set to approaching, receding or bi-directional. In addition, the detection range can be set to 15m or 30m and the output feedback LED on the front of the housing can be deactivated. The device also features an auto-trigger that activates the output every 2.5 minutes even when no vehicles are detected. The detector features two LEDs on the front of the housing, one of them is used as output feedback. The second LED informs about updates to the configuration via IR remote. Typical applications include green-phase requests at traffic lights (mobile and stationary), speed dependent detection of vehicles and auto-operation of doors and gates.

Contact

ADEC Technologies
+41 55 214 2400
info@adec-technologies.com
www.adec-technologies.com

A green aproach to speed monitoring in Abu Dhabi

READER ENQUIRY NO. 525

Aware of the importance of sustainable development in Abu Dhabi, Morpho (Safran group) has designed a solar-powered, weather-resistant speed monitoring solution to tackle the Emirate's road safety challenges.

Following unprecedented economic growth and a rise in its population, Abu Dhabi has seen an expansion in vehicle ownership and an increase in road accidents over the past 10 years. With speed monitoring at the heart of their concerns, the Abu Dhabi Police authorities chose Morpho to supply, deploy, and maintain a network of MESTA 2000 automated fixed speed cameras and violation processing stations on a motorway in Abu Dhabi.

A major constraint in the project was Abu Dhabi's extreme weather conditions, requiring equipment that can resist extreme temperatures. The Abu Dhabi Police also needed a viable solution based on a sustainable energy source, eliminating the need for electrical infrastructure. Morpho rose to the challenge with its MESTA 2000 which was tailored to meet the project's requirements. The result was an automated solar-powered speed camera solution capable of operating both day and night in temperatures of up to 70°C.

Thanks to the flexible and scalable architecture of Morpho's equipment, the company is able to incorporate new technologies and adapt existing functionalities in line with the fast-changing requirements of the road safety sector. A case in point is the solution deployed in Abu Dhabi where the MESTA 2000 camera was customized to meet the customer's specific requirements. Powered by solar panels, this integrated solution combines Doppler radar technology and ALPR.

When a vehicle is caught speeding, the system automatically captures two HD color images of the violation and creates a violation message. The message is then encrypted and transmitted to the violation processing station. The ALPR function enables the stations to identify the license plate number in order to mail a speeding ticke to the owner.

Through its local branch, Morpho has equipped the Abu Dhabi Police with a comprehensive solution and continues to provide support, with training of maintenance staff and a hotline to handle queries.

Contact

Morpho
+ 33 1 58 11 87 44
caroline.meunier@morpho.com
www.morpho.com

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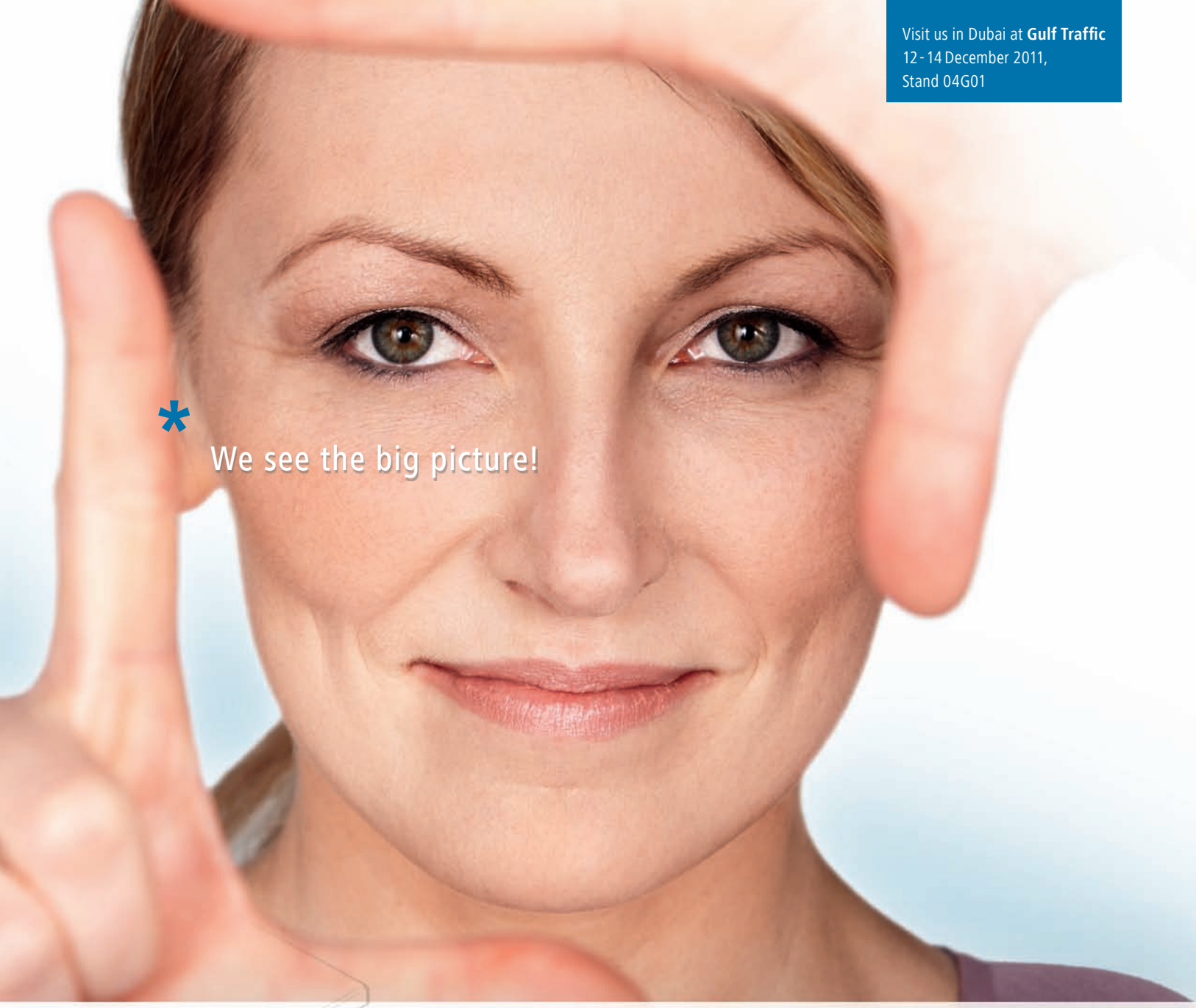

Danuta, Assistant Administration Manager

MASTERING COMPLEX PROCESSES

Everything needs to be seen in the bigger picture, not just a collection of parts. This includes project planning, implementation know how as well as back office processing abilities. Using our deep knowledge of the enforcement chain, we have developed modules for all relevant processes. Traffic Service Providing is a one stop shop for end-to-end traffic law enforcement solutions.

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