traffic
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20 YEAR Anniversary
February/March 2014
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PLUS

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Why the parking sector particularly needs to prepare for the arrival of the game-changing driverless car

Gaining by maintaining
The best in the asset management business explain how to get more from your money – and your tools

George Lee, RSMA
"Not enough pressure is placed on main contractors to ensure road markings are prioritized"

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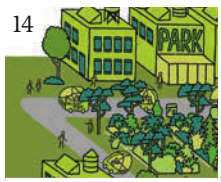
Cover story

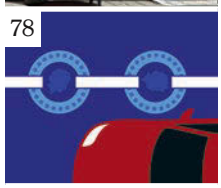
68 Island records

Traffic management in isolated regions can be a complex task

Louise Smyth discovers how ITS deployment is enabling islands to overcome unique challenges

Features





Interviews

Regulars

In **This** Issue

Technology Profiles

Foreword

We've cracked open the Champagne, baked the cake and have the candles at the ready… And if the rosette on our cover hasn't given the game away, let me tell you that we're celebrating here in *Traffic Technology International*'s control room. Some, perhaps, because this is my final issue in the editor's chair (which I've finally broken-in, hence will be taking with me!), but also as 2014 marks our 20th Anniversary.

And not for the first time in my eight-year tenure, the news gods have been kind by dropping a Double Whopper of a road traffic-related USDOT announcement onto my lap just before deadline. Inevitably it led to a last-minute content reshuffle. For the first time ever, I didn't mind a bit.

The February 3, 2014 declaration that the USDOT and NHTSA will be surging ahead to create a rule to mandate vehicle-to-vehicle technology is a game-changer (p4). Indeed, as NHTSA's acting administrator, David Friedman, said himself, we will likely look back on this period in particular as one in which "the historical arc of transportation safety considerably changed for the better". But it's also a game-changer for advanced traffic management, for congestion mitigation, for emissions reduction, for our daily commutes, quality of life, our economies – maybe even a game-changer for tolling and the way we finance our transportation infrastructures.

The industry has been researching that little box of 5.9GHz magic for several years, but in reality we haven't scratched the surface of the potential. USDOT knows this. Early results from its Safety Pilot Model Deployment must be very positive for Secretary Foxx to have come out with such strong support to initiate this car-to-car revolution, especially given the demand for the bandwidth. His thumbs-up took some by surprise.

"Historically, with NHTSA mandates, NHTSA has said it's going to do it, and by the time it does it, it's pretty much done [voluntarily by the marketplace] because they knew the rule was coming," stated ITS America's Scott Belcher a few weeks before the announcement. "I think we'll be somewhat disappointed [with the decision] because I don't think it will be as firm a signal as we would like." Belcher couldn't have hoped for a stronger message. What happens next, of course, is another story. But the first chapter is written. And I can't wait to read how it concludes.

We've always looked forward in these pages – the content of our launch edition is proof of that – but over the coming issues you'll find us gazing back, too, as we raise a glass to 20 years covering this amazing sector (p6). I'm personally pretty chuffed to have been in the driving seat for almost half of that time. But you don't get rid of me that easily; I'll be making the occasional appearance in a writing capacity. And I am certain you'll continue to enjoy the read. I know I will…

Nick Bradley, Editor-in-chief

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SEEING IS BELIEVING

Decisive action

Lloyd Fuller gauges the industry-wide excitement following the USDOT's groundbreaking decision to work toward a rule mandating V2V technologies

Decades from now, we'll look back on February 3, 2014, as the date the US Department of Transportation (USDOT) said enough was enough. "One of our administrators described it as literally a 'moon shot'," commented Secretary Anthony Foxx, addressing the world's media recently in Washington DC. He is, of course, referring to the USDOT's decision to pursue Vehicle-to-Vehicle (V2V) technology and for NHTSA to create a rule that will eventually see 5.9GHz communications deployed in every new vehicle that rolls off the production line.

"Four decades ago, when Lyndon Johnson signed the order to create the USDOT, it read that the Secretary should give top priority to the safety of our people as they travel by land, sea and air. And that's exactly what we're doing today at the USDOT," Foxx added.

"After years of working with industry, stakeholders – as well as with our own research teams – we are taking steps to unleash the power of American innovation by putting new technology in cars and trucks that could save thousands of lives – and even prevent accidents in the first place."

Motor vehicle crashes remain the leading cause of death among children and young adults in the USA, with approximately 33,000 people killed and 2.3 million injured each year on the country's roads. "While the auto industry has made great strides to reduce fatalities and injuries, the next giant leap is to enable real-time communication between vehicles and with the world around them, so crashes can be avoided altogether," said Scott Belcher, president and CEO of ITS America, in response to the news.

"This represents a significant step forward in advancing the next generation of vehicle safety and automotive innovation. It's a safety leap exceeding even seatbelts and airbags. The vision of 'talking' cars that avoid crashes is on its way to reality. This will unleash a new wave of innovation from advanced traffic management systems and smart mobility apps, to real-time traffic, transit and parking information."

Saving lives, though, is the number one aim. "Think of all the everyday situations that this technology could help with," Foxx posed. "When folks pull up to a four-way stop; driving behind a truck or an SUV that limits your visibility; or even making a lane change as a car moves into your blind spot. By helping drivers avoid crashes, this technology will play a key role in improving the way people get where they need to go, while ensuring the USA remains the leader in global automotive safety."

"The news was indeed encouraging," enthused David McNamara, president of McNamara Technology Solutions – an expert on active safety and wireless technology. "Since 2003, I have followed and participated in the development of DSRC and these safety and mobility apps. The key statement is that 'NHTSA will then begin working on a regulatory proposal that would require V2V devices in new vehicles in a future year, consistent with applicable legal requirements, Executive Orders, and guidance'. The key word there is 'require'. Similar to all policy and regulatory action, the devil will be in the details, and it will be vital to see at what pace in which the details are made known to us."

ITS America's Scott Belcher also thanked the Federal Communications Commission (FCC) chairman, Tom Wheeler, for his commitment to ensure that the 5.9GHz band – which supports V2V communications – remains free from interference. NHTSA estimates that connected vehicle technology could potentially address 80% of all unimpaired crash scenarios. "While we are working closely with our partners in the wi-fi industry to explore the potential for spectrum sharing in the 5.9GHz band, we are thrilled that Chairman Wheeler is outspoken in his commitment to putting safety first, while we examine potential solutions," Belcher stated. "It is critical that efforts to open up additional spectrum do not come at the expense of life-saving technologies. And as automated vehicles begin to be rolled out over the next decade, vehicle-to-vehicle communications will be critical for preventing crashes and enabling drivers, operators and traffic managers to navigate this brand-new world more safely and efficiently."

Next steps

NHTSA is currently finalizing its analysis of the data gathered as part of its year-long pilot program – the Safety Pilot Model Deployment in Ann Arbor, Michigan – and revealed that it will publish a research report on V2V communication technology for public comment. This will include analyses of the Department's research findings in several key areas, including technical feasibility, privacy and security, and preliminary estimates on costs and safety benefits. NHTSA will then begin working on a regulatory proposal that would require V2V devices in new vehicles in a future year, consistent with applicable legal requirements, Executive Orders, and guidance. USDOT believes the signal this announcement sends to the market will markedly enhance development of the technology and pave the way for market penetration of V2V safety applications.

2014 could see the UK's DfT conduct vehicle platooning trials. Ricardo is leading the feasibility study, which involves TRL

> "Early indications point to V2V having the potential to help drivers avoid 70-80% of vehicle crashes involving unimpaired drivers
>
> *Secretary Anthony Foxx, US Department of Transportation*

Twenty, not out

Traffic Technology International celebrates its 20th Anniversary this year. In this first of a series, and after having pored over hundreds of articles going back two decades, **Nick Bradley** highlights a recurring theme – intelligent vehicles

1995

ITS/AHS TECHNOLOGIES

The two principal technological changes in the automobile/highway system expected in the next decade are the transition from the ICE for propulsion to an electric drivetrain, in which the key enabling technology is believed to be highway electrification, or the RPEV, and increasing automation of the driver functions through the introduction of machine intelligence in the vehicle and highway, or ITS and AHS. However, it is clear that considerable opposition is likely to arise

The electrification of our roads – as envisaged in this 19-year-old article about a US$11m Californian project – is still a hot topic today. Yet bar a few pilots, we're no nearer to it becoming a deployable reality. EVs, meanwhile, still have a lot of ground to make up before they come close to displacing the ICE…

1994

of intelligent autonomous vehicles and infrastructure related vehicle to roadside and vehicle-to-vehicle systems.

The technologies presented in Paris ranged from those which are likely to see extensive uptake by European drivers within the next 12 to 24 months through to concepts which appeared to be mildly adventurous with potential 15 year development periods still ahead.

Among the technologies expected to be on the market in the near future were a wide variety of dynamic in-vehicle route navigation systems which incorpo-

1997

CLOSING NOTE

We close with a final word from Dick Bishop on the achievements demonstrated in San Diego: "We changed the world. Literally. Several thousand people came to San Diego, with widely varying opinions about the viability of vehicle-highway automation. They left with a larger sense of what is possible, and knowing that the technology is fully up to the task."

The National Automated Highway Systems Consortium (NAHSC) Demo '97 event in August 1997 was a landmark achievement in showing what could be done with the available technologies of the time. Today, of course, autonomous strategy focuses very much in-vehicle – driving on any road, anywhere…

1998

with universal acclaim, though they are now accepted by almost everyone. However, there is a small section of the population that views EVSC as a system that will thwart the right to total freedom when driving. While the concept of having the right to break a law at will is interesting, and I will not discuss it further here, they might change their mind when they become aware of the potential safety benefits.

2006

VII is moving forward regardless, but technology will not be the barrier: what will be are human factors, cost to the vehicle purchaser, use of industry standards and the capability to reduce legal exposure. Sometimes things can be over-automated and the sheer complexity results in risks of both human and electronic errors. VII will likely evolve to successful demonstrations and a few of the technological successes may end up in production in a similar manner as the AHS program.

We are still in the infancy of future traffic

Longstanding contributor Bruce Abernethy was right in some respects with his predictions for VII in October/November 2006. But it didn't go the way of AHS – it became the Connected Vehicle program. And after the monumental USDOT announcement in February 2014, the story will continue. Legal exposure and liability remain the biggest hurdles to overcome.

2008

around in the utmost safety by autonomous vehicles, using our time to check email, read or take a nap?

"I believe in a future where autonomous features are the norm," Whittaker concludes. "How such features are used will evolve in time. There's a tremendous amount of engineering and refinement needed to make it a good product, but it's no longer a question of whether it could it be done – because it just has been."

Arguably the 'Godfather' of autonomous driving, Red Whittaker of Carnegie Mellon and DARPA fame was interviewed in our January 2008 edition. Little did he know that – seven years later – driverless cars (albeit prototypes) using much of the same technology that featured in his Chevy Tahoe 'Boss' would be driving legally on roads in Nevada, Florida, California and Michigan. More will follow…

2014

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Traffic Technology International's founder, Tony Robinson, reported on the Prometheus Board Member Meeting in Paris in October 1994, after getting to grips with Mercedes' "no-hands-no-feet" VITA II. Daimler engineers told him at the time the aim was not to replace the driver entirely, which no doubt pleased self-confessed car fanatic Robinson. Twenty years later, Google seemingly has other ideas!

External Vehicle Speed Control – known today as Intelligent Speed Adaptation – is under Peter Jesty's spotlight in this June/July 1998 article. The University of Leeds continues to research ISA and reports most drivers are in favor of speed assistance technologies, and acceptance increases as they gain experience of using the technology. Perhaps those giving the thumbs-up have had one too many speeding tickets?

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also entirely feasible that a significant
ists will still prefer to drive their vehicles
traffic make-up will be mixed, which in
e new roadway management problems.

What's clear from our more recent coverage of self-driving cars is the focus has switched from whether they're technically feasible to how we will manage them when they start rolling off the production line. And that will be our focus for the next 20 years…

Going back to the launch issue and IMPACTS

Proving we've always liked a good acronym, in the 1994 launch edition, Neil Hoose, now director of Bittern Consulting, authored an article about IMage Processing for Automatic Computer Traffic Surveillance. IMPACTS assessed how visible road space was being used at a specific moment in time rather than considering traffic on a vehicle-by-vehicle basis

How did IMPACTS turn out in the end? Unfortunately, it didn't make it past the initial field prototypes and never became a mainstream product. I think there were two main issues that went unresolved. The first was that the business case for the customers and – hence the case for further investment in product development – wasn't clear. As a result, it was difficult to create a viable business plan that would justify the extra development needed to address the technical problems encountered in the pilot implementations. Interestingly, no computer vision product has reached the market that delivers the output described in the article. There are successful computer vision products and suppliers able to address those applications where the technology has a real edge – e.g. tunnel monitoring, ALPR, data and stationary vehicle detection where other technologies cannot operate. But we still have many areas with extensive CCTV coverage where, for the majority of the time, the cameras are not being viewed or monitored. This is partly down to the technical capability not meeting customer requirements at a cost they feel is worthwhile.

How would you assess the evolution of traffic management since 1994? In the mid-1990s, we were in the throes of the transfer from analog technologies to fully digital approaches. Traffic management has similarly shifted from a very passive approach to much more active interventions. During this time we have seen many technologies such as CCTV, ALPR, electronic message signs and displays, smart cards and electronic payment tags all become mainstream. More active management techniques in respect of signal sequencing, variable mandatory speed limits and area road pricing (e.g. London and Stockholm) have become part of the transport manager's toolkit. What is perhaps surprising is that many of these are still acting in silos and that the system-wide, integrated use of these technologies is still very rare.

> "We actually have more capability from the technology available now than we can effectively use

The most significant ATMS contribution to the way we manage our roads? It's hard to pick one, but the biggest enabler in my view has been the change in communications technology. The growth in bandwidth coupled with the availability of mobile communications underpins so many applications we now regard as the norm. It has also enabled new forms of data – such as journey times and routes – to be available on a scale that was hitherto infeasible. The capability to exchange data with remote devices – fixed or mobile – with a high degree of reliability but at low cost has transformed the way road management can be performed.

What will be the big challenges in the future? We actually have more capability from the technology available now than we can effectively use. So the biggest challenge is to create the organizational arrangements and the human cognizance that can understand, deploy and manage large-scale, complex systems. The sort of capability being demonstrated in terms of autonomous control of vehicles, the connectivity of electronic devices and the sophistication of software means it is possible to build systems that can be highly efficient and safe. In doing so we are pushing the envelope and potentially reducing the resilience of the system so that when things do go wrong – which they inevitably will – the consequences are much more severe. Apart from a few niche areas, such as aerospace systems, the experience with owning, operating and maintaining such systems is lacking. If we are to realize the potential that many can see then the challenge we need to address is creating the soft structures, i.e. people and processes, which enable a 'systems' approach to the whole lifecycle of deployment, ownership and decommissioning.

So, take us forward: how will we be managing roads in another 20 years? At its core, I don't think it will actually change that much because the key challenges of safety, congestion and environmental impact are also likely to remain. The precise nature of these challenges will shift due to changes in societal expectation on deaths, the effects of technology and lifestyle changes on patterns of travel and changes in vehicle engineering such as electric and alternative fuels. I think there will be a continued shift to providing information via multiple channels to travelers to enable better choice, but many people actually have too many other constraints that prevent substantial changes in timing or mode. The main area of change will be in processing and interpreting the increased amount of data available. In particular, there will be an increase in algorithms that can interpret the qualitative data available from social media and create responses by the same channels. In my view, this will be driven by the need to improve the resilience of the transport system and to improve the response to major disruptions.

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Smart corridors

Given we can't go on building new roads, authorities around the world are making better use of the capacity they have. **Lloyd Fuller** picks out some recent deployments that are paying dividends

Washington State Department of Transportation has deployed a Bluetooth tracking system (47 readers) as part of its effort to study traffic congestion on the I-5 corridor around the Joint Base Lewis-McChord military installation. A time, date and location stamp will be recorded from the devices and uploaded to a server; the data will be combined with other traffic studies to determine how people use the regularly congested stretch of I-5. Typically, WSDOT uses a human to photograph license plates for these types of studies, but with such a large area under review, that was considered to be too labor-intensive. **Did you know? WSDOT expects the study will capture roughly 25% of vehicles using the corridor daily, which is statistically adequate**

(www.wsdot.wa.gov)

Congested development

The Illinois Tollway Authority is to introduce an active traffic management program on the Jane Addams Memorial Tollway (I-90). Similar 'smart corridor' technology used in Europe has resulted in an up to 7%

improvement in getting vehicles through congested areas, with a 3-30% decrease in traffic incidents, such as crashes, and an up to 50% drop in secondary incidents that typically involve a vehicle hitting another vehicle that has already stopped.

The Tollway Authority is introducing the technology on a section of the I-90 from the Kennedy Expressway to Barrington Road, as part of an improvement program that includes reconstruction and road widening. The rollout is expected in late 2016 when the widening project is completed.

"We can't keep building a lane every time congestion increases," commented Kristi Lafleur, executive director. "The changes should enable us to leverage more capacity of the roadway as a result of building it right. Staff at tollway headquarters will check cameras and traffic sensors to monitor the road more dynamically."

(www.illinoistollway.com)

The MIDAS touch

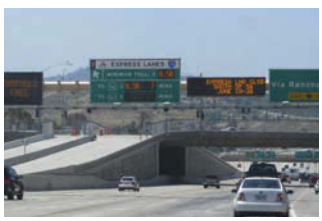
Major technology improvements have commenced on England's M62 in West Yorkshire. The £20m (US$33.4m) scheme is part of the UK government's £317m (US$529m) Pinch Point improvement program. The work involves installing electronic MIDAS (Motorway Incident Detection and Automated Signaling) loops in the carriageway to detect traffic flow – when it slows, warnings are automatically set to advise drivers of queues. These will be displayed on 13 verge-mounted electronic VMS. Nine CCTV cameras will also be installed to enable the HA's Regional Control Center to monitor and manage incidents as necessary. The new technology will also require 9.6km (6 miles) of fiber

optic cabling to be installed. "The new technology will relieve congestion and improve safety on this busy section of motorway, while providing drivers with more information," confirmed Thomas Howard, the HA's assistant project manager. **Did you know? MIDAS-based systems have been used across the region's motorway network for many years and have been successful in reducing the number of shunt incidents caused by stop-start conditions**

(www.highways.gov.uk)

The San Diego Association of Governments (SANDAG) has completed a successful 'Coordinated Test Plan' with all members of the I-15 Integrated Corridor Management (ICM) Demonstrator Project team in San Diego. In fact, the team has said it could be the first time that a traffic management decision has been successfully made entirely based on automatically triggered real-time simulations of the entire multimodal transportation network.

SANDAG contracted Delcan as systems integrator to provide a real-time modeling tool for the decision support system (DSS). The DSS is a 'smart' traffic management system that will give system managers comprehensive awareness of the performance of the entire corridor; it will



also enable them to take proactive steps to prevent system breakdown using enhanced controls across multijurisdictional devices, such as traffic signals, ramp meters and VMS.

At the heart of the DSS is Aimsun Online from TSS-Transport Simulation Systems, which uses live traffic data and simulations to dynamically forecast future corridor traffic conditions based on the current state of the network. **Accolades: The San Diego I-15 ICM Project won the Best Innovative Practices gong in ITS America's 2013 Best of ITS Awards**

(www.sandag.org)

Pacific grim?

Consistently named as one of the top five worldwide cities for livability and quality of life, **Vancouver** also has its fair share of traffic problems

Infographics courtesy of Louise Adams

The **City of Vancouver**, British Columbia, and **Mayor Gregor Robertson** work together with **TransLink** and **Metro Vancouver** municipalities to build and maintain an integrated transportation system that moves people and goods through the city and region

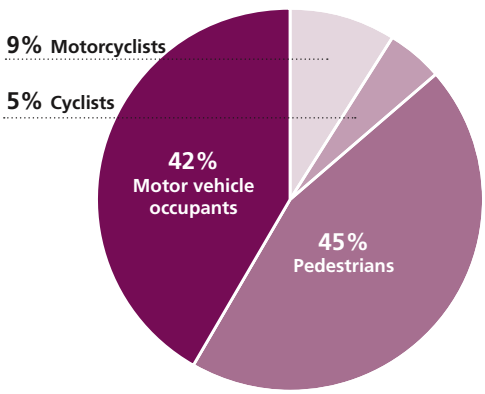
The current population of the city of Vancouver is estimated to be

603,502

up 4.4% since 2006 – which equates to a population density of approximately 13,590 people per square mile

40% of all trips in the city in 2008 were on foot, bicycle or by transit. The 2040 Target set in the Transportation 2040 Plan is to have that figure rise to at least two-thirds. Also, by 2020 it is hoped that the average distance driven per resident will be reduced

Vancouver's traffic fatalities



The *2013 TomTom Travel Index* shows the Vancouver region has edged out Los Angeles by as North America's most congested city **1%**

TomTom says the cumulative delay for average commuter with a 30-minute trip is an extra **93 hours,** or more than 11 working days, spent behind the wheel each year

Metro Vancouver could see an additional 1.4 million residents by 2041 which – by 2011 estimates – could result in...

700,000

...more vehicles vying for road space

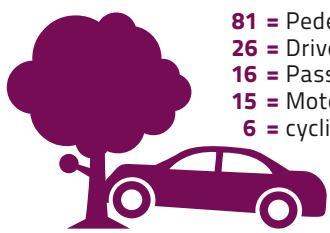
Metro Vancouverites have Canada's fourth-longest commute to work at an average of 28.4 minutes, according to new data released by Statistics Canada

Transport Canada conservatively estimates the total cost of congestion in the lower mainland at C$1.5bn annually

$

A University of British Columbia report recently stated that nine times more Canadians die each year from chronic exposure to air pollution than in traffic crashes – about 21,000 compared with 2,400

Vancouver Police Department records between 2005-2011 reveal that:



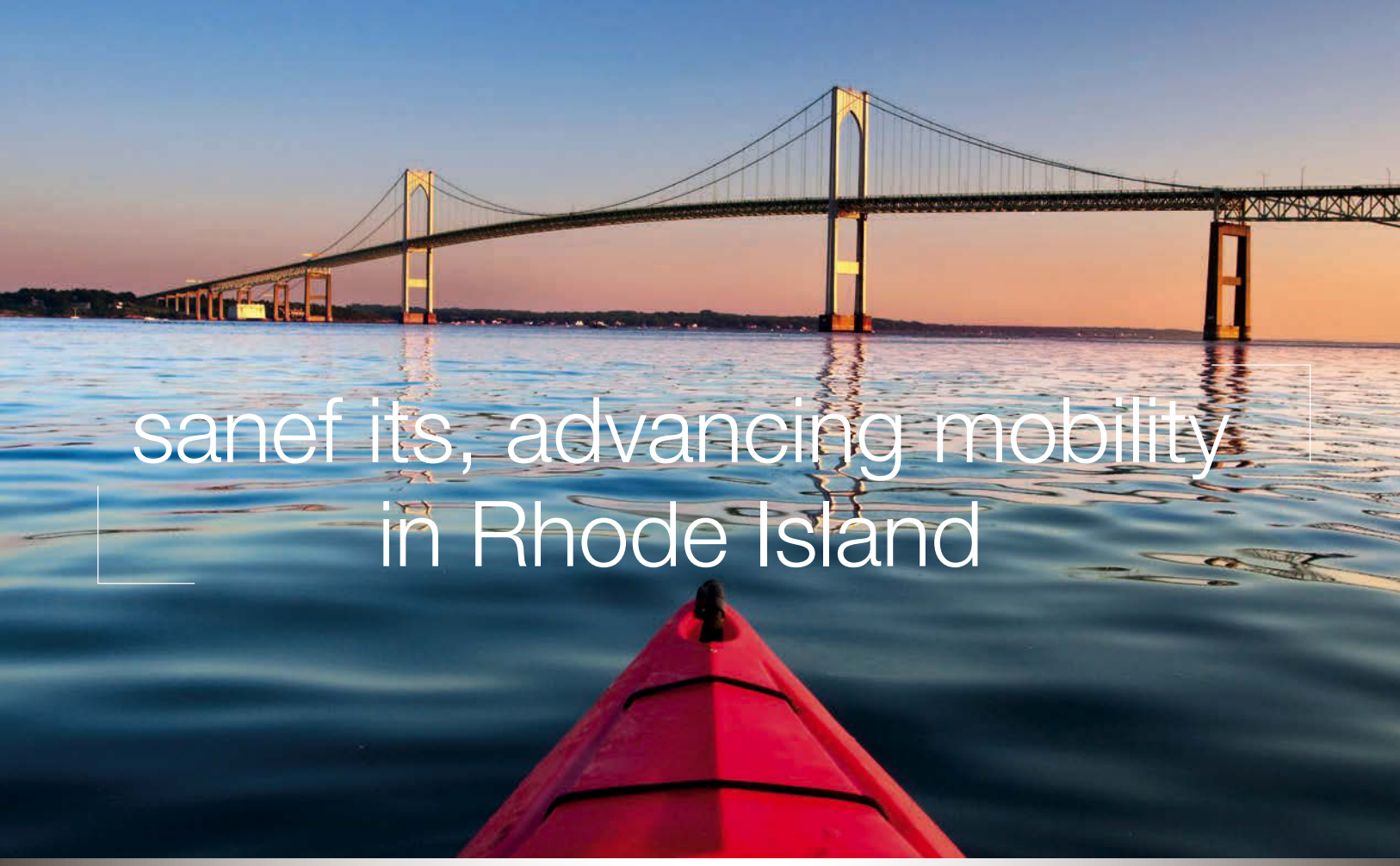
81 = Pedestrians
26 = Drivers
16 = Passengers
15 = Motorcyclists
6 = cyclists

were killed as a result of traffic crashes

Vancouver travel times were

36%

longer at peak hours than during non-rush hours, according to the *2013 TomTom Travel Index*



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- All Electronic Tolling (AET) on the Sakonnet River Bridge

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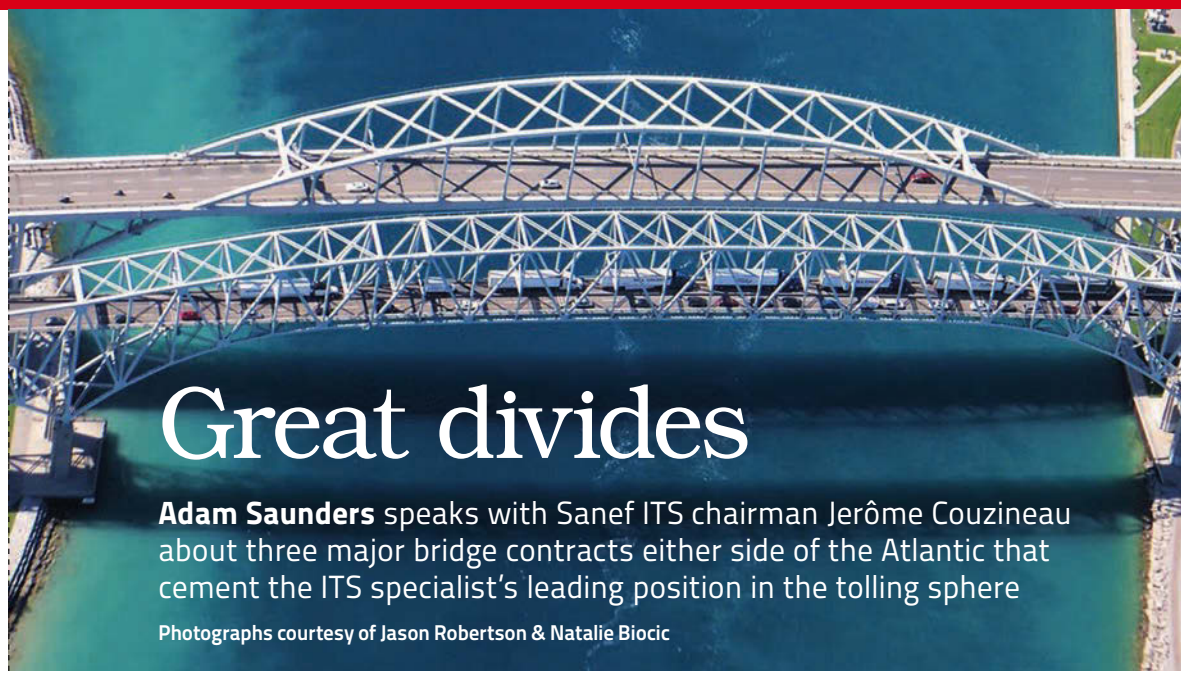
Barrier-free on the Thames

At the end of September 2013, England's Highways Agency awarded Sanef the £367m (US$392m) contract to design, implement, deliver and operate the new free-flow charging system at the Dartford-Thurrock River Crossing. The seven-year deal includes the opportunity to extend the contract by up to a further three years. "We are introducing new technology and road layout alterations to change the way drivers pay to use the crossing," said Nigel Gray, the HA's project manager for the scheme. "Once it is fully implemented, drivers will not have to stop at the barriers, but will pay for their journey remotely. This will reduce congestion and ease traffic flow. The contract covers the development as well as the ongoing operation of the new payment system. We remain on track to deliver this improvement in October 2014."



Great divides

Adam Saunders speaks with Sanef ITS chairman Jerôme Couzineau about three major bridge contracts either side of the Atlantic that cement the ITS specialist's leading position in the tolling sphere

Photographs courtesy of Jason Robertson & Natalie Biocic

Proving to be a real powerhouse in the global tolling field, French company Sanef ITS has announced three contracts in recent months – two in North America and one in the UK – that exemplify not only its standing in the industry but also its capability to overcome challenges that have had some authorities grappling for workable answers. Through its Sanef ITS Technologies America subsidiary, the company will design, integrate and operate an electronic toll system at Blue Water Bridge in Canada (BWBC) and will also work with the Niagara Falls Bridge Commission (NFBC) to implement its FastToll Interop for E-ZPass interface software.

7 facilities managed under California's BATA are now to come under BestPass. With 121,000 tags in service, it is compatible with E-ZPass among others

> "ITS companies will have to provide road users with additional services to enhance the toll offering. We are preparing for this future
>
> *Jerôme Couzineau, CEO, Sanef ITS*

Contract talks

BWBC owns and operates the Canadian side of the bridge, which extends across the St Clair River between Point Edward/Sarnia, Ontario and Port Huron, Michigan, USA. The NFBC, meanwhile, owns, maintains and operates the Lewiston-Queenston, Rainbow and Whirlwind-Rapids Bridges. Both contracts demonstrate cross-border interoperability. "We encourage authorities to use their infrastructure more cleverly, so it's not always necessary to build new infrastructure," says Jerôme Couzineau, director of development at Sanef and chairman of Sanef ITS. "We're helping operators and toll customers to achieve the interoperability they've needed for years," continues Couzineau, before going into detail about the NFBC deal. "We're the operator of the Alliance for Tolling Interoperability (ATI) hub clearinghouse, so we're at the forefront of such initiatives. Our solutions enable authorities to maximize their revenues while improving customer service. We enable them to use a single account in multiple locations."

Sanef's flagship North American project is arguably the C$1bn Port Mann Bridge, which went live in December 2012. "That's been a big success for us; we opened with 70% tag transactions. High tag rates reduce revenue leakage," Couzineau confirms. The Sakonnet River Bridge contract in Rhode Island also highlighted the benefits to authorities and customers alike of efficient interoperability capabilities. "Our designs also focus on financial reconciliation – a key component of managing an interoperability program."

(Main) **The Blue Water Bridge connects Highway 402 in Ontario with both I-69 and I-94 in Michigan** (Left) **Rainbow Bridge at Niagara Falls**

Technical specifications

The new NFBC E-ZPass capability is based upon FastToll Interop architecture that enables agencies to select the interoperability model and integrate the software seamlessly within their existing back office. "It provides all the necessary data transfers, controls and reports to efficiently and accurately reconcile and settle toll transactions between agencies participating in the E-ZPass scheme," adds the Sanef ITS chief.

The new ETS Back Office System (BOS) for BWBC is based on Sanef's FastToll ERP architecture, which supports its current operational needs and can easily be expanded to meet future business requirements, subsystems and locations (toll points, plazas and lane types). "To meet the requirements at the roadside, we will also implement our FastLane solution, giving them the flexibility to operate manual, mixed and automatic lanes. Customers will thus be able to pay with a variety of methods such as US or Canadian currency, cash and debit cars, or private and commercial accounts."

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With Google aspiring to have its self-driving car in public hands by 2017, AV expert **Paul Godsmark** contemplates how a city embracing this autonomous future now by creating an AV-only zone could steal a livability march on every other municipality around the world

Illustration courtesy of Tim Ellis

Quality streets

Readers may recall the *Countdown to autonomy* article from the October/November 2013 edition of *Traffic Technology International*, the focus being 'Level 4 automated vehicles' – i.e. the NHTSA definition where vehicles are capable of unmanned operation.[1] "As for maximizing the benefits of Level 4 technology," the article concluded, "we need to remove the suboptimal human element from behind the driving wheel altogether – which could arrive much sooner than people realize if the municipalities are willing to embrace the challenge."

But why would municipalities want to remove human drivers from their roads? Is a driverless car neighborhood a realistic, achievable or even desirable goal? Perhaps it's best to answer these questions by looking at what we want for our municipalities and then establishing how the 'shiny new toy' of fully automated Level 4 vehicles might actually be of assistance.

Aspire to be different

Municipalities aspire to be great places to live. There are subjective views on what makes a place 'great', but a number of independent indices have appeared, which rank cities against each other based on certain criteria that key factors can influence, such as the number of cars. The Mercer Quality of Living Survey is one of the most widely recognized indices (see *Ranking the world's most livable cities*, overleaf).

Mayors, councilors, city planners and city officers all have an interest in making whatever improvements might be possible across these categories to improve their cities. Transportation is a key element that takes a major portion of municipal funding and directly – or indirectly – influences most of these categories.

City officers may desire safer roads with far fewer vehicles and zero emissions. They may want greatly enhanced access and amenity for those engaged in active transportation, such as walking, bicycling, etc. They may also desire improved quality of life, streets to be reclaimed (from vehicles) for the populace,

> The hopes and plans of many municipalities are too often limited or even curtailed by the current dominance of the motor car on our streets

thriving businesses, more city-center space for human-scale development and amenity, and so on.

But the hopes and plans of many municipalities are too often limited or even curtailed by the current dominance of the motor car on our urban streets. The car – which is the lifeblood of a nation's road arteries – is now clogging up more than just the smaller capillary streets of our cities. Even where mass transit has been hugely successful, we find motor vehicles still congest the surface streets far too regularly for the comfort of a city's inhabitants and


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Ranking the world's most livable cities

In 2012, the Mercer Quality of Living Survey ranked 221 cities from Vienna (first) to Baghdad (last) on quality of life. Public services and transportation (electricity, water, public transportation, traffic congestion, etc) was just one of the 39 areas used as part of the evaluation.

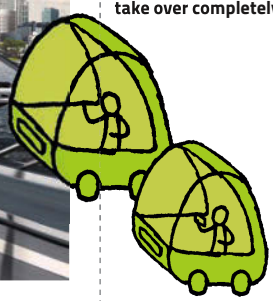
Other factors include political and social environment (political stability, crime, law enforcement) and economic environment (currency exchange regulations, banking services). Sociocultural environment, such as censorship and limitations on personal freedom is also factored in, while medical and health considerations come into play too – medical supplies and services, infectious diseases, sewage, waste disposal, air pollution, etc. As you would expect, schools and education are important (standard and availability of international schools), while recreation (restaurants, theaters, movie theaters, sports and leisure, etc) and consumer goods (availability of food/daily consumption items, cars, etc) are also benchmarked. Housing (rental housing, household appliances, furniture, maintenance services) and natural environment (climate, record of natural disasters) also have an impact on a city's ranking.

AVs can positively impact on all of these categories to some extent and improve the quality of life – and relative attractiveness – of the municipality that deploys and promotes them.

Vienna has been ranked as the number one city with the highest quality of life in the world. Could embracing AV-only zones cement that position?

Image courtesy of Continental

Slowly but surely, automobiles are doing more of our driving for us. It's only a matter of time before they take over completely



visitors. Arguably, the car has metamorphosed into the very antithesis of what we desire to achieve in making our cities great.

The dawn of a new era

But that may be about to change – and all because, in the not-too-distant future, our cars will be able to drive themselves. This will result in the first new paradigm in surface transportation since the modern motor car itself was invented, when it displaced the horse as the primary propulsion system. Interestingly, the new paradigm of automated (autonomous, self-driving or driverless) vehicles will have very similar capabilities to the previous equine-powered system – i.e. sufficient onboard sensors and intelligence to navigate itself when the rider/driver was otherwise incapacitated.

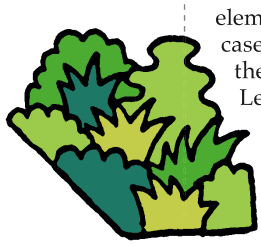
Level 4 vehicles, or fully automated vehicles (AVs), will provide the owner (or user) with a chauffeur-like service that is capable of working in its own right. They will be able to move people and goods more cheaply by removing the cost of the driver and because they will drive more smoothly, use less fuel and require less maintenance. They will also reduce costs as a result of lowered insurance premiums, limit the need to pay parking costs and, if rented, shorten rental times. Users would simply hire a new AV taxi ('aTaxi') when required and off-hire at the end of each trip.

Automated vehicle benefits

From a mobility perspective, cities will see AVs providing benefits to surface transportation in many ways once initially introduced, and during the transition period when they share the road with human drivers. Apart from the fact that automated vehicles will bring about improved road safety and reduced parking requirements, they will also likely usher in a transition to electric propulsion, leading to reduced emissions within a city. Passage through intersections will almost certainly be more efficient as a result of these driverless vehicles being introduced. Meanwhile, shared AV car fleets and aTaxis could also reduce the need for some bus transit services and provide a cheaper and more direct service for intra-city travelers. AVs could also greatly improve access to road transportation for those who are mobility-impaired, don't have a driver's license, are too young, are medically at risk, or senior citizens, etc. They could deliver automation and efficiency improvements in repetitive tasks, such as road sweeping and snowplowing. And with the average American spending 50 minutes a day commuting, that time could ultimately be spent more productively.

Yet the biggest benefits will accrue once all vehicles on the roads are AVs. Once this occurs, the suboptimal human driver element will no longer be the limiting case for many issues encountered on the road network. And with only Level 4 vehicles driving around on our roads, there will be a consistency of driving standard and style, which will enable cooperative Level 4 driving systems such as platooning,

> Arguably, the car has metamorphosed into the very antithesis of what we desire to achieve in making our cities great



AVs and education

Automated vehicle technology could be used to benefit the education sector in a number of ways, not least when it comes to the automation of school buses/transport. Bus drivers, for instance, could become overseers/mentors who could be far more engaged in the welfare of the children on board.

A larger number of smaller vehicles could also be deployed, enabling greater optimization of routes – older children might not even require a supervisor.

In such a scenario, school buses/vehicles would no longer have to be dedicated for school use only – they could be put to work at all other times. A school bus's catchment area, meanwhile, could also be increased with route optimization, resulting from smaller vehicles.

Meanwhile, intra-day transportation could be

provided much more easily, which would enable a greater variety of school visits at a lower cost than existing transport provision.

which is further enhanced by Connected Vehicle technology that will facilitate optimum road network performance.

As safety benefits are essentially maximized in such a scenario, the risk of crashes will be lowered to the extent where it would be acceptable to remove most – if not all – of the passive safety equipment and protection from AVs, which will result in ultra-lightweight vehicles that are considerably more efficient.

The desire for folks to use aTaxis will also be enhanced, while the desire to privately own an AV will reduce due to cost and likely peer pressure as shared resources will be construed as less wasteful. This will almost certainly lead to a big reduction in the average number of vehicles per person experienced prior to Level 4 technology.

Intersections could be further optimized and traffic signals might even be considered for removal entirely. Street furniture associated with human driving may become a thing of the past.

With the consequent improved safety situation, active transportation modes, such as walking and bicycling, could be more actively promoted. And with increased street space due to optimized traffic operations (smaller vehicles, closer vehicle headways, narrower lane widths, minimal curbside parking), a more pedestrian-friendly streetscape could be embraced.

Reclaimed parking lots and structures will find new uses, based on specific city policies. The private sector may seek to develop, whereas the city may choose to direct the provision of more community-friendly facilities aimed at improving quality of life.

Given the potential for such huge benefits when all vehicles on the road are automated, city and urban planners may subsequently look at what the AV offers in terms of benefits and compare those with their own criteria for improving the city, which would then be reflected in the various livability indices.

(Left) **Land could become available if city parking lots are no longer needed in an era of AVs such as the Google SDC** (right)

> Traffic signals might be considered for removal entirely. Street furniture associated with human driving may even become a thing of the past

Indirect benefits of AVs

In addition to the transportation benefits, municipal leaders may also be influenced by some of the indirect benefits of AVs. They could add value, for instance, within the education service (see *AVs and education*, left). They might improve access to recreation and sport facilities for all, but especially those currently disadvantaged (a great way to promote more active lifestyles). The ensuing reduced transportation costs would impact positively on the prices of goods in stores and retail outlets, with some stores now coming to patrons as mobile AV retail points, leading to time and cost savings as a result. The growing trend of urban dwellers not owning vehicles and using public and shared transport could be given a huge boost by shared aTaxi fleets, in doing so increasing the demand to live within city limits. And with land becoming available from existing parking lots and structures the chance to reclaim prime real-estate and develop it in line with city policies that promote quality of life will be immense. Conversely, the opportunity to raise money by selling to private developers could also prove extremely tempting.

Municipalities may therefore choose to actively promote the deployment of AVs in order to begin to see some of the many benefits associated with the technology. But the greatest benefits wouldn't be seen until after several decades, when the natural turnover of vehicle fleets and the gradual reduction in human driving eventually results in AVs being the predominant mode of operation. In the meantime, municipal leaders may even decide the benefits of the full deployment of AVs – when humans are displaced from the driving task altogether – are so great that they justify artificially creating an AV-only zone earlier than would result from any natural evolution.

Image courtesy of Google

Such an automated vehicle zone (AVZ) could be set up so as to exclude human-driven vehicles (apart from, say, bicycles and other active transportation modes) from a specified zone where the roadway infrastructure and land-use could take advantage of the benefits of AVs. Planning for the zone would need to take place many years in advance of implementation, with the AVZ inhabitants and resident businesses being given sufficient warning – in five years, for example, human-driven vehicles would not be permitted for use within the AVZ (see *Implementing the zone*, right).

The hottest topic in town

Such a vision may sound too far-fetched and radical to most municipal leaders, planners, engineers and transportation professionals, but there are some indications that suggest that AVZs are already becoming a legitimate topic for discussion.

The 'Shuffle City' concept from Alloy Build, for example, incorporates the principles of automated shared vehicle fleets for public use and explores how the reclaimed urban space could be used more productively to enhance the streetscape (their brief video is well worth a watch!).[2]

In June 2013, at the World Cities Summit Mayors Forum in Bilbao, the Singapore national development minister, Khaw Boon Wan, spoke about the subject. "In time to come, there will be driverless electric cars in which, by then, private transport will become less important and therefore less reliant on road service and land to be set aside for roads and parking lots." Speaking to reporters, he added, "These are [among] the technological changes and ideas that the mayors discussed with great excitement and expectations. It won't happen next year, it may happen in 10 years' time, it will most certainly happen within 15 to 20 years."[3]

The mayor of LA, Eric Garcetti, recently discussed AVs as a way to alleviate traffic, as well as how to create neighborhoods optimally designed for them. "I would love be the first big city in the world to have a driverless car neighborhood," he said in a blog report from the 2013 LA Tech Summit.[4]

Implementing the zone

How might an AVZ be implemented? A motor vehicle is generally the second most expensive item a family might buy, and the average age of US vehicle stock is 11.4 years. So any change to domestic purchasing habits and for inhabitants to better understand the shared fleet mobility concept would need significant warning – let's say five years.

Taxi, car rental, car share, ride share and P2P companies will all likely be interested in participating with the provision of AV fleets at the earliest possible opportunity as they risk losing market share if they don't. The promotion of car-share and ride-share facilities during the five years that precede the AVZ will help ease the transition to AVs. The city transit bus fleet could be used to help lead the way by deploying AV technology within the AVZ as soon as it is available.

The five-year period would be used to plan how the AVZ boundaries are enforced, and to set policy for land-use within the AVZ to take advantage of the reclaimed land from curbside and parking lots and structures when they become available.

Ultimately, any city that deploys AV technology and creates the environment for a successful AVZ will reap huge benefits that would be captured by the quality-of-life indices, helping to proclaim those cities as great places to live. And if the mayor of LA has expressed an explicit desire to have the world's first driverless car neighborhood, don't be surprised if AVZs become a hot topic in your municipalities very soon.

• *Paul Godsmark is a chartered civil engineer (UK) residing in Alberta, Canada. He is a co-founder of the Canadian Automated Vehicles Centre of Excellence (www.cavcoe.com). Feel free to email pgodsmark@cavcoe.com*

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> Any city that creates the environment for a successful AVZ will reap huge benefits that would be captured by the quality-of-life indices

(Above left) **The components to make up these self-driving features include not only radar, laser and cameras but also a processor in the car that can interpret sensor information and construct a 3D environment**
(Right) **Intersections in a world of automated vehicles could negate the need for conventional stop lights and stop signs**

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Prized assets

Although deploying the very latest in traffic equipment is vital for safety, efficiency and mobility, **David W Smith** learns why managing the maintenance of those assets so they perform effectively over their whole lifetimes should also be a priority

Main photograph courtesy of Robert Peel

With financial pressures still a heavy burden for governments and local authorities around the world, now more than ever before there's simply no room for any nasty, expensive surprises. Perhaps that explains why asset management has come to the fore. In the USA, the 2012 Moving Ahead for Progress in the 21st Century Act (MAP-21) made it mandatory for states to produce specific asset management plans for transport infrastructure. Meanwhile, in the UK, an all-party parliamentary group on highway maintenance has recommended that local authorities be refused government funding without such a plan in place.

"Here in the UK we are seeing local highways authority budgets cut by anything from between 20-40%," says Matthew Lugg, director of public services for Mouchel Infrastructure Services. "That makes it all the more vital that they pursue sound asset management practices to make the best use of any available money."

Maintain to gain

Yet Lugg sees too many authorities being keen to invest in new infrastructure without considering the cost of maintenance. "This is particularly true as the government is trying to pump-prime the economy with new capital funding for transport

In the palm of your hand

The City of Westminster in London was the first of the capital's boroughs to fully document its practices for highway maintenance in accordance with the *Well-Maintained Highways Code of Practice*.

The London Technical Advisors Group (LoTAG) built upon the work of the City of Westminster and produced a generic document entitled *Framework for Highway Maintenance Management Plan* as the London-wide standard. This provides a starting point for boroughs to develop their own plans in a standard format.

Westminster City Council's approved plan sets out how highways inspectors should undertake risk assessments

Photograph courtesy of Robert Peel

of highway defects that have reached pre-agreed levels, to determine whether a repair is necessary and when it needs to be done.

The city council's *Risk Register for Highway Safety Defects* includes a wide range of defect types likely to be encountered on Westminster's streets. It has been incorporated into handheld devices and is used on streets by highways inspectors to assess each type of defect. The faults are assessed on a scale in terms of their extent, location, network hierarchy and type of use. Automatic 'orders' are then created and issued electronically to the city council's service provider.

infrastructure while there are up to 40% cuts in maintenance budgets," he says.

A highly respected figure in the asset management arena, in recent years Lugg has been instrumental in putting together a lot of guidance for local authorities. He spent several years lobbying for a code of practice for managing ITS and traffic tools – 'missing code' that finally became available in 2011 when the *Management of Electronic Traffic Equipment Code of Practice* was published. "There was a lot of expertise and good practice tucked away in specialist codes for rising bollards, interactive signs and upgrading traffic signals," Lugg reveals. "What we did with the *Code of Practice* was pull it all together into a single document containing 19 recommendations."

Then, in 2012, Lugg conducted a potholes review on behalf of the government, in which he concluded that asset management was "not well-embedded" in the UK. And a year later, in 2013, he helped to produce the *Highway Infrastructure Asset Management Guidance* document – an initiative of the Highway Maintenance Efficiency Programme (HMEP), for which Lugg has been seconded as an advisor for the past two-and-a-half years.

Process and culture

Although the key principles of asset management are basic, they need to be embedded in an organization's culture. Lugg says it is perplexing, for instance, the number of authorities that don't keep track

The Highways Agency has developed a new asset support contract for maintenance and improvements to motorways and trunk roads in England

> Problems arise when key decision makers want to spend money inappropriately – because the road doesn't look good or there is political benefit

Matthew Lugg, director of public services for Mouchel Infrastructure Services, UK

The role of technology

The transport sector has seen a huge spike in the use of technology over the past decade. Ian Patey, Mouchel's principal technical director, says much of it assists asset management – even if it effectively becomes another asset to manage.

"Technology is everywhere now," he says. "Smart motorways, satnav and travel information have become mainstream. More and more technology is finding its way into vehicles and onto mobile devices. Technology is also commonplace at the roadside and in control centers."

The downside of all the technology is that the maintenance of this growing asset base is essential for the efficient operation of networks. "Failures and degradation of functionality all need to be detected with associated strategies and plans," Patey says.

Photograph courtesy of Stuart Howat

Photograph courtesy of Robert Peel

Ian Patey, Mouchel's principal technical director (far left) **says barcodes on traffic equipment aid the asset management process**

However the gains outweigh the downsides. Technology is very useful in asset management because it records and analyzes data in ways that reduce human error. England's Highways Agency, some local authorities and other transport operators use such systems through their asset management contracts.

"For example, the use of barcodes on assets removes the need for someone to write down the relevant data and this can be combined with location-aware systems such as GPS. The addition of mobile communications to devices enables remote monitoring, diagnostic checking, fault reporting and software updates.

"Other technologies that help include lidar scanning of roads for pavement management, radar scanning of surfaces to check a job's been completed right and remote diagnostics of equipment to negate attendance on-site."

Photograph courtesy of Robert Peel

Photograph courtesy of Robert Peel

of the size of their assets. "It's not just about having an asset management plan. It's about developing a process and culture," he stresses. "That starts with knowing what you've got – how many traffic signals, or interactive signs – and what condition they're in. A surprising number of councils don't have good inventories."

One of Lugg's responsibilities for the HMEP has been to provide toolkits that enable authorities to sharpen their asset management practices. The first toolkit gave guidance on lifetime planning and deterioration models, including examples for ancillary assets such as traffic signals. Deterioration modeling helps councils to predict the future condition of assets and react appropriately. "It's becoming more important as a lot of authorities are taking the approach of not building loads of new roads, but making better use of existing capacity," he notes.

Planned for perfection

One of the leaders in the application of deterioration modeling is Hertfordshire County Council in the UK, which uses optimization analysis to assess likely outcomes 15 years hence and reports them for 10 years. The authority generates a lifetime plan for each road section and selects suitable treatments. The individual plans are rolled up into a network-wide program by selecting treatments offering the best value. The model has a full range of options from surface dressing through to reconstruction and suggests the one that offers the greatest benefits and best value.

Lugg is now also working on producing an e-learning toolkit in collaboration with England's Highways Agency, which he says should be available in the next six months. "The idea is to look at how the HA addresses asset management and use that as the basis for developing an e-toolkit for local highways authorities," he reveals. "The advice has to be adapted as there are distinct differences in managing smaller networks."

One of the money-saving possibilities open to smaller authorities is collaboration, a fine example of which Lugg says can be seen in the partnership between Transport Scotland and the Welsh Government to procure a single contract for the supply of an Integrated Road Information System (IRIS), including all road condition surveys. IRIS was procured in 2012 for a seven-year period and brought IT asset management services under one supplier. Existing contracts were replaced as they expired. And the partnership has brought about major savings.

"Collaboration is the definitely the best way forward for many authorities, but too many like to keep their sovereignty," Lugg believes. "Problems arise when key decision makers want to spend money inappropriately – because the road doesn't look good or there is political benefit. But we need decisions based on data, not anecdote."

Private finance initiatives (PFIs), he adds, are a great advantage for authorities lucky enough to have them. "The PFIs in Portsmouth, the Isle of Wight, the borough of Hounslow, Birmingham and Sheffield enable them to take a long-term view about investment, which puts them in a different place compared to most other authorities."

Prudential borrowing – which requires debt borrowing to be conservative and affordable – is another good option for authorities looking to spend money now to prevent networks deteriorating. "If you borrow money and invest it up front to get the road in good condition, you save a huge amount in reactive maintenance," says Lugg. "Paying interest on the loan can be much less expensive."

Blackpool Council made its case for prudential borrowing by demonstrating that at current rates of deterioration it would take 25 years to get its network in

(Top) **Burgeoning traffic growth has brought increased recognition of the importance of highway maintenance** (above) **at both a strategic and local level**

> Budget cuts have driven us to get smarter, and we now have a new generation of maintenance contracts, called asset support contracts
>
> **Richard Arrowsmith, Asset Management Office, Highways Agency, UK**

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an acceptable condition. But an up-front capital investment of £30m (US$49m) over five years would bring it up to the required standard and reduce the cost of routine maintenance, creating a long-term saving of £100m (US$165m). The Lancashire town council obtained £30m of prudential borrowing and highway maintenance budgets were ringfenced for 25 years.

Wider scheme of things

The Highways Agency's network is valued at more than £100bn (US$165bn) and includes everything from pavements and drainage to large structures and technology. Some challenges are different from those facing local authorities. "Motorways have to be kept to higher standards," comments Richard Arrowsmith, head of the Highways Agency's Asset Management Office. "They are in use constantly and the safety implications of a defect, such as a pothole, are much greater than on lower-speed roads. This is all reflected in our approach to managing assets."

Yet the Highways Agency still faces the same financial constraints as local authorities – albeit on a much grander scale. "Budget cuts have driven us to get smarter, and we now have a new generation of maintenance contracts, called asset support contracts," Arrowsmith reveals. "These are designed to increase competition and innovation and they'll contribute toward achieving cost savings of 20% over five years. They work by being less prescriptive about how work is conducted and focusing more on outcomes for road users. One key to saving money in the long term is working with supply chains to find new ways of doing things that drive down unit costs and get the most use out of each asset."

Blazing an asset management trail

New Zealand has long been leading the world in asset management strategies – and is arguably 10 to 15 years ahead of some countries. "When I give talks around the world, asset managers are envious of New Zealand having asset management driven by legislation – and it really has helped," reports Tony Porter, director of New Zealand's Opus International Consultants (Opus was once New Zealand's Ministry of Works).

(Left) **Asset management activities are integral to make every penny spent on equipment** (bottom) **count**

Its forward-thinking approach was a response to a financial crisis in the late 1980s. "The government changed the accounting procedures for the public service, bringing in accrual accounting," Porter recalls. "The changes impacted local government, which was forced to have asset management plans evaluated by the auditor general. In many ways, our local authorities are ahead of central government. Legislation is now being changed to bind long-term financial plans and commit councils to much longer financial plans."

> When I give talks around the world, asset managers are envious of New Zealand having asset management driven by legislation – and it really has helped
>
> **Tony Porter, director, Opus International Consultants, New Zealand**

Porter says that the practical consequences of New Zealand's policies are that maintenance budgets tend to go through planning stages without interruptions and councils have more time to debate capital improvements and expenditure. But he thinks the biggest trend in asset management in recent years has been the move away from focusing on the assets themselves to a focus on the services provided. "Increasingly we see councils and government looking to non-asset solutions to provide services. On roads, we see ITS used on existing networks rather than just constructing new lanes, as was the case in days gone by. It's no longer just about engineers preserving the assets they love."

Another big trend influenced by financial constraints is the recognition that authorities can manage their money by providing a range of service levels. "We used to always try our best to improve the condition of all assets," Porter continues. "Now we're saying, 'We don't have the money to do that for every asset.' For lower-trafficked roads, a lower standard of maintenance can be appropriate. In some cases, we consciously 'sweat the asset', letting it deteriorate a bit so that money is available to maintain major highways. A back-country road can tolerate the

Management in the cloud

Yotta has developed a cloud-based visualized asset management tool that makes it easier for managers to visualize, manage and optimize all their asset management strategies and records in one place. Known as Horizons, it's helping organizations use asset data to inform better operational and strategic decisions. It provides a single point for viewing facets such as road surface condition data, defect inspection data and video surveys through a very easy-to-use mapping interface. The data sources include contract and works management systems and in 2013 Yotta acquired Mayrise Systems, the UK provider of this type of software for managing services such as streetlighting, streetworks and highways.

Since Horizon's launch in 2012, the solution has been adopted by the Highways Agency, among others, although Yotta has also recently launched the solution in the USA following the opening of an office in Denver, Colorado.

The integration of GIS

Surrey County Council in the UK has developed a single asset register for the storage and management of data, driven by the increasing use of GIS. The aim of the register is to avoid the haphazard data storage common to many local authorities.

Surrey installed a new central geo-database and spent 18 months shaping the register and migrating data from existing systems. All highway infrastructure asset data is now stored in one place. The single asset register enables accurate, repeatable and schedulable reports and analysis. Asset inventory and condition data is available. Customer service and accident data will also be updated.

The biggest benefit of the single asset register is in providing a single source of 'truth', which eliminates the risk of conflicting information or duplication. The register also enables the visual display of information on GIS maps, which facilitates the understanding of data. And it empowers staff when they communicate with the public. Surrey is validating the data that has been transferred into the asset register and further integrating it with existing tools.

occasional pothole, which you wouldn't tolerate on a motorway. So 'fit for purpose' is becoming very important. We've conducted some work showing that some of New Zealand's best-kept roads were carrying the least traffic, which doesn't sing good asset management. That's where we get debate – and it's all about debating!"

Priority rules

Local authorities in the UK are also learning the importance of prioritization. Cornwall Council has established a network hierarchy based on road use in managing its highway drainage infrastructure. A risk-based approach ensures resources are targeted to deliver the best results. Sites are ranked with reference to legal obligations, strategic objectives and policies. Each site is then visited by the council's asset team. Data is gathered and used to determine priorities.

Of course the UK isn't alone in its growing awareness of the value of asset management. "There's been a lot of talk in the USA about the state of infrastructure," says Omar Smadi, director of Roadway Infrastructure Management and Operations Systems at Iowa State University. "Roads and bridges are deteriorating and the trend in terms of infrastructure asset condition is declining. During the most recent economic crisis, Congress authorized US$800bn in additional infrastructure spending on 'shovel-ready' projects within a two-year window. The USDOT was able to account for how the money was spent, but was not able to assess the impact of that spending on the condition of the infrastructure."

MAP-21 was introduced to clarify these issues. "The FHWA has to establish minimum standards for pavement performance on the interstates and minimum performance for bridges," Smadi adds. "Not more than 10% of the bridges should be structurally deficient. MAP-21 mandated asset management plans on state DOTs for pavement and bridges on the National Highway System and created seven performance measures that each state DOT and metropolitan planning organizations have to report back on and set targets for."

> USDOT was able to account for how the money was spent, but was not able to assess the impact of the spending on the condition of the infrastructure

Omar Smadi, director of Roadway Infrastructure Management and Operations Systems, Iowa State University, USA

(Above) **Traffic signals are a big asset to be managed for local authorities** (Below) **US state transportation agencies will be facing many new asset management issues in the years ahead**

In the Middle East, too, countries are awakening to the importance of asset management following a period of rapid infrastructure building. Scott Bloxsom, a consultant at Mouchel, says the trend is especially apparent in the UAE. "There's a strong drive to embed a structured asset management approach, led by the public sector 'asset-owning' organizations such as the Department of Municipal Affairs within the Roads and Transport Authority in Dubai," he reports. "For many decades the focus has been on capital expenditure to build new roads to link communities and business, whereas increasingly there's an awareness that these infrastructure assets need to be maintained effectively. Although capital expenditure continues at pace in the Middle East – especially in emerging markets such as Kuwait and Iraq – countries such as Qatar and UAE are facing the challenges of maintaining their transport infrastructure and keeping their network moving."

Ultimately, nobody can afford to be complacent and believe they have cracked the asset management conundrum – even in New Zealand. "The asset management journey has no end," concludes Tony Porter. "We are always seeing something we can be smarter at. The best approach is continuous improvement. I'm certain that the asset managers of the future will still be saying, 'If only we could do just that, then we'd be really good.'"

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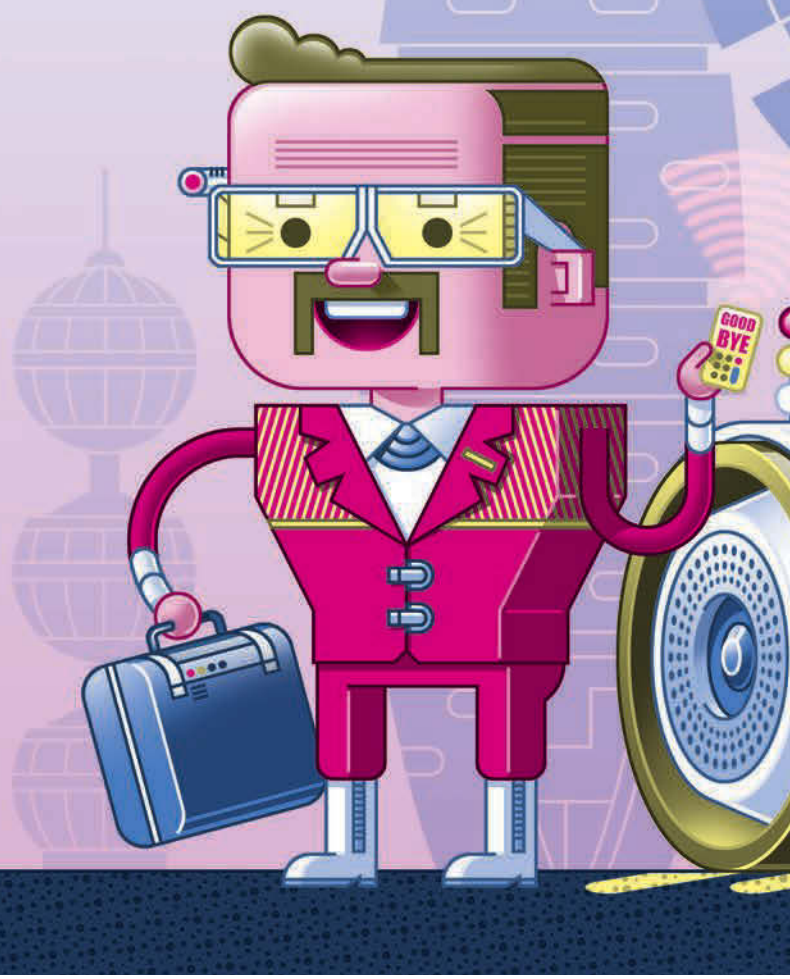
Static electricity

The move toward more automated and connected vehicles may be a lightning bolt for parking operators. **Max Glaskin** asks whether its effect will spark new life into the industry – or kill it off

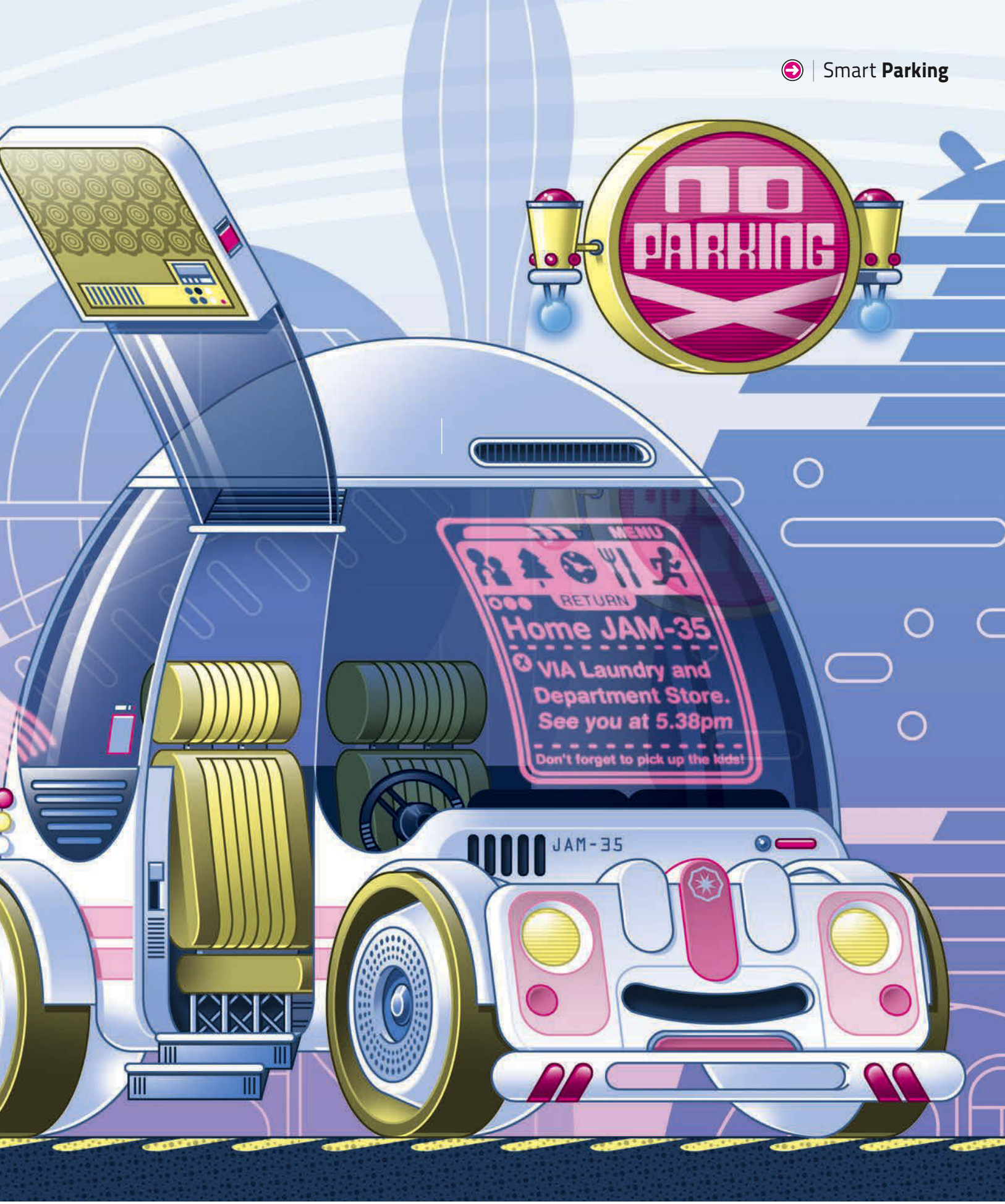
Illustration courtesy of Lee Hasler



The parking industry has long benefited from the fact that the majority of vehicles spend most of their time parked. But technology is not so dependably static, and it remains to be seen how the sector will cope with the trend toward vehicle automation and connectivity. Will these technologies create commotion or harmony in parking lots, parking garages as well as at the curbside?

Casey Jones, the immediate past president of the International Parking Institute, is convinced that the increasing intelligence of vehicles is of relevance to the parking industry. "We've identified two trends, not just in North America, but elsewhere too," he says. "The first is that there are shifts in concerns about congestion. The second is that we know urban areas will continue to grow. The combination of these issues necessitates new solutions, which we're beginning to see with the new levels of automation in vehicles and the availability and sharing of information for automobiles. That will open the door for collaboration between OEMs, parking technology companies and facility owners, whether public or private."

Together, Jones tells us, those three parties can construct a seamless system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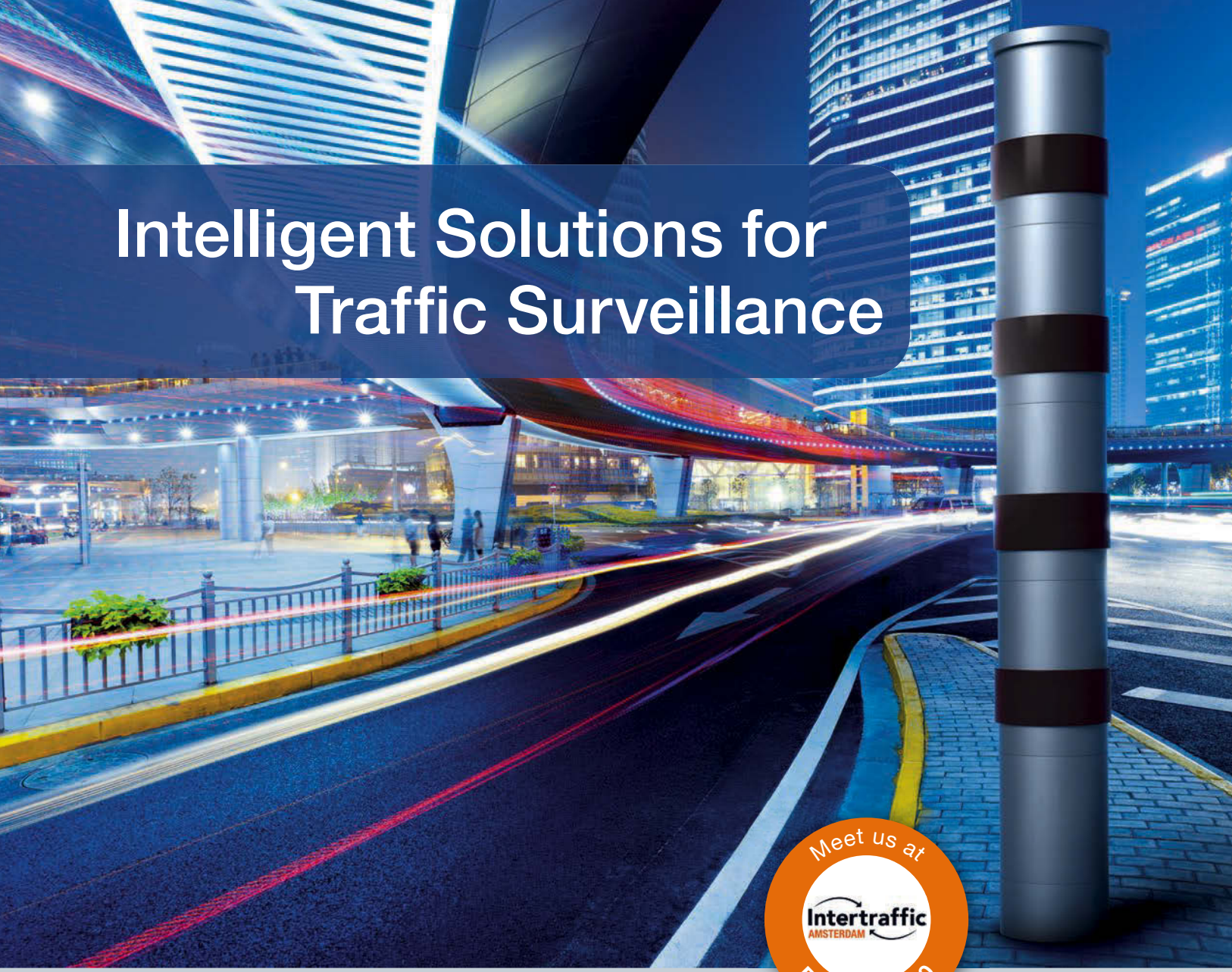

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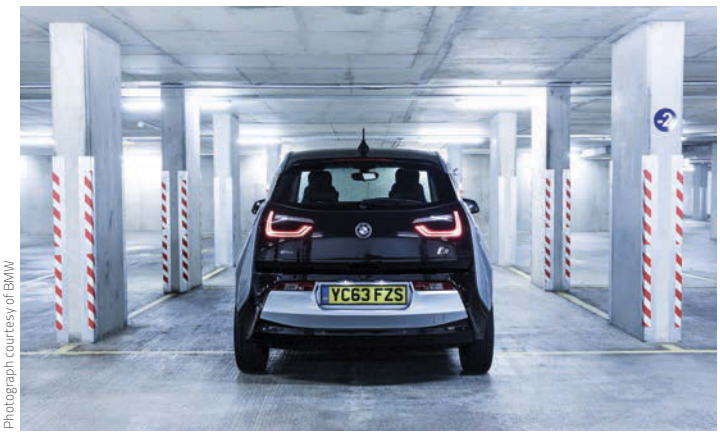


Photograph courtesy of BMW

BMW's Park Assistant package on the i3 is available today and offers a fully automatic option whereby it accelerates, brakes and steers itself

whereby vehicles know drivers' destinations, take them to convenient parking spaces and pay according to their wishes. "Not only does all that offer immense convenience for drivers but it addresses problems such as congestion and sustainability, which will only get worse if we don't tackle them now," he says. "However we must transfer technology and knowledge across industries."

Service charge

In particular, new communication technologies are changing how the market works. "Parking is emerging as a service industry," continues Jones. "It hasn't always been that way; it used to be about stacking cars on concrete structures." Now that the world is more connected – maybe not so much for vehicles yet, but certainly for occupants – every player is more accountable and has to reassess its responsibilities. Jones says the parking sector is doing this.

"What's changed is that we now have a role in the overall travel experience," he continues. "We used to be separate from the trip, but now we see ourselves as part of that continuum. So we offer conveniences such as real-time information, which makes it easy for people to locate a parking space close to their intended destination. We're making payment simple, helping parkers avoid committing infractions. All these things make the whole experience so much more positive. Technology is enabling that capability."

Jones characterizes the impact of connectivity as an explosive revolution for the parking sector. "There are so many initiatives going on now, putting real-time information into the hands of parkers," he says. "Conversations are under way right now between the technology providers in our sector and the OEMs about how information from the parking facility can become available in vehicles to help with parking locations and provide other parking assistance. That's not an abstract discussion; it's very real and it's moving very rapidly. Before there weren't conversations between the parking and auto sectors. Today it's happening frequently."

> Parking is emerging as a service industry. It hasn't always been that way; it used to be about stacking cars on concrete structures
>
> **Casey Jones, immediate past chairman of the board, International Parking Institute, USA**

Those people investing in new parking facilities should bear this in mind if they want to prepare for the future. "The systems we use today are very robust IT systems with connected networks," adds Jones. "Use a little bit of forethought – allow a little bit of extra room, a little bit of empty conduit that you can fill later with components that maybe aren't even conceived of yet. It's very difficult to bore through concrete, especially with certain types of construction, so just planning for additional 'plumbing' in a garage will serve you very well," he advises. "Parking garages have to last 50-75 years so it's much less expensive to put in a little bit of raceway or conduit now rather than to try to figure out how to retrofit it later."

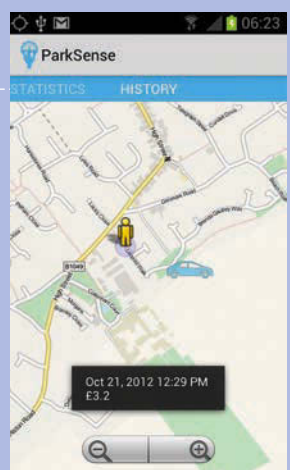
Admittedly, fully automated cars that drive themselves using data from their own sensors and through network connectivity are some years away. Yet there are vehicle technologies close to market that may soon impact parking operators. According to Jerry Marcus of the Parking Advisory Group, some that have been demonstrated on the open road need to be improved if they are to be helpful in a parking garage. "GPS, for instance, will operate on one floor pretty well but there are problems with using it over multiple floors inside buildings," he says. "Machine vision will also need to improve. Garages are sometimes not well lit, and right now

Space exploration

With many studies showing 30% of city traffic is comprised of drivers looking for parking spaces, there is certainly demand for technology to spot empty bays. Clearview Traffic's M300 occupancy sensors are among many products that can detect and relay the information in real time to drivers and enforcers via a third-party interface. Now Sarfraz Nawaz and colleagues in the computer lab at Cambridge University have taken this a step further by eliminating the need for any hardware to be installed at all.

They've demonstrated how ParkSense, an app on the driver's smartphone, can automatically tell the network when the vehicle vacates a parking space. The app tracks the phone's location and velocity continually by monitoring the strength of its wi-fi connection to the many city center beacons. As the smartphone moves, the connection strength changes. When it recognizes movement typical of driving away after being parked, it transmits the location of the vacated space to everyone else with the app.

Similar previous attempts by others went nowhere. PrimoSpot closed in October 2013 after four years developing its app, and Google's OpenSpot is dormant. Both failed as they relied on people acting as sensors and feeding data to the system. ParkSense, on the other hand, collects and distributes the data without human intervention.



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Four thought

On a small stand at the LA Auto Show in December 2013, Tim Kentley-Klay displayed a concept for a totally automated vehicle. Zoox is comprised of four identical quadrants, each with a motorized wheel and intelligence. These fit together and share data for all safety, navigation and control functions. The distributed network, like the internet, provides redundancy. The idea is that using replicated quadrants simplifies production. The concept may be one that changes our notion of parking requirements completely. "We'd love to see parking disappear," Kentley-Klay told *Traffic Technology International*. "Our model transcends the need for parking. It's on-demand, point-to-point mobility and could potentially enable cities to reclaim road space and car parks for other uses."

This idea is worth keeping an eye on as a result of the interest shown in it by Anthony Levandowski, project leader on the Google SDC. He invited Kentley-Klay to make a presentation to the Google team. Now Zoox is assembling its own team of engineers to build a prototype. "We've been talking with Tier 1s – not with OEMs," says Kentley-Klay. "OEMs make cars for drivers. That's not for us."

cameras face all kinds of challenges in low light. There are also concerns with some of the software: it may be able to recognize signage on a highway, but parking garages do not generally have those standard signs, so that would have to be changed, perhaps by implementing a standard."

Payment models

Then there is the topic of who will pay to develop and implement new standards in garages. "In a municipal transit garage you might see government getting involved and paying," Marcus proposes. "It's a little bit more difficult when you're asking private operators to pay for upgrades on their own facilities."

One factor that is always raised when the subject of driverless cars is discussed is liability. There are those who say new rules will have to be written, with implications for parking facility operators. "It's a little bit more difficult when you have self-park cars mixing with autonomous cars and valet cars," says Marcus. "Who actually has liability? In a self-park garage owners try to shield themselves from liability, so basically have no liability when one customer hits another. But in a garage that mixes valet and autonomous cars, it's a little bit cloudier. For valets the trend toward autonomous cars is an issue because even cars that have parking assistance today use different systems." Valets will need to be trained in each to be able to operate them correctly.

Marcus is far from pessimistic however and recognizes that increasing automation could benefit drivers and parking lot operators. "We have very large spaces in some places because some people don't park very well," he says. "The technology should help operators because more precise parking will permit spaces to be reduced in size."

In Marcus's opinion, there's not a lot that parking facilities can do just yet to prepare for increasingly connected and automated cars. "There's no clear winner in terms of technology right now," he believes. "But new facilities will at least have to bear it in mind in the near future. For instance, I think we'll see fewer two-way systems in garages: there will be more one-way movements so there are fewer conflicts. In a two-way drive aisle there's usually a yield point at the end to enable one car to pass before the second car makes its maneuver. In other words, there cannot be any clear concentric turning in the drive aisle. That complicates systems. Ultimately garages will move to one-way configurations to minimize the amount of yield activity, making them much friendlier to autonomous vehicles."

Marcus believes it should be relatively easy to integrate autonomous vehicles with current space-sensing and notification systems. As ever, though, it will come down to price. "Space-sensing and notification technology costs upwards of US$300-US$500 a space," he says. "It could easily be retrofitted but who bears the cost? I think the model is going to change eventually to more of a Google Ads model, whereby an equipment vendor supplies the hardware and software to the car park and receives

> **If in the future we have autonomous vehicles that can deliver occupants to their destinations and then park themselves elsewhere it's hard to see how the parking regime would not be affected**
>
> **Nick Lester, president, European Parking Association**

Photograph courtesy of Volvo Cars

(Left) **Volvo's Autonomous Parking concept relieves drivers of the time-consuming task of finding a vacant parking space** (Right) **According to the MIT Media Lab, in congested urban areas about 40% of total gasoline use is by cars looking for parking**

Photograph courtesy of University of Oxford

Autonomous driving technology could provide solutions to some of our most intractable social problems, including the perceived wasted urban space given over to parking lots

a percentage of the revenue, in the same way that Google makes a nickel on every click. The operator will write an agreement to fund the cost with a percentage of the transaction revenue."

Location, location, location

For Nick Lester, president of the European Parking Association, the value of a parking lot is largely linked to its location – hence growth in vehicle connectivity and automation has to be monitored with that in mind. "Currently people want to park close to where they want to be, so if in the future we have autonomous vehicles that can deliver occupants to their destinations and then park themselves elsewhere it's hard to see how the parking regime would not be affected," he says. "That car park could be two or three miles away and the only thing that might keep the old link with location is if you then have to wait a while for your car to return to pick you up afterwards."

But Lester also suggests the technology could have an impact on car ownership, with autonomous cars being used like taxis. "In lots of fields people pay for consumption, not ownership, so it could be more convenient for them if they don't own cars either," he says. "That would be a substantial cultural change and have a fundamental impact on parking, breaking the link between popular destinations and car park location."

Lester also foresees another impact on parking lots if vehicles are not occupied when they park. "We have larger span sizes already, to accommodate wider vehicles and doors that open much wider than they used to," he says. "If the occupants have got out before parking then there's no need to have a bay to suit wide-opening doors."

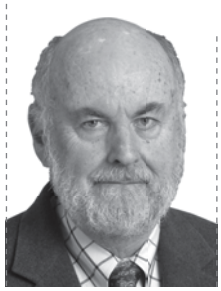
Pay and display

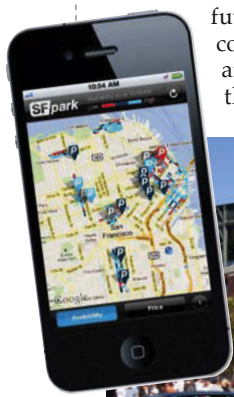
The bottom line is always money. Will increased connectivity and automation make a positive difference to parking operators' balance sheets? The go-to man for parking market economics is Donald Shoup, professor of urban planning at UCLA and author of *The High Cost of Free Parking*. "For drivers, connectivity will eliminate a lot of uncertainty about where to park and how much they'll have to pay," he says. "It'll make the parking market closer to being a perfect market. That's already started in some cities, where drivers can see the prices across neighborhoods on the web."

For Shoup, lack of intelligence is a major characteristic of the parking market. He thinks that when drivers become aware that pricing intelligence could be available to them, it'll create a demand for the relevant technology to be installed by parking operators. "Intelligent cars will lead to an intelligent market for parking, and that should reduce traffic in cities," he says. "There will be symbiosis: car manufacturers are cautious but they will piggyback on all of the work that's being done by people in the smart parking arena. Each will benefit from the other."

In that way, parking will find its own space in the future of traffic technology. It's not just around the corner, but if OEMs, parking technology providers and parking operators keep their eyes on each other, they'll see openings.

> Intelligent cars will lead to an intelligent market for parking, and that should reduce traffic in cities
>
> **Donald Shoup, distinguished professor of Urban Planning, UCLA, USA**





SFpark sets a dynamic market for street parking by measuring average occupancy on each block and then setting prices according to demand

Slotting in

Current and imminent ADAS for parking from Ford, BMW, Toyota and Audi win admiration for their precision in parallel and even perpendicular parking. Yet they have been outperformed by a team from Stanford University whose driverless car has successfully completed a powerslide into a curbside space – a maneuver involving a 180° rotation. It was a party trick good enough to win the lead engineer a job on Google's driverless car project.

Google majors on the safety of its vehicle but doesn't make much of its parking capability,

perhaps aware that vehicle makers seem to have already made this function available. The only obvious evidence of its involvement with parking has been when it used the top deck of a Long Beach garage to demonstrate its car's ability to drive at speed around a tight circuit without a driver in control.

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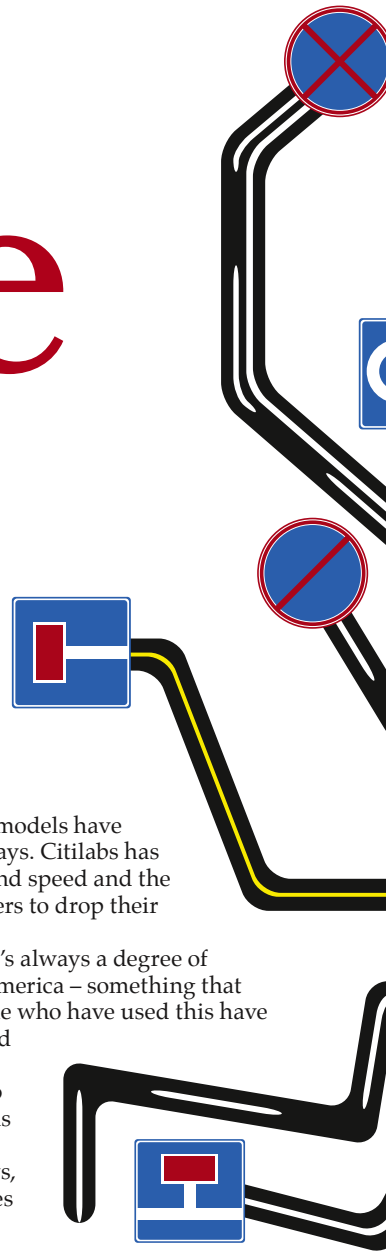
Interactive experience

Timothy Compston finds that advances in modeling plus increasingly immersive visualization tools are enabling stakeholders to feel the benefits of a proposed scheme virtually before they take root in the real world. But amid radical change, how will the technology branch out?

Illustration courtesy of Mr Aesthetics



Given that the number of companies developing transport modeling software doesn't even break into double figures – and the number of seats globally is quite small compared with markets for CAD, GIS, 3D animation, etc – it might be baffling to find out that there's still plenty going on in the field.

Yet in investigating bigger-picture macroscopic, fine-detail microscopic or even 'best-of-both-worlds' mesoscopic techniques, we discover these virtual engine rooms for more effective and intelligent traffic planning and operations management are increasingly being driven by the world revolving around them, not necessarily those tasked with developing the software. And while some sector insiders tell us to expect future consolidation (fewer companies and packages), more integration (of adjacent complementary technologies) and migration (away from the desktop and hence away from CD-ROMs and perpetual licenses), some developers, consultants and, crucially, users hint at gaps in existing software capability. So what are these gaps – and more importantly, how do we fill them?

Up in the cloud

Where processing takes place is certainly high on the agenda for Oliver Charlesworth, UK regional director at Citilabs – the brains behind the Cube suite of software programs such as Dynasim at the microscopic level and Avenue, a dynamic traffic assignment extension for the Voyager forecasting tool. "What we've seen recently is that as desktop computers have become faster, transport models have become bigger and more ambitious," he says. Citilabs has attempted to address the challenges around speed and the scalability of such models by enabling users to drop their models into the cloud.

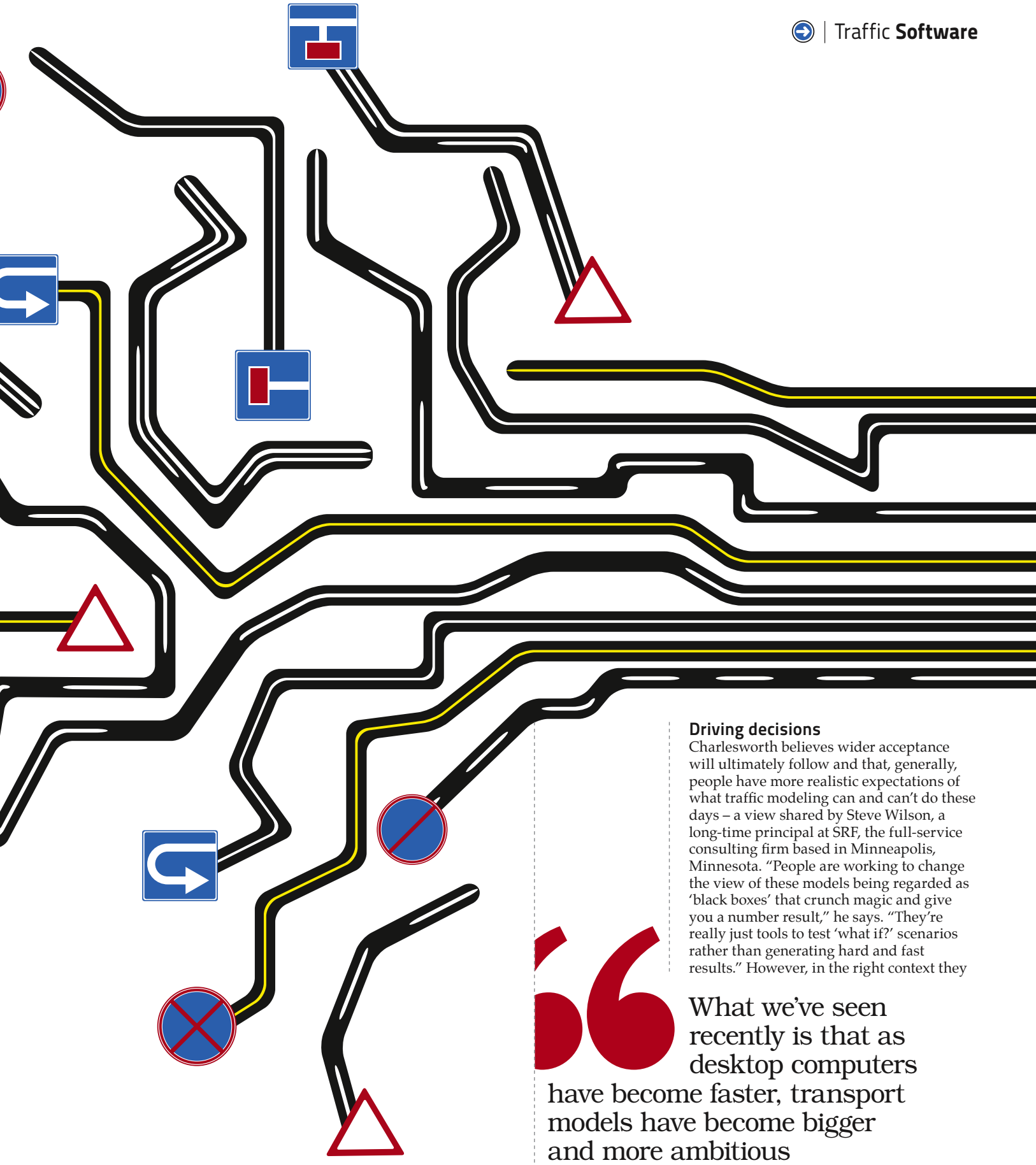
Of course, as with anything new, there's always a degree of skepticism, especially outside of North America – something that Charlesworth accepts. "So far, most people who have used this have been American clients who have embraced it with open arms," he reports. "They're a little bit ahead of the UK when it comes to software such as this. One of the questions people in the UK ask is, how safe is their model in the cloud? My response is always, 'We're already using Amazon web services – and that's a secure system, isn't it?'"

Image isn't everything

Although there have been clear improvements to models, Dr John Hourdos is not so sure things have progressed to the same extent in relation to accuracy. "Accuracy is always a tough question but it is clear to me that the modeling itself is not necessarily the highest priority for developers," says the director of the Minnesota Traffic Observatory. "3D and other 'bells and whistles' seem more important."

So where is there further scope for improvement? "There are several standing problems not well covered by models: roundabouts; freeway entrance ramps (especially double clover-leaves); mode selection and trip chaining for dynamic traffic assignment in micro and meso models," he says.

On a positive note, Hourdos feels the capability to model large urban areas has been beneficial. "The introduction of mesoscopic traffic simulation models and their combination with micro into hybrid models has been a real breakthrough. At last, we no longer have to make assumptions regarding path selection due to the results – we can simulate them!"



Driving decisions

Charlesworth believes wider acceptance will ultimately follow and that, generally, people have more realistic expectations of what traffic modeling can and can't do these days – a view shared by Steve Wilson, a long-time principal at SRF, the full-service consulting firm based in Minneapolis, Minnesota. "People are working to change the view of these models being regarded as 'black boxes' that crunch magic and give you a number result," he says. "They're really just tools to test 'what if?' scenarios rather than generating hard and fast results." However, in the right context they

> What we've seen recently is that as desktop computers have become faster, transport models have become bigger and more ambitious
>
> **Oliver Charlesworth, regional director, Citilabs, UK**

(Left) **There is great potential for the useful application of microsimulation models to the analysis of complex traffic problems in urban areas** (Right) **The capability to model complex highway junctions and congested networks has been a massive benefit for traffic practitioners**

offer decision makers the level of confidence that they need to choose the best path forward for a specific project.

And the newer models, Wilson believes, are much better at helping people understand what the results are. "At the start of my career, we just conducted a traffic analysis and said to people, 'This intersection would be a level of service D' and then you'd hold up a picture of a standard intersection," he recalls. "Now with simulation we can drop the intersection design into a virtual world, layer over aerial photography, 3D representations of surrounding buildings, etc. We can introduce vehicles and simulate conditions such as stop-and-go traffic at peak hour – it's a different ballgame."

But is there such a thing as too much detail? And is running an all-encompassing model that addresses requirements from a wide to a more detailed view practical? In Wilson's opinion, such a bells-and-whistles approach isn't always necessarily desirable nor is it logical, as the more detailed the model, the more information is required to implement it. "If you're a regional planning agency and you have a budget for modeling, it's likely to be for top-down, bigger-picture data tools and techniques," he says. "In contrast, if you're an engineer in an agency and your design decisions are at a facility level rather than a big-picture system level, you may just want to invest your resources at the microscopic scale and not necessarily work your way back-up."

Action in Auckland

In discussing the AMETI (Auckland Manukau Eastern Transport Infrastructure) project in New Zealand, Nathan Harper, a traffic modeler at international infrastructure consultancy Opus, has adopted a multi-layered approach to modeling. "Essentially, East of Auckland didn't have good transport connections. There was congestion and this project [which is under construction] was a response from Auckland Transport to come up with better ways to move people into the city. It morphed into a real multimodal project that includes a dedicated parallel busway, in addition to the normal traffic lanes, a bus station along the way and a major bus station at the end, integrated with a new rail station. Underneath all of this is a new link road for general traffic.

> People are working hard to change the view of models being 'black boxes' that crunch magic and give you a number result
>
> **Steve Wilson, principal, SRF, Minneapolis, USA**

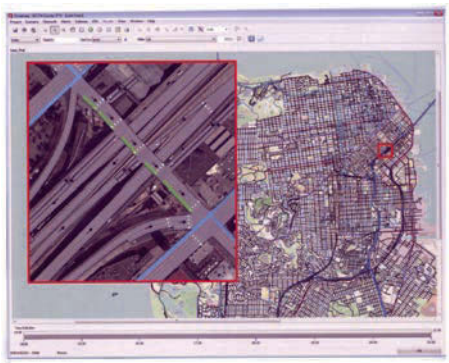
"From a modeling standpoint, I think what's special in our situation is that we used four different types of transport model to assess the project and each had different strengths and weaknesses," adds Harper. "The highest level covered the entire Auckland region and that was looking strategically at where people are trying to get to and how many were getting there by car, by bus and by rail, etc. Dropping down

Deliver me the detail

Daniel Morgan believes one of the 'hotter' current topics in modeling is how to deal with managed lanes such as high-occupancy toll (HOT) lanes. "Many states are considering them as an option, if they don't already have at least one in place," says the director of traffic simulation at Caliper – developer of TransCAD, transportation planning software and the TransModeler traffic simulation package. "But nobody really has a great idea of how to model them well. I think our approach has been very different from anyone else in the USA."

Traditionally, people have been modeling these systems in more of a regional model context. "They use a static traffic assignment of some kind, which doesn't capture any of the dynamics over time. We believe the people who use toll lanes are emergent and not necessarily predetermined."

And although he concedes there will be drivers who will use toll lanes no matter what – as well as other people who will refuse to use them come what may – the secret is to model what happens with the people in between the two groups. "Microsimulation," concludes Morgan, "will more accurately capture the capacity of access and egress areas, the interchanges between the toll lanes and general-purpose lanes, and can actually simulate a driver's response to the actual message signs as they pass them at a high fidelity."



A multilayered modeling approach has been adopted for Auckland's AMETI project – an integrated, multimodal transport project in an area that has experienced massive growth over the past few decades

a level – in a different model – we considered how cars and congestion were impacting the area, and yet another level down we brought in how the congestion was interacting with cyclists, pedestrians and bus and rail."

As the models become smaller and smaller, correspondingly you obtain greater and greater detail. "In the lowest layer, we're modeling each car, person and cyclist. We have the means to run really complex models within which you can look at how the flows interact. It's much more detail than we ever could have hoped for in the past."

Multiple models

For Eric Rasband, mobility manager at Utah Department of Transportation, the real value of traffic modeling is in planning and operations. "In cooperation with our metropolitan planning organization (MPO), the state of Utah has settled on the Cube platform," he says. "Utilizing this, we'll model our urban and statewide transportation network for future projects as well as travel-demand characteristics. The travel-demand model helps us determine high-level project benefits and assists when it comes to setting priorities over a 20- to 30-year planning horizon."

On the topic of operational models, Rasband says that the solutions employed depend to a large extent on the scope of the project being analyzed. "This could be a simple deterministic model, such as Highway Capacity Software (HCS) or Synchro. If more refined analysis is needed, due to the complexity of the project, we may transition to SimTraffic or Vissim.

"Three-dimensional graphics for public presentations have been a really powerful tool," Rasband suggests. "There's also the capability to analyze innovative intersections and to confidently make decisions based on the results of the software. For me, the accuracy of the models seems to be improving all the time."

Yet as the complexity of software improves, Rasband reports consequent challenges in keeping qualified staff. "To overcome this, we have used the private sector to help us with our modeling needs – our internal staff provide a quality check of outside work to ensure our operational needs are actually being fulfilled."

Tolling analysis

Outsourcing expertise is common practice for Washington State DOT (WSDOT). "We're still quite new to tolling, for instance, so a lot of our investigations that involve traffic modeling tend to be hired out to consultants," reveals Mark Bandy, traffic engineer, WSDOT. "Most of our projects are 'brownfield' where we've had something in place, so our analyses will help us look at how tolling will improve a facility, the impact of adding toll lanes, and so on."

One aspect that has helped with WSDOT's modeling requirements has been the rich traffic volume and speed data that is now available for the state's freeway system. "We're able to better calibrate models, which means we have a leg-up on some other places that don't really have that sort of data," Bandy explains.

> We have the means to run really complex models within which you can look at how the flows interact
>
> **Nathan Harper, traffic modeler, Opus, New Zealand**

But he says there are gaps in current modeling provision; for WSDOT, one relates to the fact that models often assume that drivers know the best economics-to-time trade-off. "In 'model land' they have this complete understanding of the roadway network and the most economically effective choice but we know that people don't behave that way in the real world," he says. "Even though we might perform calculations and conduct surveys, people's value of time is not constant. A single number, for example, cannot represent the mood I am in on a certain day or the fact that I might need to get home quicker on another day for something important."

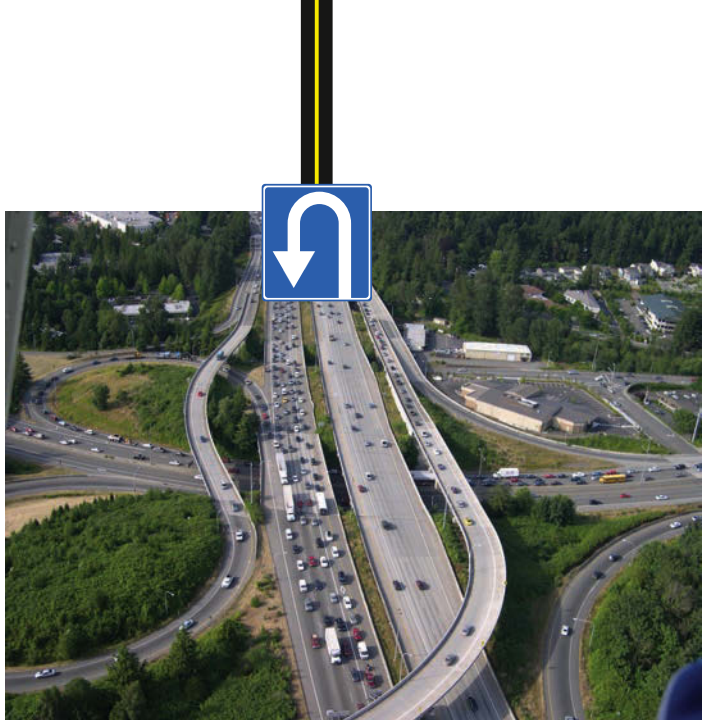
Bandy and his WSDOT colleagues have therefore been studying a new mesoscopic model that has helped to a certain extent. "There's

A dynamic approach

Talking with Shane Velan from INRO, the company behind Emme for transportation forecasting and Dynameq for wide-area traffic simulation and dynamic traffic assignment, his enthusiasm is evident when honing in on the capabilities of modern-day solutions. "Parallel computing and more memory enable us to deploy faster methods to work with ever larger datasets and to make finer economic evaluations," he says. "Multi-threaded routing to Dynameq enables larger simulation models and Emme traffic and transit assignments are now all multi-threaded and faster." Velan is finding users

pushing for applications to be larger, more sophisticated – as well as faster.

He goes on to underline the importance of taking the time out to evaluate software on real projects to test the claims made by some vendors. He also stresses the need to focus on modeling fundamentals. "There are enormous discrepancies between solutions that appear to be based on similar science," he adds. At a practical level, he believes that any study area involving modeling should – out of necessity – include the entire area of influence of local changes at a junction or along a corridor. "Traffic and transit passengers can easily adapt their routes on a daily basis to bypass a bottleneck or to take advantage of new capacity. Accounting for these routing impacts is critical when evaluating the costs and benefits," he says.



Traffic modeling helped WSDOT identify short- and long-term, multimodal improvement strategies for the I-405-SR520 corridor that align with the agency's overall goals

microscopic and there's demand modeling but the mesoscopic (dynamic traffic assignment) is something in between," he details. Microsimulation doesn't adequately reflect the price on a particular road or set of lanes, as far as Bandy is concerned. "With the mesoscopic layer, you can actually put in the travel cost on roadway segments. Although not as fine-grained a relationship of vehicle volumes and speeds on roadways, it does a pretty good job of reflecting traffic signals and levels of congestion. We really needed this for our Downtown Seattle network where we were talking about tolling the new SR 99 tunnel."

The road ahead

Managing traffic, whether it be on SR 99, at intersections, on arterials or in our bustling city streets, remains a complex business. The problem of road traffic – and its effects on pollution, wasted time and the subsequent social and economical detriment – demands an accurate policy and planning of road networks. Clearly from talking with researchers, vendors, consultants and transportation engineers, there are great strides being made on the traffic modeling front to assist, particularly in the processing and presentation of data. What's also clear, however, is that the journey into this virtual world is far from over. ○

> We're able to better calibrate models, which means we have a leg-up on some other places that don't really have that sort of data
>
> **Mark Bandy, traffic engineer, Washington State DOT**

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23

things you won't read about Intertraffic Amsterdam anywhere else…

The 22nd edition of Intertraffic Amsterdam taking place at the RAI Convention Centre from March 25-28, 2014, will feature more than 800 exhibitors from around the world, displaying products and solutions over an area of approximately 60,000m². If you've been to the event before, you'll know there are three ingredients to making your visit a success: comfortable shoes are a must; an insider knowledge of which stands have coffee machines on them (or something a little stronger); and a good show preview to help you locate the must-see exhibits. We can help you out with the latter…

Over the following pages you'll find a sneak peek of 23 of the stands that are sure to be buzzing at the event. We've collated the latest news, details about new product launches as well as interviews with folks at the show to whet your appetite ahead of the world's biggest traffic technology showcase.

The *Traffic Technology International* team will also be on hand on stand 11.527 with copies of this edition and sister title, *Intertraffic World*, published in partnership with the RAI. Feel free to drop by, say 'hello', suggest a feature, or even just rest your feet.

»

INFRASTRUCTURE

Walk the line

Borum
Booth 06.200

Line marking is widely regarded as one of the most important means of ensuring the safety of motorists during their travels. This is especially true at night and during inclement weather, when the markings themselves are one of the few visual traffic guidance clues that drivers can still see. A technology that has contributed substantially to improving the visibility of line markings is retroreflectivity.

The retroreflective material applied to line markings is glass beads. Line markings are visible at night because the light from headlights is reflected back into the drivers' eyes by the glass beads embedded in the lines. Glass beads can be pre-mixed in the marking material before application, or they can be dropped onto the marking material when making the lines.

"As it is very important for the degree of retroreflection that the line markings have beads, we have come up with a variety of features to help ensure proper bead application when applying lines," says Steffen Lüth from Danish line marking expert Borum. These features can be mounted on all of Borum's range of machines.

Lüth and his colleagues will be on hand on Borum's stand at Intertraffic Amsterdam to dispense advice to those looking to invest in new line marking equipment or even to upgrade their existing tools.

The stand will showcase a number of the company's latest innovations, including the Borum LineMaster computer. The well-known Dot'n'Line line marking machine for hot thermoplastic and spray-plastic application is another highlight. "We'll also be presenting our line marking machine for application of two-component material 98:2, multifunctional for spray, extrusion, agglomerate and dot application (Borum model: BM CP 250-2)," Luth reveals. "Additionally, we will show our trailer with thermoplastic pre-heater, power station and filling system, which can be used for manual work or filling of a small machine, and of course our line eraser."

The abovementioned features for mounting on Borum's machines will also be presented at Intertraffic. These include a bead alarm (a sensor mounted on the bead gun, detecting the stop of bead flow and providing a subsequent alarm) and an air dryer for bead tank, which removes the moisture from the air before being supplied to the bead tank and thereby prevents the beads from blocking in the tank. "These new features are designed to help ensure proper bead application for optimal retroreflection," Lüth explains.

A big part of Lüth's role at Borum involves being in direct contact with customers on a daily basis and taking their feedback home to the engineers, who can then develop the solutions required. He predicts that customer demand will be focused on two key areas for the foreseeable future. "We'll see a focus on obtaining optimal retroreflection for a long time to come, as well as a concern about what more we can do to improve the durability of the markings," he concludes.

EXHIBITOR CASE STUDY

Rob Sims

Director of sales, Findlay Irvine
Booth 05.456

What will visitors see on your stand at Intertraffic this year?

Our best-selling road surface friction measurement (SFM) system, GripTester, which is now available in a portable, one-person-operated version called Micro GripTester. This uses the same technology as the original but can be used in much smaller areas. Visitors can also get details on our climate monitoring and management technology and systems.

What's your latest news?

Transport Scotland is trialing Micro GripTester in its Instant Response vehicles and to test micro texture degradation. Leith's (quarry production and aggregates company) is also evaluating the product on new thin surfaces.

What trends are you noticing in your sector of the industry?

Highways agencies are taking more preventative measures. These are based on the deployment of wireless sensor technology that communicates climate data (windspeed, temperature and precipitation) to a central management system, from where timely action can be taken. Beyond this, the automatic activation of warning signals represents a step change in the capability to minimize disruption, for example by alerting drivers to diversions much sooner. Proactively measuring road surface friction forms part of this approach.

Can you tell us about a recent success story?

Micro GripTester is being trialed by several agencies and private operators throughout Europe, from which significant sales are expected this year.

INFRASTRUCTURE

Steel a look

ArcelorMittal
Booth 05.328

Patrick Le Pense, manager, ArcelorMittal Flat Carbon Europe says that in addition to the company's range of steels, visitors to his stand will also be able to see an array of road equipment (such as safety barriers, sound fences and light poles) made by its customers using ArcelorMittal steel.

"In particular, the high-strength steels with the new Magnelis coating are an optimized solution for resistance, durability and environmental performance," he explains.

ArcelorMittal is also launching a new substrate for its pre-painted steel products, under the name Optigal, which offers long-term durability.

Le Pense believes that part of the innovation process in the road equipment sector is driven by changes in standards and regulations. "The new EN 1317-5 harmonized standard is entirely performance-based," he says. "It allows the introduction of new solutions and designs for safety barriers. As a result, we have seen an increase in demand for steel with better resistance, longer durability and reduced environmental impact."

LIVE FILM VIEWING

Orafol
Booth 01.106

Sylvia Lucht from Orafol's Reflective Solutions division says that Intertraffic visitors will be treated to a live demo of one of the company's systems. "They will be able to see our Oralite UV traffic sign printer in action, as well as our full range of retroreflective films that are used in the traffic sign industry for both permanent signs and temporary road markers.

"Since we exhibited two years ago, we have added CE certifications to numerous products, so can now present a complete range of CE-certified film for all permanent traffic sign applications." Certification is an important topic in this sector and Lucht explains that this is at the forefront of Orefol's ongoing R&D efforts. "With the new European regulation that went into force last summer, of course we have seen an increasing demand for the CE-certified materials. Our range includes all relevant grades of reflectivity and these will all be shown in Amsterdam. We've also observed an increased demand for fluorescent colors and we have a range of products in this arena that we'll be displaying."

Lucht reveals that this is a busy time for the Reflective Solutions division and it's seen a huge growth in recent times. "In our German facility in Oranienburg (also the Orafol headquarters), we are investing in additional capacity," she says. "The facility is being expanded with an additional production hall of no less than 8,500m², which will be for conversion of special products within the Reflective Solutions and the Adhesive Tapes divisions. Our new production hall will be completed shortly."

Plastic fantastic

Aplus Molds & Plastics
Booth 06.202

A Taiwanese company, Aplus Molds & Plastics (A+MP) will be heading to Amsterdam in order to use the show as an opportunity to present its new eco-friendly, lightweight warning safety barrier. "The A+MP road warning safety plastic guide rail is a newly developed innovation that is suitable for roads around the world," reveals the company's Gina Chen.

Although it is an unconventional concept in theory, Chen believes that using a plastic guardrail has a number of advantages over traditional Jersey barriers or steel guardrails. "The benefits include stronger product structure safety, higher malleability, a very light weight and the benefit of anti-corrosion."

Chen says that the plastic guide rails are anti-UV treated and can withstand continuous sun exposure and heat, and the material can even be recycled. "It will not damage the soil or the ecosystem, making it better suited to current environmental protection goals," she explains.

The company is also heavily promoting the safety potential of this plastic system as well as its economic and environmental merits. Aplus says that as well as being incredibly strong, the plastic guide rail also boasts a higher shock absorption than traditional products, the aim being to achieve a plastic-based rail that is just as crashworthy as one made of steel.

From a customer's perspective, Chen says that there are a number of points road operators will find particularly attractive. "As well as the fact it is eco-friendly, it boasts lower maintenance costs than metal-based products," she says. "It's also easy to install, with a high elongation for use in curved roads."

There's one final advantage associated with the use of plastic that traditional steel products cannot compete with: the color of the barrier can be selected by the customer!

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SAFETY

Calvin Hutt

Truvelo
Booth 01.138

What's in store for visitors?

We will be exhibiting our new D-CAM R, which is a radar-based speed and red light camera. It is a flexible system that can be deployed at fixed or mobile sites. Other exhibits include our D-CAM P piezo-based speed and red light camera, which gained UK Home Office Approval in 2013. Our new hand-held ProLaser 4 speed gun and LASERwitness Lite digital video mobile speed enforcement camera complete the line-up.

Latest company news?

We have recently introduced a range of radar-activated speed display signs for local councils and industrial plants. Our first installation was in the baggage handling area of a major UK airport. In other news, the ProLaser 4 has passed all UK Home Office Type Approval tests and shipments of the new system are due to commence in late March.

Can you tell us about a recent success story that highlights your capabilities in the traffic sector?

Although I can't reveal the name of the customer for confidentiality reasons, I am able to say that installation of the newly approved D-CAM P began in mid-2013 in West Yorkshire for a local authority client.

Process engineering

EXHIBITOR SHOWCASE

StarTraq
Booth 01.413

"Exciting and rewarding" is how Allan Freinkel describes the past year for UK-based enforcement software specialist StarTraq – the brains behind the popular browser-based Dome (Dynamic Offence Management & Enforcement) solution. "It began with us securing two new contracts to provide our traffic offense-processing software," recalls the company's CEO. The first of these was with the newly formed regionalization project involving the English police forces of Bedfordshire, Cambridgeshire and Hertfordshire (BCH), while the second saw StarTraq delivering its offense image adjudication solution to North Yorkshire Police, which went live with Dome in March 2013.

"BCH needed one solution that would be capable of processing all offenses from the three forces, as well as the capability to share the workload between the three," Freinkel explains. "Hence if staff numbers were down at any of the three, they wouldn't lose any offenses – staff from the other two simply pick up the workload overflow."

This signifies a wider trend in the UK law enforcement sector, according to Freinkel. "Clients want more efficient processing platforms; they want to consolidate operations that are geographically split, yet they also want to retain a local processing capability," he says. "Our solution gives BCH the freedom to keep their own identities, so if an offender was captured speeding by Bedfordshire [police], then all correspondence can be branded with their crest, even if processed by Hertfordshire [police]."

As to other trends that Freinkel has noticed, he thinks Software as a Service (SaaS) is becoming more popular as agencies can reduce their risk and initial cost of investment while benefiting from a scalable solution.

StarTraq's tagline, 'Driving safety through Education & Enforcement', is much more than a marketing catchphrase, with the 'Education' element being evidenced by StarTraq Live ('Learning in a Virtual Environment') – a web-based e-learning platform that manages online education for drivers who have committed traffic offenses (non-usage of seatbelts, red light running, cell phone use, etc).

"The idea is that it eliminates the need for traditional enforcement and instead offers potential clients the choice of an educational alternative, which delivers long-term benefits for road safety," Freinkel adds. "We will be demonstrating our seatbelt and red light courses at Intertraffic this March."

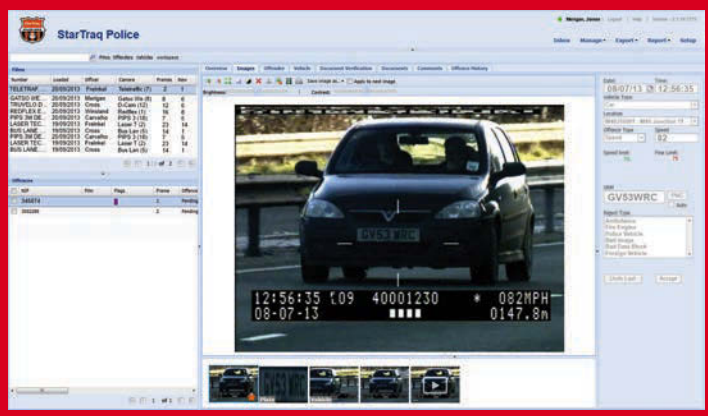
StarTraq values the global exposure it gains at the best-attended and largest traffic exhibition in the world, which may have helped it secure its contract with the Fiji Land Transport Authority – a system that went live last April. "We supplied the back-office system to process the offenses and look forward to a long and trusted relationship with the LTA as the program continues to grow," continues Freinkel, who offers a sneak peek as to what visitors can expect at Intertraffic 2014.

"We've introduced some pretty innovative features to Dome over the past year, not least a completely customizable user interface that's been restructured from the ground up to offer users the freedom to work their way," he says. The result of this will be a boost in user satisfaction and a subsequent knock-on effect on productivity.

There's also a new graphical workflow engine that enables the business processes to be distilled into graphical maps that illustrate the route that a particular process should follow. "This graphical process simplifies and speeds up the installation process, delivering to the customer's front office the capability to see and change their processes without needing to ask the IT department to code a specific requirement."

Stop and Grab, meanwhile, is the next phase in StarTraq Dome's video functionality and enables users to capture any frame of an offense video. "These snapshots are then saved to the offense record and made available as part of the verification process including ALPR," details Freinkel.

Finally, the DomeForWord plug-in enhances the process of responding to correspondence, while OffenseView offers an offender the freedom to view their offense information in a secure and accessible online portal. "Contained within the portal are the supporting offense images, videos or documentation," confirms Freinkel.



EXHIBITOR SHOWCASE

Safety camera

SVS-Vistek
Booth 11.820

The EVO 6040 may sound like a super-fast sports car, but in actual fact it's a new 6MP camera that SVS-Vistek has integrated into its CMOS sensor line-up – the ideal component to integrate into high-level ITS and road safety imaging applications such as ALPR, enforcement, tolling, etc. "The KAC 06040 from Trusense Imaging has a one-inch format with 4.7µ pixel size," reveals Andreas Schaarschmidt, president, SVS-Vistek. "As with our current 12MP CMOS sensor-based camera, there's a choice of using the camera in a rolling or global shutter mode, while we're also using a C-mount optical interface, which enables the use of lots of lenses."

At Intertraffic in Amsterdam, Schaarschmidt will be keen to discuss how news of SVS-Vistek's expertise in machine vision is spreading, especially in light of a new office being unveiled in Yokohama, Japan. "The foundation of the Japanese sister company will enable us to create new features with added value for all regions of the world."

On the radar

Redflex
Booth 01.330A

Australian traffic safety expert Redflex is heading to Amsterdam to show off a number of solutions.

Its RedflexSpeed radar is one of the first systems on the market to use non-intrusive dual-radar technology for accurate speed detection across up to six lanes of traffic in all weather conditions, with lane identification, vehicle position and positive vehicle classification. The company says that the system is ideal for enforcing all types of speed situations. The RedflexSpeed radar is a flexible solution that can be pole or gantry-mounted.

Another advance the company is keen to promote at Intertraffic Amsterdam is the Redflexiips enforcement image and incident processing system, which is a flexible and scaleable enforcement ticket processing back-office, able to cater for all enforcement processing requirements, regardless of volume.

The company will also be extolling the virtues of its recently introduced high-definition license plate recognition system, which is a scalable, solution that suits a wide range of applications from car park and restricted lane monitoring to tolling, travel time monitoring and surveillance.

Redflex says it ALPR tool is Ideal for both single- and dual-lane operation and pole, tripod, gantry or bollard-mounting. Itdelivers high-speed capture of most international license plates and Redflex says that it is easily configured to recognize new plates or characters.

SAFETY

No barrier to safety

Gibraltar Cable Barrier Systems
Booth 05.128

When a vehicle leaves the roadway and traverses a highway median into oncoming traffic, the results can be horrific. In very narrow medians, concrete or guardrails can be used, but in wider medians – or for roadside applications – high-tension cable barriers can be a cost-effective method of mitigating crossover crashes.

Mark Bloschock from Gibraltar Cable Barrier Systems explains that high-tension cable barriers (HTCB) have become a popular tool in recent years. "The cables are installed at much higher tension than low-tension barriers," he says. "This provides the advantage of reduced deflections, longer run lengths between anchor points and they maintain a cable height sufficient to capture another vehicle after most typical impacts."

HTCB also have an attractive economic advantage, as Bloschock reveals: "Based on the average installation costs, an agency can install four times more HTCB than double-sided guardrails and 10 times more than concrete barriers for the same cost."

SAFER SPEEDS

EXHIBITOR SHOWCASE

Vitronic
Booth 01.320

Vitronic has enjoyed a strong period of growth since the previous Intertraffic in 2012, especially given the way Middle Eastern countries have embraced enforcement cameras to reverse their traffic safety records. "We've seen exponential growth there with several very large projects being awarded to us," reveals Daniel Scholz. One of Vitronic's existing customers in the Gulf region recently ordered a further 300 new PoliScan^{speed} systems featuring laser scanning measurement. Scholz explains that, "All these systems are deployed in the PoliScan design housing – a design that has already become a symbol for road safety in the Middle East."

In the speed and traffic enforcement arena, Scholz is observing a trend toward more complex and integrated projects. "Our customers want to deploy enforcement schemes that help them achieve their road safety goals not only by installing single speed enforcement units, but they also want to combine spot-speed enforcement with red-light violation monitoring, license plate recognition and section speed monitoring, network all these devices and keep the deployments flexible," he details. "We are one of only a few companies that is able to provide this whole range of enforcement systems and integrate them with the necessary back-office software."

"For the tolling sector, we see a similar trend toward more flexibility," he adds. "While earlier projects relied on fixed installations for collection and enforcement, we see more projects on the market that include semi-stationary and mobile enforcement solutions."

Scholz and his team will be using Intertraffic Amsterdam as an opportunity to showcase Vitronic's entire PoliScan line of speed and red light enforcement products. And he hints that there will be an exciting announcement relating to this line at the show. "We strongly recommend that anyone interested in road safety technology comes to our stand, where we will announce some important additions to our PoliScan portfolio."

What's in a name?

Lumix/Phoxene
Booth 01.424

Traffic safety applications often rely heavily on specialized lighting. For certain tasks, such as enforcement, it is mission-critical to achieving successful results.

Deeply rooted in power optoelectronics and professional photography, Lumix has been designing flash illuminators for more than two decades. Among other product lines, it has been offering a range of turnkey flash illuminators specially designed for traffic enforcement since 2006. Either integrated within fixed traffic control equipment or used as standalone units for mobile control, the performance and reliability of Lumix flash solutions are field-proven. Almost 1,000 units are now in use around the world.

Jean-Claude Sirieys can also reveal that, in 2014, Lumix is changing its name to Phoxene. "The adoption of a new name and brand identity is a logical next step in our strategy of broadened offerings and growth. In that context, the launch of a new flash unit, the FR80, illustrates our willingness to better serve the needs of enforcement systems integrators."

Sirieys says that the Phoxene FR80's key features enable systems integrators to leverage the overall performance of their equipment. "The optimized

optical design can project enough light up to 100m and light intensity can be adjusted within a few tens of micro-seconds through a simple electronic interface," he explains. "We've also boosted energy and fast-firing sequence capabilities, such as eight shots of 80 Joules in 0.2 seconds."

Sirieys also cites the flexibility of assembly as a key selling point. "Whatever type of configuration is requested by our enforcement customers, Phoxene can offer a solution."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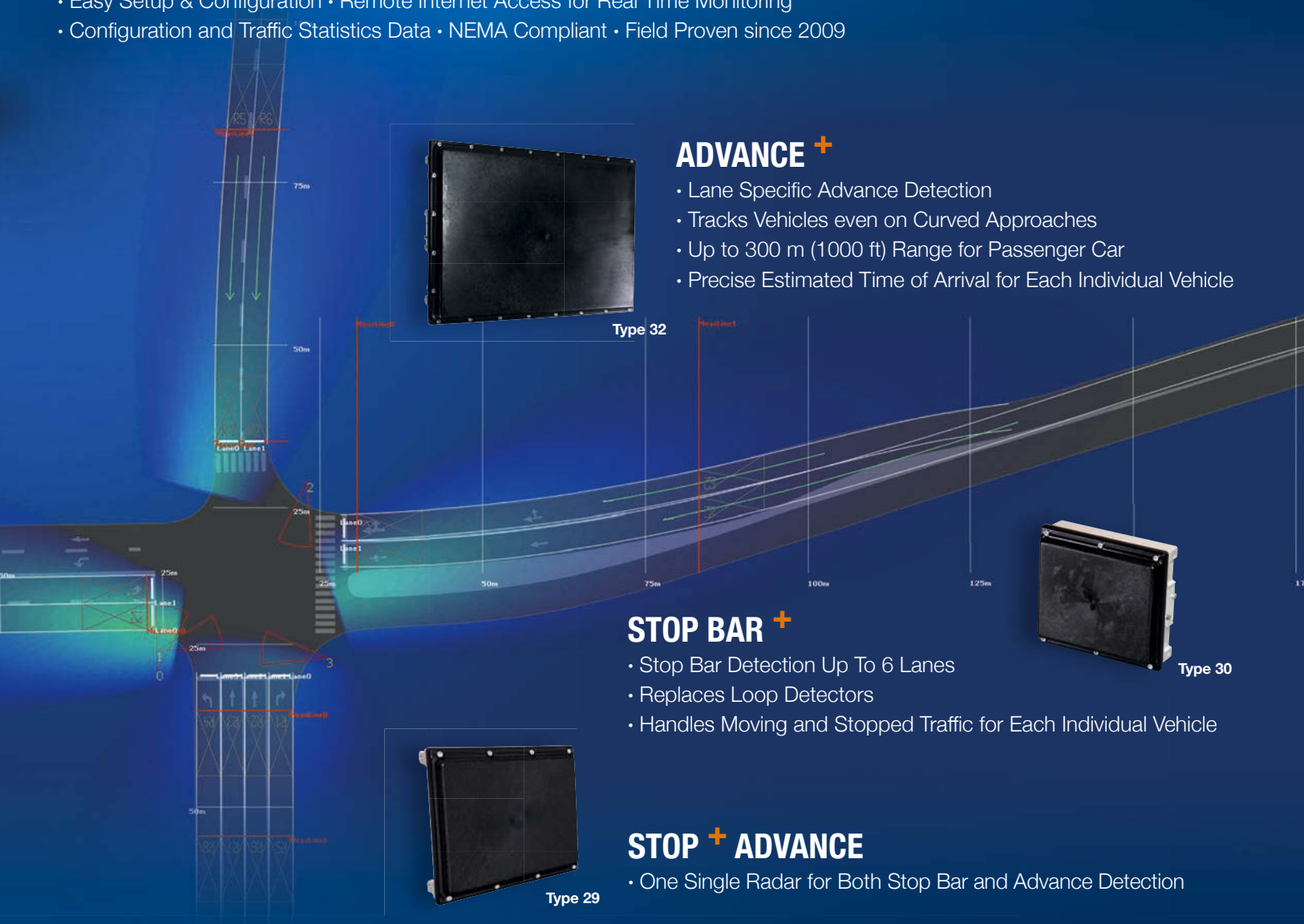

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TRAFFIC MANAGEMENT

Taiwan tolling success story

EXHIBITOR CASE STUDY

JAI
Booth 11.501

The Far Eastern Electronic Toll Collection Co (FETC) was appointed by the Taiwan Area National Freeway Bureau to set up an electronic toll collection (ETC) service in order to further strengthen – and cooperate with – the national transportation policies in Taiwan.

In September 2013, FETC achieved a remarkable feat when it recorded more than five million ETC users. This was a milestone for the company as the per entry-based construction of the ETC system was completed only eight years prior, in 2005, and the program had been fully operational from February 10, 2006 – a mere seven years. At the beginning of 2013, FETC started moving away from toll plazas that relied on the use of traditional ETC and manual payment systems to administer and deploy a multilane free-flow (MLFF) tolling system. The system – which has now been successfully implemented on three highways – covers a route of 1,000km from the north to the south of Taiwan.

In a bid to reduce installation costs and minimize road closures during regular maintenance schedules, FETC chose to use JAI camera technology. The company's advanced imaging products are known throughout the world for their low cost of ownership due to their reliable, high-performance features. JAI – in close cooperation with its Taiwan partner, Far EasTone – has delivered more than 1,000 Viscam 350 systems and TNL-50 flashes to FETC for the initial roll-out of the scheme. This has resulted in a dramatic improvement in travel time as well as lower levels of traffic congestion and pollution in Taiwan.

In Amsterdam, JAI will be promoting its Viscam range, particularly the Viscam 100, which is its newest all-in-one imaging system. "This five megapixel system incorporates real-time, through-the-lens light sensing, dynamic range control, a video self-triggering function and other features designed to maximize the quality of images that are produced for automated license plate reading (ALPR)," reveals Thomas Moore from JAI's Denmark office.

Moore also reveals that JAI will be displaying several new CCD/CMOS cameras suitable for integration into third-party traffic vision systems.

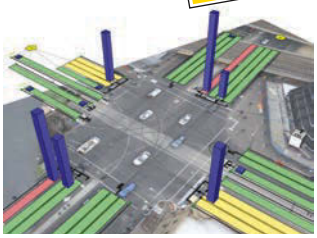
Smart software solutions

EXHIBITOR SHOWCASE

TRL Software
Booth 11.626

TRL Software will be focusing on two new products at this year's show – TRANSYT 15 and the latest version of TRANSYT Online – which takes advantage of TRANSYT 15 functionality. "We will be demonstrating the products through customer case studies and hope to have a very interesting storyboard video wall to convey our messages," explains the company's head of software, Gavin Jackman.

Jackman adds that as well as the two new products to promote, TRL also has some new business to boast about: "We have



recently been awarded a part-funded project by the European Space Agency (ESA) to integrate traffic control (SCOOT) and air quality/weather data, sourced from satellites and thereby removing the need for ground-based sensors. We will have project team members explaining the project and the latest progress on our stand."

Jackman is also keen to showcase other news that showcases TRL's continued success in the traffic arena. "In addition to the contract above, we have just extended our contract with Transport for London (TfL) to research, maintain and integrate the SCOOT kernel into their UTC and associated software assets, for a further three years until 2016, which means we'll have provided continuous service in this area for 20 years!

"We are also just about to embark on a further tranche of off-street trials for TfL," Jackman concludes. "These are largely focused on cyclist behavior with regards to new traffic control and infrastructure configurations."

Georg Clement

Point Grey
Booth 11.127

What's in store for visitors?

We will be showcasing a variety of CCD and CMOS cameras ideal for traffic applications. One of the highlights will be the new, competitively priced Grasshopper3 camera, featuring Sony's first global shutter CMOS sensor. This enables images of fast-moving vehicles to be captured without the motion distortion – a critical requirement for applications such as open-road tolling or ALPR applications.

Latest company news?

The Grasshopper3 is our biggest news right now. It is characterized by the capability to take crisp, clear, distortion-free images at high speeds. The CMOS sensor uses a special 'analog memory' that perfectly stores the light collected in the photodiode. This memory is shielded from all sources of noise and allows for a clean conversion during the analog-to-digital process. The IMX174 supports many features such as high-speed triggering and region of interest (ROI) functionality.

What trends are you noticing in your sector?

In the past five years we've seen an increase in global shutter CMOS sensors on the market and they are gaining popularity in the traffic sector. Some of the benefits include lower-power consumption, less expensive compared to CCD sensors, while smear and bloom aren't an issue with CMOS.

TRAFFIC MANAGEMENT

William Kroll

Intercomp
Booth 11.135

What's in store for visitors?

We'll be presenting our virtual weigh-in-motion (VWIM) system, which works directly with our innovative new high-speed in-road WIM strip scales.

Latest company news?

Our AX900 axle scale systems are now available with fully integrated RFX wireless weighing technology. This time-saving, cable-free operation improves safety and efficiency and is made possible by embedded radios enabling wireless communication to a variety of devices, while digital output still allows for cable back-up. Calibration is stored at the scale providing users with interchangeability of all components. Alternatively, users are able to interface their own indicator to the scales using analog output versions.

What trends are you noticing in your sector?

Advances in technology are providing authorities with an abundant amount of meaningful data to help them create safer, longer lasting roadways.

Can you tell us about a recent success story that highlights your capabilities?

We have recently noticed a surge in demand from port authorities. These agencies are asking for a way to determine the center point of a weight for load-planning purposes. We have therefore developed a solution to calculate the center of balance and the dimensional data for every object.

SMART THINKING

EXHIBITOR CASE STUDY

Smartmicro
Booth 11.802

Visitors to the Smartmicro stand will be able to see the company's radar-based traffic management products, which can be used for intersection management (stop-bar and advance detection), arterial management (traffic counting and classification) and enforcement (red light and speed). "These extremely high-performance 3D traffic tracking radars have now become capable of performing many new features, such as the handling of curved roads or bicycle classification and having an Ethernet interface," says Dr Ralph Mende, Smartmicro's managing director.

A new generation of radars will be introduced at the show, Mende adds. "The UMRR-0C range is a complete high-end radar platform comprising three models that will feature the 2DHD and 3DHD high-resolution technology required for the handling of dense traffic. A wide field-of-view and detection ranges of 500m are now available combined with what we believe are unmatched vehicle-separation capabilities, enabling 100 and more objects to be tracked simultaneously."

The company will also be presenting new accessories, such as its traffic management interface board (TMIB). "This enables a user to connect four radars at an intersection to only one cabinet card, which provides relays, CAN, SLDC and Ethernet interface to all connected radars," Mende continues. "It also makes the setup and configuration as well as remote internet access very simple."

Mende reports that in 2013 Smartmicro greatly increased its market coverage for traffic radars. Sales in North America and Europe were boosted and

the company also became active in new markets such as South America and China. "Our most significant single contract of 2013 was a project comprising more than 2,500 sensor installations for traffic counting and classification, used for an ITS system in Russia," Mende reveals.

"In other news, we've also contracted new distributors. We are proud to announce our new partner Econolite, which has taken responsibility for the sales of our Advance + Radar models in North America."

Matter of experience

EXHIBITOR SHOWCASE

Siemens
Booth 11.209

"'Experience integrated mobility' is the banner under which we will be presenting our new range of intelligent traffic control products and solutions," reveals Dirk John, CEO of Business Road and City Mobility, Siemens, infrastructure and cities sector. Highlights of the range include Sitraffic SmartGuard and Sitraffic STREAM.

"Our Sitraffic SmartGuard software enables city officials to access a central traffic control system using a PC, tablet or smartphone via a so-called 'private cloud'," John says. "It lets them control traffic-related

installations such as traffic signals, detectors or parking garages as easily and effectively as if they were standing right next to the traffic computer itself.

"This is especially interesting to customers who still want to enjoy the benefits of the latest traffic control technology without investing in the necessary hardware," continues John. "The user can access installations from any location via a PC, tablet or smartphone and also obtain an overview of the entire system from the maps in the OpenStreetMap application."

Sitraffic STREAM, on the other hand, is designed to make life easier for public transport operators and emergency services. "It allows public transportation vehicles to reach their destinations faster," adds John. "Several seconds before a bus approaches a red traffic light, the built-in GPS receiver sends its position via the mobile network (GPRS) to a computer. Soon after, the traffic light will turn green, speeding the vehicle on its way. It also helps ambulances and fire trucks to reach the scene of an incident as fast as possible."

Get connected

Moxa
Booth 11.800

Moxa is using Intertraffic to showcase the latest developments in its range of communications solutions. One such product is the new VPort 56-2MP camera, which the company claims is the "world's first rugged full HD IP zoom camera designed for mission-critical applications and temperatures ranging from -40 to 75°C, without the need for a heater or a cooling fan".

It has been tailored to increase system reliability in extreme conditions and decrease maintenance costs for operators.

With an optional built-in fiber interface and VP-PT1201 positioning PT scanner accessory, the VPort 56-2MP camera can be transformed into an IP positioning system with PTZ capability. The full HD resolution (1,920 x 1,080) H.264 IP zoom cameras come with an advanced optical technology featuring 10x optical and 16x digital zoom to improve the efficiency of a user's surveillance system and ensure the best video quality.

The camera is best suited for ITS tasks, especially those in extreme weather conditions.

On patrol

EXHIBITOR SHOWCASE

Ekin Technology
Booth 01.221

"We are particularly excited to be participating at Intertraffic Amsterdam this year because we will be introducing our new product, iPatrol," says Erdem Eray from Ekin Technology.

"This is a product that we have been working on for a long time, especially for the traffic management and road safety industry."

Eray explains that the in-vehicle system has been designed to combine multiple functions that users expect from an enforcement system in one unit. "With iPatrol it is possible to read and record license plates, capture speeds and match these two types of data together simultaneously while the vehicle is moving.

"We believe that with its technical capabilities and sleek design, this product will prove extremely popular with law enforcement personnel."

Eray is keen not to reveal too much about specific potential customers for this new system as he doesn't want to give his competitors any useful information. But he will go so far as to say that Ekin has already had interest in the iPatrol system from areas as diverse as North Africa, GCC, CIS and Europe.

Part of this interest is generated in response to a trend seen throughout the ITS sector – of wanting to do more with less. "Most of the common traffic enforcement systems today are designed to detect violations only," Eray observes. "As the technology develops and the need for integrated systems increases, it is important to include traffic surveillance, real-time monitoring, traffic density detection as well as intelligent crossroad management as a part of the enforcement solutions."

P PARKING

Patrice Schick

Schick Electronic
Booth 01.322

What's in store for visitors?

We will be presenting our brand-new SP2-115 detector, which features multicolored LEDs and ultrasound capabilities. With a new approach to detection and measurement, we are certain that the system will have an important impact on the industry. The detector is simply installed in the front of the parking space.

What trends are you noticing in the parking sector?

A recent survey by the Global Parking Association Leaders found that employing a parking guidance system appears to have the greatest effect on the parking profession than any other solution. We have responded to this trend by spending much of 2013 rolling out our Signal-Park system across the world.

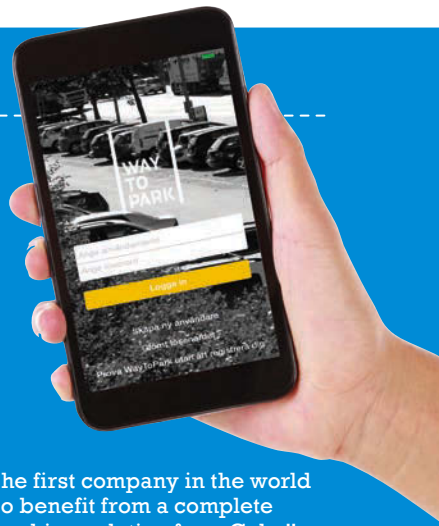
Can you tell us about a recent success story?

As a part of its recent expansion, the Mont-Blanc parking area in Geneva has just ordered our Signal-Park system for the third time. They have been using our system for 40 years and are consistently impressed by its quality and reliability. We have been progressively developing the system for a long time. Most recently we have integrated software that is compatible with smartphones and tablets.

Digital delivery

EXHIBITOR SHOWCASE

Cale
Booth 02.102A



"The world's industries are becoming increasingly reliant on digital technology and the parking business is no exception," believes Martin Frid, sales and marketing manager at Cale. "We have recently developed a new Digital Concept that enables increased efficiency in everything from payment, to special permits to enforcement."

In addition to its well-known CWT terminals and back-office system, Cale will be using this year's Intertraffic event to showcase the three innovative solutions that make up its new Digital Concept: a mobile app called WayToPark; an enforcement system known as Argus; and Smartpark, an advanced system for the handling of digital permits.

"All of the components in our Digital Concept can be integrated with external systems," Frid explains. "At Intertraffic Amsterdam, we will demonstrate how – by combining all of these parts into one system – profitability and efficiency can be substantially improved."

Some customers are already approaching Cale for a complete, integrated parking solution. Tønsberg Parkering in Norway, for example, is the first company to implement Cale's WayToPark mobile app.

"Tønsberg Parkering has previous experience with our CWT terminals and our CWO back-office software," explains Frid. "It will soon also add in our Argus system and Smartpark software. It will be the first company in the world to benefit from a complete parking solution from Cale."

Although the advances in digital technology are a sure sign of progress, Cale is not only expanding in terms of its product offering. The company has also recently established new subsidiaries in Spain and Denmark, as well as new distributors in Asia and the Middle East.

Better connected

Skidata
Booth 01.101/09.101/09.200

Robert Weiskopf, Skidata's senior vice president of car access, remembers when the first mobile phones were introduced. "They could do nothing more than make phone calls," he says. "But today, our phones are powerful computers that we can use to surf the internet, check emails and get directions using GPS navigation."

In the same way, parking management was also in its infancy 20 years ago – simply focused on monitoring entries and exits, and collecting parking fees. But like phones, the industry has grown to become more mobile and connected.

"Modern technology enables drivers to book parking spaces online and receive guidance to the parking garage via GPS," says Weiskopf. "A single ticket can provide entry to the garage, charging for electric vehicles, tickets for trains and much more."

Online, flexible and connected, today's operators can keep track of and control occupancy rates, actively manage marketing activities and optimize revenue generation. The required information is available anywhere and at any time.

At Intertraffic Amsterdam, Skidata will be explaining how e-ticketing and new payment methods present a diverse range of revenue opportunities while also simultaneously benefitting end customers.

It will also be talking about its 'Expert Service'. "We introduced this last year because we know that service makes all the difference," adds Weiskopf. "Skidata Expert Services provides support for the ongoing operation of facilities, in addition to the decision and implementation phases. We aim to provide the right answer and the right service at the right time."

Skidata's technology has recently been installed at several airports, including Madrid, Munich and Verona, as well as shopping malls and towns such as the Municipality of Haarlem in the Netherlands. It is even operational at some leisure attractions, including Legoland in Germany.

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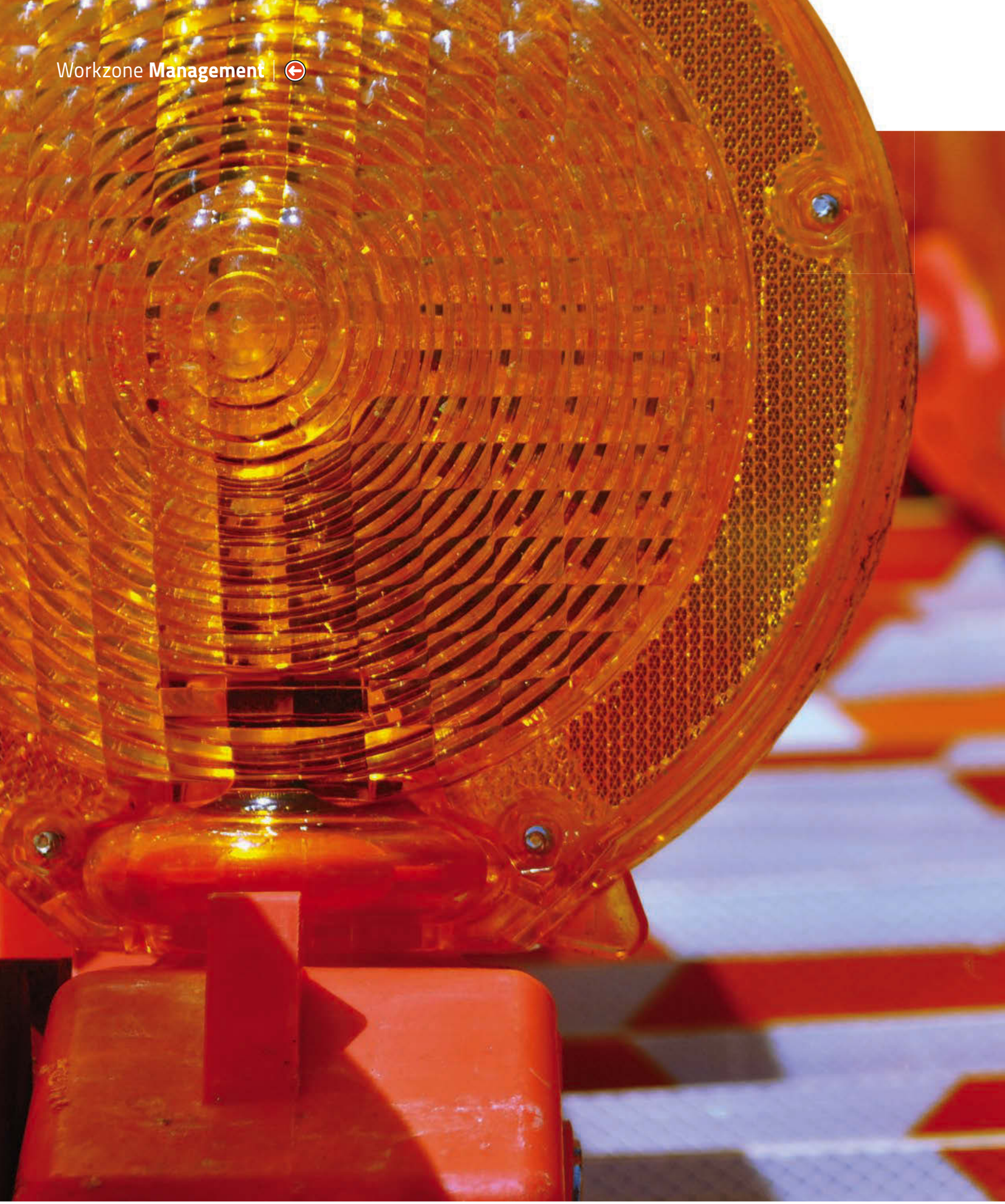


Masters at work

Having kept a close eye on best practice and the state-of-the- art in workzone management, what **Saul Wordsworth** has unearthed could be music to the ears of DOTs looking to limit disruption and enhance safety in these high-risk areas

Main photograph courtesy of Steve Wood

Workzones have a bad reputation. For many road users, they're a means of slowing traffic while prompting more profanities than a stubbed toe. 'They're not even doing anything!' is a familiar refrain – and all too often true.

In a historic city such as London, with its network of narrow roads and backstreets, even short periods of work can wreak havoc, causing ripples of chaos that can spread hundreds of yards from the workzone itself. "Thankfully, it's not as bad as it used to be," says Mark Beasley, head of planned interventions for Transport for London (TfL). "Until five years ago, we had the Noticing Regime. A utility company would explain the work it wanted to undertake and unless there was a state funeral or existing works, you were pretty much powerless to prevent it. Thankfully, we now have the London Permit Scheme, which hands control back to road operators. Utility firms no longer call the shots: we can now tell them they must work at night, be finished in a week and deploy temporary lights. We grant the permits and impose the conditions."

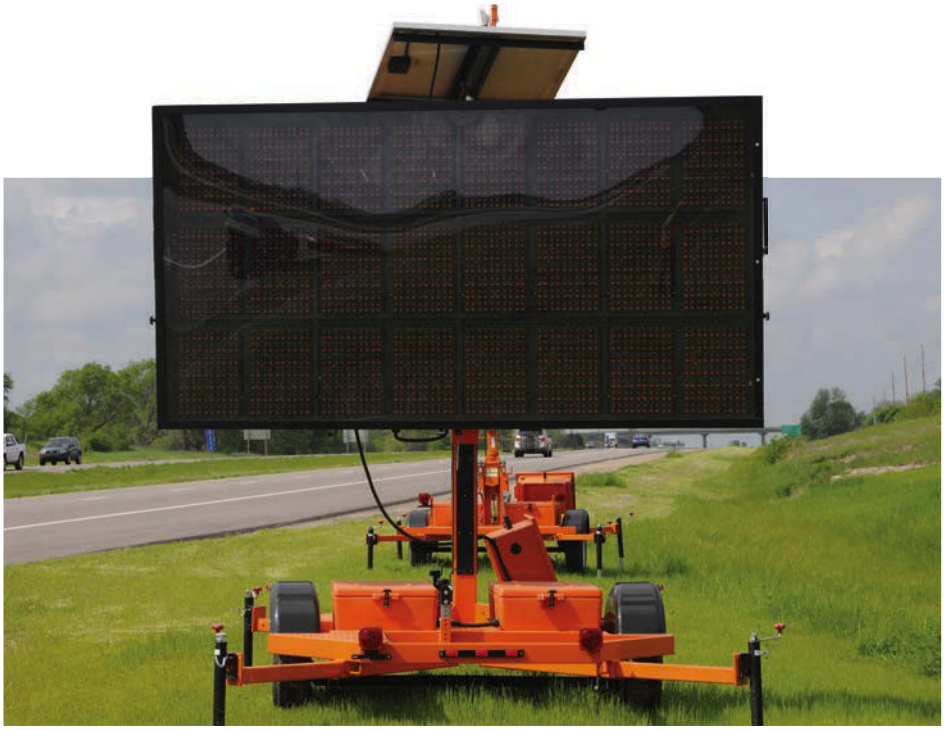
Workzones are a necessary evil, but more can be done to reduce the disruption they cause

This doesn't of course guarantee the work will be done on time. So in an effort to combat slow workmanship, TfL has been trialing automatic roadworks monitoring (ARM) cameras to check work volumes. The cameras are portable and can be mounted on nearby lamp posts or traffic signals. "They report back 24/7 on the footprint it's programmed to focus on," reveals Beasley. "A utility firm may claim it is going to take 10 days for a particular job to which we'll turn around and say, 'We think you'll only need eight'. On the eighth day they may say they need an extension because they're not going to finish – to which we can respond, 'You were only working on six of those days

Stateside developments

The US Federal Highway Administration has gone on record stating that queue warning system applications – where drivers are warned about queues ahead in real-time through the use of sensor data and portable changeable message signs (PCMS) – will be increasingly deployed. There is also ongoing

research in the USA in the area of Connected Vehicle applications, where drivers in commercial and privately owned vehicles will be alerted of queues and delays through the use of roadside sensors and onboard equipment. Meanwhile, the FHWA retains a strong emphasis on workzone performance measurement. Key areas include delays, user costs, exposure, safety and public perception.



– and on two days you did absolutely nothing!' That kind of 'big brother' technology is very useful."

According to Beasley, is it quite common for workers to be pulled off a job and be put on another, leaving the first site unattended. Indeed the utility companies are keen on seeing such technology deployed; very few have direct employees so subcontract. "The likes of British Gas, for instance, might be telling contractors to work between 6:00am and 10:00pm, but the cameras will show that they arrived at 9:00am and left at 4:00pm," Beasley continues. "The motion detection camera software was written by IPSOTEC. TfL had prototypes for proof of concept and now it has a business case going internally to purchase the cameras and put them on-site."

The degree to which a workzone can be electrified or plugged with technology is an area of contention. "In my opinion, ITS does have a place in workzones but should be limited to non-critical areas of a worksite," suggests Chris Towns of South Australia's Department of Planning, Transport & Infrastructure. "This way, if a power failure occurs it won't have any negative effect on road users navigating through a construction area."

Hats off to Kansas

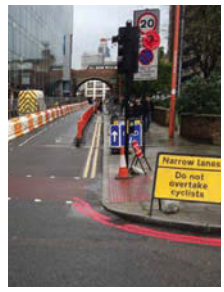
Someone who may beg to differ is Kristina Ericksen, senior engineer responsible for the workzone unit within Kansas DOT. "Our overarching strategy when attempting to manage workzones is safety," she says. "We are trying to prevent crashes, even just bumps and snags. Of secondary concern is that the work gets done as quickly as possible. Ideally we are trying to find a balance between the two. For this purpose, technology and ITS are tools we can use to make it happen."

Last year Kansas applied for – and received – a federal grant to carry out a demonstration project using workzone ITS, and was able to retain the equipment after the project. The goal was to influence traffic operations on I-35 during interchange construction work.

"We wanted to achieve that in two ways," Ericksen recalls. "One was to use congestion notifications displayed upstream to encourage diversion when congestion occurred. The second was to employ travel-time information and variable speed limits in the work area in order to inform drivers making their way through the construction zone in an effort to get a smoother stream of traffic with fewer differences in speed and calmer drivers."

Traffic sensors were placed on either side of upstream interchanges to infer the amount of diverting traffic, then further sensors every 0.25 miles through the workzone. Sensors were placed on either side of the road to read across up to four lanes of traffic, logging speeds, volumes and lane occupancy every minute. The data was available for instant graphing or could be downloaded for analysis using the vendor's proprietary software. Portable changeable message signs (PCMS) were placed upstream of the outlying interchanges for congestion messages and at 18 intervals in the workzone. Eight variable message signs (VMS) were placed in the actual work area,

> "No longer do the utility firms call the shots. We can now tell them they must work at night, be finished within a week and deploy temporary traffic lights"
>
> **Mark Beasley, head of planned interventions, TfL, UK**



(Top left) **Portable changeable message signs in Kansas** (Above, left) **US workzones are estimated to constitute about 10% of overall congestion** (Right) **Examples of bad** (left) **and good worksite practice in London** (far right)

Driven by distraction

A US$60,000 project in the North Star State may deliver a priceless safety innovation in the future. **John Hourdos** from the University of Minnesota reveals more about the prototype Intelligent Drum Line system

With the intention of transforming workzone safety, the Intelligent Drum Line (IDL) prototype has been created to provide an audible and visual alert to speeding and potentially distracted drivers negotiating these critical areas. Just how risky such sites can be is reflected in official figures from Minnesota DOT – a three-year average for the state's workzones is 1,819 crashes and seven fatalities a year, not to mention the near-misses that see flaggers running for cover.

"The IDL prototype uses two modified traffic drums placed 1-3ft from the shoulder of the road and 300-400ft apart," reveals the University of Minnesota's John Hourdos, principal investigator for the US$61,986 project.

Testing of the IDL has taken place primarily at the MnROAD pavement test track and involved a passenger vehicle, a light truck and a three-ton truck traveling at speeds up to 85mph. "Sensors in the first drum detect the vehicles, measure their speed and distance, and communicate

> If a sufficiently obvious and directed warning is delivered to distracted drivers, we can limit the risk of serious accidents

this information to the second drum through a wireless communication subsystem," Hourdos explains.

Both drums contain processing components and auditory and visual warning systems. When the IDL system detects an oncoming vehicle traveling faster than a threshold speed, the system activates visual warning systems in both drums and initiates a countdown. "When the speeding vehicle is approximately one second away from the first drum, an air horn is activated to warn the driver," Hourdos adds. As the vehicle passes the first drum, the audible alarm stops and the system transmits a command to the second drum to begin another countdown and, similarly, when that vehicle is one second away from the second drum, another audible alarm is activated.

Although IDL proved effective at gaining drivers' attention, Hourdos says a sufficiently cost-effective speed and distance measurement system needs to be sought to reduce the currently prohibitive US$3,000 price tag for the microwave sensors currently used. Two other systems were examined – the first a less expensive sensor that wasn't able to measure vehicle distance and assumed

Intellicone enables standard traffic management equipment to be turned into an electronic safety perimeter

four in each direction, along with six cameras to visually confirm congestion placed at the field engineer's preference. All in all, the smart workzone spanned about seven miles.

"The vendor's software was the glue that bound a collection of individual smart workzone devices into a smart workzone system," Ericksen continues. "The software monitored data from the sensors. When congestion was detected, preconfigured messages were displayed upstream and the speed limits were changed in the area where the congestion was detected and upstream of that location. All this took place automatically, although we had the capability to override at any time. There was a public website that displayed the travel time and speed information, similar to Google maps, as well as providing users with the chance to see what was currently posted on the PCMS and VMS."

Although a final analysis of the success of the initiative is still pending, the user satisfaction survey showed very positive results.

Innovation in the UK

Back in the UK, Highways Agency contractor A-one+ has deployed several cutting-edge technologies that have been taking hold in the workzone. Ryan Wood is the company's traffic management technical supervisor. "We have been working on the Intellicone for the past two years," he says. "It is a device that converts a roadside lamp into a sensor, turning standard traffic management equipment

> The vendor's software was the glue that bound a collection of individual smart workzone devices into a smart workzone system
>
> **Kristina Ericksen, senior engineer, Kansas DOT, USA**

a 300ft detection distance (not suitable for large trailers, which trigger the alarm early); the other a system that incorporated a separate advance sensing cone around 100ft upstream of the first drum. But this violated MnDOT's mandate for using no more than two drums.

"Microwave speed and distance sensors are relatively new to the market," accepts Hourdos. "While currently too expensive to be cost effective, their cost may decrease in the next few years to the US$500 range necessary for wider implementation."

The IDL prototype will need further modifications to pass FHWA crash tests, too, which would be necessary for it to be tested in actual workzones. "Testing of the system's effects on drivers in real-world conditions is also needed," confirms Hourdos. "Drivers in the MnROAD tests were aware of the system so they were unsurprised by the air horn." An MnDOT project to evaluate these human factors for a number of different systems is already underway.

(Top) **John Hourdos was the principal investigator of the IDL project** (Above) **The portable, dynamic IDL system provides visual and audible warnings to drivers who may have ignored – or missed – previous warning devices and pose a danger to workzone crews** (far left)

into an electronic safety perimeter. Essentially it senses an impact by a vehicle and sends a warning to the workzone."

Intellicone consists of wireless impact sensors that relay impact or heavy movement to a portable site alarm (PSA) situated with the crew. The GPS module provides accurate location information for each PSA, so the crew know where the impact took place.

The other system Wood is excited about is Impact Protection Vehicle 360, which has been created by Colas as part of a joint venture with A-one+. Its job is to prevent collisions where work vehicles are hit by road users, usually from behind. These often take place at high speed and as a result of drowsiness or inattention. Between 2006 and 2011, there were 149 such incidents on the UK network. "IPV 360 is a portfolio of solutions including rumble strips, an audible warning system and an early warning system that detects a vehicle approaching from behind that poses a threat."

Around the workzone

Clearly a workzone will greatly affect the roadway where it is located. But what of its sister roads, where the ripple effect truly takes hold? "When looking at all aspects of setting up a construction site, the area around the actual location of interest is already a key element in the planning phase way before we actually start work," says Arno Piko, regional road maintenance expert at ASFiNAG, Austria's motorway operator. "In this matter, our project managers evaluate the traffic situation at critical junctions with the arterial road network and prepare the solution. This could be as simple as

setting up speed limits to gain more performance, or rerouting the traffic to other nearby junctions. After the roadworks have started, traffic is so dynamic that previous planned scenarios might not even occur, or could turn out to be more drastic than one could ever imagine. Hence we sometimes have to improvise."

"Here in Kansas we contact local areas, asking what projects they have going on, what they anticipate the traffic doing, and so on," continues KDOT's Ericksen. "Sometimes it's really informal: 'We're sure we're going to do this and that, we don't have any data to support it but you'll probably see an increase on these roads.'"

(Above, left) **Workzones on US freeways are estimated to account for nearly 24% of non-recurring delay** (Above) **Disruption from roadworks costs London around £750m (US$1.2bn) a year** (Right) **TfL's 2012 Lane Rental Scheme has a target of reducing disruption caused by roadworks by 33% by 2015**

Impact assessment

Such informality may be about to change. The US federal government is currently involved in a research project using a new tool called Workzone Impact and Strategy Estimation (WISE), which can be used to assess the optimal sequencing of projects during the project planning stage and determine the efficiency and cost effectiveness of various strategies. The software is being tested in Iowa and Arizona using historical data, with pilot tests in New York and Florida using WISE to analyze projects currently in the planning phase.

"It helps at a Metropolitan Planning Organization (MPO) level to incorporate plans from all surrounding cities and look at a high level to see what impact workzones might have on arterial roads," confirms Ericksen. "It is especially handy if there are multiple projects planned at the same time that may affect one another. WISE can export data to a more detailed model and help facilitate conversation between the city, the DOT and MPOs. Although we were not selected as a trial city, we look forward to using the system."

Transport for London, when managing areas around a workzone, likes to set up its VMS well in advance. The authority has 150 fixed VMS and often requests utility companies to put up extra portable VMS where necessary. TfL's Network Performance division then provides expert advice on timings on lights, rather than leaving it to those on-site to estimate. In the wider area TfL will alter traffic signal timings that need altering to cope with any diversions expected so that an area can manage optimally with roadwork disruption.

"We are responsible for 6,200 sets of signals across London," concludes TfL's Mark Beasley. "The vast majority of these are controlled by a central computer, so we can change timings immediately should we need to."

> Traffic is so dynamic that previous planned scenarios might not even occur, or could turn out to be more drastic than one could ever imagine
>
> **Arno Piko, regional road maintenance expert, ASFiNAG, Austria**

The mother of invention

In 2012, London mayor Boris Johnson established the Transport for London (TfL) Lane Rental Scheme, or TLRS, to supersede a one-off fee (which ranged between £60-£240, depending on the type of works and category of road). The fee was purely to offset the cost of coordinating the works and granting the permit. The TLRS fee by contrast is related to the economic cost of disruption to traffic, so any company wishing to carry out work can now pay up to £2,500 a day. This has spurred innovation from the utility companies – Core and Vac being a prime example.

"It's a bit like keyhole surgery, or ice fishing," says Mark Beasley, head of planned interventions for TfL. "The innovation came from the USA and was first used outside the Houses of Parliament. A core is taken out of the ground, the equipment lowered to carry out the work, then the core is put back in and sealed, with any debris being vacuumed away. It's all done within a few hours rather than days, and that's driven by the threat of extra expense from the permit scheme."

In the same vein, CISBOT (Cast Iron Sealing Robot) has become a fixture within the gas industry (left). Lowered into a small gas main excavation and controlled remotely, it finds the leak and sprays it with sealant. It can travel as far as 500m before a fresh excavation is required. "It's much better than digging, not getting the right place first time and having to try again," states Beasley. "All that disruption to the surface is negated."

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Island records

Unearthing ITS projects in unlikely areas, **Louise Smyth** meets traffic management practitioners from very different islands around the world to discover how they are deploying ITS and tackling the unique challenges they face on a daily basis

Illustration courtesy of Ian Dodds

The eruption of Mount Kelud in Java on February 14, 2014 – which killed three people and saw tens of thousands evacuated by road – put into perspective the challenges that traffic managers and ITS practitioners can face when tasked with a complex land mass such as an island.

Thankfully erupting volcanos aren't an everyday occurrence – even if you're managing roads within Indonesia's Ring of Fire. Nonetheless geography alone causes a number of difficulties. And that's not to say these remote islands all face the same hurdles either. As we learn over the following pages, ensuring vehicles flow safely and smoothly in Iceland, for instance, isn't the same assignment as it is in Jamaica or even Tasmania.

Middle of the Med

Malta is the smallest island state in the European Union yet has one of the highest levels of car ownership per capita. Facing up to that is Peter-Paul Barbara, coordinator of Malta's National Electromobility Platform (MNEP) and ITS, set up between the Ministry for Transport and Infrastructure and Transport Malta. Barbara says it's an exciting time as far as ITS is concerned for the 316km^2 island, located in the middle of the Mediterranean. "The next two years will see Malta roll out ITS at a national level," he says. "For a small island state, the planned deployment will be substantial – both in terms of the impact on the transport system and in terms of investment that has been earmarked for urban traffic management and control.

Image courtesy of Trisnadi/AP/Press Association Images

Clouds of volcanic ash rendered evacuation difficult on Java

"With approximately 322,960 licensed motor vehicles on our roads, the challenges of managing such a fleet on a such a small network are great," continues Barbara. "Capacity problems and bottlenecks now exist at a number of critical locations on the 2,350km network, particularly at major intersections on our 260km SRN."

As well as trying to achieve a modal shift towards sustainable transport by encouraging drivers to use public transport (buses) instead of cars, in the past 10 years, a big focus in Malta has been on improving its road network, which for Barbara has meant creating proposals for projects that will compete for EU funding.

Turning point for Maltese mobility

Last year was a critical one for Maltese ITS. "In line with the EU ITS Framework Directive, we published the *National ITS Action Plan for Malta* at the beginning of 2013 and last December, the MNEP published the *Malta National Electromobility Action Plan (MNEAP)* to implement our government's electromobility policy," Barbara confirms. "This includes no fewer than 22 concrete projects to step up electromobility (vehicles and infrastructure deployment) in the Maltese islands. We want to showcase how electromobility can address a number of environmental issues at a national level.

"With Malta being such a small island and the distances traveled being relatively short, electromobility offers us the solution to address most of our European environmental targets that need to be achieved – in the short and in the medium term," he says. "The range anxiety issue common to larger countries as predominantly the main barrier to mass deployment of electric vehicles is not an issue at all here – at least on paper."

Transport Malta also recently published a public tender for the purchase and installation of a number of ITS-related technologies. These include the setting-up of a state-of-the-art traffic control center and the deployment of a range of high-powered CCTV

Frozen assets

In contrast to the warmer climes of islands such as Malta, Jamaica and Cyprus, experts in Iceland have extreme conditions at the other end of the spectrum to deal with. **Einar Pálsson** and **Nicolai Jónasson** reveal more

Einar Pálsson, an engineer responsible for winter maintenance at the Icelandic Road and Coastal Administration (IRCA), says that the challenges to managing traffic in his country are primarily weather-related. "On a daily basis we are dealing with the hazards associated with wintry conditions, such as blocked mountain passes, blowing snow, frequent high winds and wind gusts, and occasional avalanches – both of snow and mud."

Further challenges found on the island include natural hazards such as floods of melting glacier water. But as Pálsson's colleague, Nicolai Jónasson, observes, despite these more unusual issues, traditional traffic management headaches are not much of a problem on Iceland: "Congestion is a question of 10-15 minutes during rush hour in the capital."

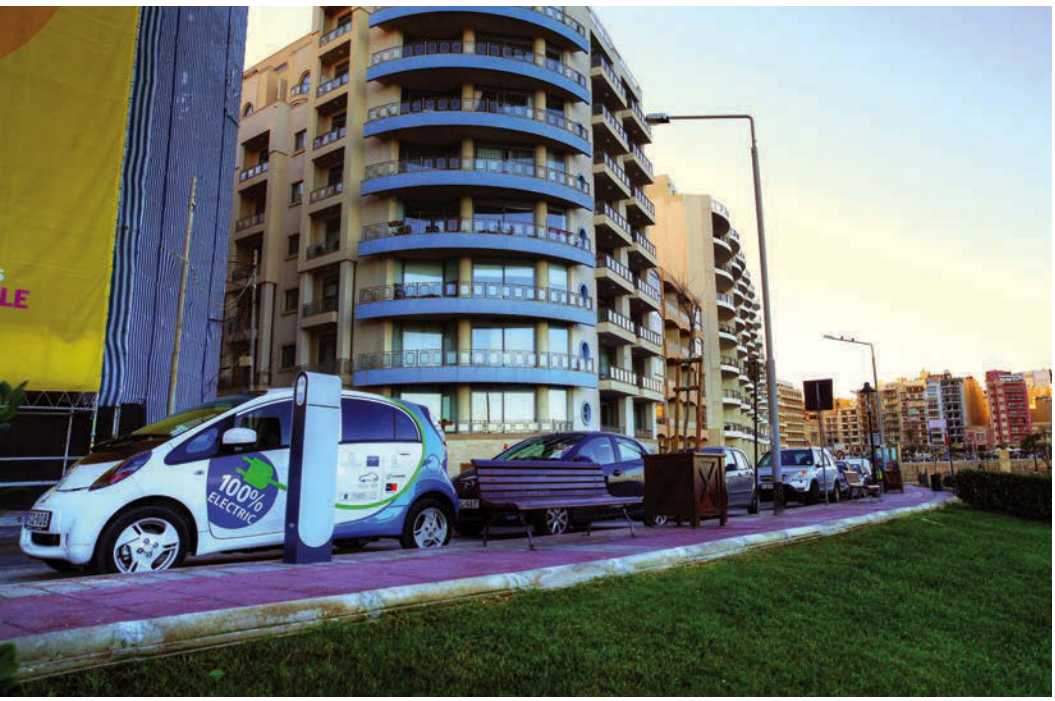
But Jónasson, who is an engineer responsible for ITS and electrical road equipment at the IRCA, has noticed an increase in a specific sort of traffic in recent years. "We've seen tourist traffic grow rapidly. In the past two years the number of visitors has grown by 18-20% yearly – such that the number of visitors is almost three times the population! Although this is mostly during the summer, winter tourism has also increased. Vehicles and buses stop on the roads where there are no shoulders or rest areas to view natural wonders such as the northern lights, which causes danger for passing vehicles."

With regard to ITS deployments in Iceland thus far, Jónasson explains that some progress is being made, although it's proving very hard work. "In the capital, the IRCA together with the Municipality of Reykjavik have automated the traffic light network on the main roads (via a Siemens-based system). IRCA also has traffic classifiers [from Golden River/Clearview] and counters on all major roads in the country (loops and piezo). As many equipment locations are far away from inhabited areas, power sources and communications is an ongoing challenge. IRCA primarily uses wind generators and solar cells in areas where a connection to the power grid is not available."

It goes without saying that there are plenty of weather stations (around 100 in fact) dotted around Iceland. "These stations feature freezing depth sensors, among others," confirms Pálsson. "They are serviced by both our own personnel and local contractors, depending on where they are."

Pálsson says that for a traffic manager in Iceland, this weather data is invaluable. "A typical day for a traffic manger would first and foremost involve checking and passing on the actual road conditions to the

> "On a daily basis we are dealing with the hazards associated with wintery conditions



road user. Conditions cover everything from whether roads are passable, to whether they have spots of ice, are slippery, extremely slippery, have snow present, and so on. Warnings given to drivers include difficult driving, difficult road conditions, impassable, etc. Simultaneously, the traffic manager must respond to the tasks and conditions in question, such as conducting winter maintenance."

Pálsson says that VMS are mainly used to communicate information to drivers, with messages displayed both in Icelandic and English. "We place VMS on both sides of mountain passes so that travelers can get information about weather conditions. It's not good for your trip to see messages such as 'Closed' or 'Violent storm'," he laughs.

(Above) **VMS are a critical component of Iceland's winter road management strategy** (Left) **Einar Pálsson, engineer, Road and Coastal Administration (IRCA)**

Malta is looking to electromobility as the future of sustainable travel

cameras along all of Malta's TEN-T network. These will enable real-time monitoring of traffic congestion levels, while a network of DMS will also be deployed along the TEN-T network in critical areas as well as preceding critical traffic bottlenecks.

"If there's increased interest from the private sector, the government may consider setting up an electromobility and ITS hub in the years ahead, within which companies will be able to carry out all sorts of R&D activities and use Malta as a test-bed for future innovative solutions," hopes Barbara.

Cyprus travel guide

Dwarfing Malta as far as size goes, Cyprus is the third largest island in the Med. And while these two islands in the sun drive on the left, that's likely where their similarities end. Aristotelis Savva wouldn't be offended to read that, despite its larger size, Cyprus still has a long way to go before it can boast the innovative ITS schemes of its much smaller cousin, Malta.

Savva is an executive engineer within the Public Works Department of Cyprus's Ministry of Communication and Works. When probed as to the major challenges associated with managing traffic on the 9,250km^2 island, his extensive list sets out the reality of what he and his team face on the country's 12,134km network.

First off, entrances to the country are exclusively ports and airports, through which Cyprus sees the majority of its goods and people movement. Seasonality, meanwhile, is a key factor affecting traffic patterns. "We're a major holiday destination and attract approximately three million tourists annually, most of them visiting during the summer months and staying in our coastal areas," says Savva.

But despite the many and varied challenges – and the financial crisis that has affected Cyprus and close neighbor Greece over the past few years – Savva insists ITS is alive and kicking on the island. "The Cypriot government introduced adaptive central control of its traffic-signalized

> The range anxiety issue common to larger countries as predominantly the main barrier to mass deployment of EVs is not an issue at all in Malta – at least on paper
>
> **Peter-Paul Barbara, national coordinator, Malta National Electromobility Platform and ITS**

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intersections back in 1993," he says. "The current generation of the system, Version 4.5 of SCOOT from Siemens, is operated from the Public Works Department headquarters in Nicosia and facilitates the control of 90 intersections in Nicosia, Limassol and Larnaca.

"We have traffic counters in the motorway network that are collecting information about traffic flow, speed and axle weights; the collated data is used for conducting traffic studies and for road pavement maintenance. And we have several permanent weighing stations, at which our traffic police undertake checks of heavy vehicles to discourage the overloading of heavy goods vehicles, which can cause a lot of damage to the road and increase the risk of accidents occurring."

Safety push

Road safety has also been top of the agenda for Cyprus in recent years and Savva reports some major progress here. "Accident rates, particularly fatal accidents, have been reducing steadily in recent years due to coordinated action being taken by all relevant stakeholders, including road improvements at accident blackspots and preventive, educational campaigns to foster better road safety attitudes. Fatal accidents have dropped from over 110 in 2004 to 56 in 2010 and just 41 last year. The steady decline in fatalities suggests Cyprus is well on its way to meeting the EC's target of reducing road accident deaths by 50% by 2020, compared to 2010 figures."

And much more is still to come from Cyprus's fledgling ITS sector, as Savva details. "Through the EU INTERREG Programme Greece/Cyprus 2012-2013, two projects are being implemented," he says. "A first pilot project, DIAVLOS, aims to improve information provision to road users regarding travel times, congestion and roadworks on the interurban road network and primary road network of Nicosia, with the capability to expand to cover all cities in the island. In addition, information will be provided regarding parking availability in the city center. We're collecting real-time information through 28 traffic counters, 28 Bluetooth devices and five CCTV cameras, while we disseminate appropriate information through web and smartphone applications that will also include multimodal routing applications."

> We're a major holiday destination and attract approximately three million tourists annually, mostly visiting during the summer months and staying in our coastal areas
>
> **Aristotelis Savva, executive engineer, Public Works Department, Ministry of Communication and Works, Cyprus**

(Left) **A fleet of EVs in Malta** (Top right) **The A6 in Cyprus**

Swarco Mizar won the contract so the system is being built on its OMNIA-MISTIC platform. Furthermore, the project includes deliverables such as creating an ITS architecture suitable for island cities and designing specific systems suitable for local needs. The initiative will be completed in spring 2014 at total cost of €900,000.

The second pilot, PRODROMOS, aims to improve exchange of information between international port authorities, as well as between port authorities and the responsible agencies that are managing the inland road network, and particularly information regarding the movement of dangerous goods or abnormal loads, and safe movement of people using the ports.

Savva will spend the next few years managing the delivery and expansion of the two projects, but also hints at the rollout of a camera-based speed enforcement program, all of which will have a major knock-on effect for Cyprus, too. "Real-time

Island intersections

The island of San Andrés in the Caribbean has a surface area of only about 52.5km², making it Colombia's smallest 'departemento', yet it can now rely on one of the most modern and efficient traffic control and traffic light switching systems in the entire country. In total, 14 intersections on the island have been equipped with Siemens' ST900 controllers linked via glass fiber cables to its urban traffic control center. The video cameras installed at key intersections provide the real-time monitoring data that the responsible operators need to define the optimal response to the current traffic situation and minimize the number of stops and the waiting times at the intersections. In a later phase, the currently installed components will be linked up at any time to an adaptive SCOOT control system. Additional improvements of traffic flow are achieved by the integrated green-time request functions of the pedestrian lights, which will only prompt the traffic lights to switch to red for the motorized road users when – and if – there are actually pedestrians waiting to cross. The LEDs in the new traffic lights also ensure low power consumption and a long service life.

Devil's in the detail

Famous for its unusual mammal, the Tasmanian Devil, the island state of Tasmania is part of the Commonwealth of Australia and located 240km to the south of the Australian continent, separated by the Bass Strait. With around 500,000 inhabitants, the island itself is the 26th largest in the world and covers 62,409km².

Like most other places in the world, improving traffic safety is a priority. In January 2013, a new variable speed limit (VSL) system went live on the Tasman Highway on a section of the road that was forever becoming congested during peak times and experienced an elevated crash rate compared to other roads in the state. So in peak times, even a minor crash had the potential to significantly impact a large volume of traffic.

The Tasmanian Government introduced the 9km VSL scheme between Liverpool Street, Hobart and the Cambridge Road Interchange, including the Tasman Bridge. Along this section of the highway, existing static speed limit signs were replaced with electronic VSL signs, operating 24 hours a day. Although this was the first deployment of its kind, VSL signs are used in other parts of Australia and are similar to signs in school speed zones around Tasmania, so it wasn't an entirely alien concept.

Unlike static signs, the benefit of a VSL system is its capability to respond to changing road conditions such as traffic congestion, a crash or weather conditions such as rain, ice or wind. VSL systems have been shown to improve safety and traffic flow.

Tasmania is adopting VSL signs to try and improve road safety

In a progress report from September 2013, Tasmania's Department of Infrastructure, Energy and Resources (DIER) stated that, "The new VSL system is working well and initial results indicate that it has already helped reduce crashes.

"During the past six months, the system has shown that the majority of drivers are obeying the lowered speed limits, especially during peak hour travel times. This is really positive and shows that motorists have really embraced this new technology."

The DIER reported no significant road crashes have occurred during the peak morning period since the VSL system went live. And initial data indicated that there has been a 57% overall crash reduction over a 24 hour period from the end of January to mid-July 2013.

traffic management will be possible for the first time once these deployments are fully operational," concludes Savva, "providing not just information relevant to agencies but to road users also."

Tropic wonder

Over in the Caribbean, Michael Saunderson is an ITS specialist at Jamaica's National Works Agency (NWA). "The challenge for ITS managers on islands such as ours is to recognize early on that many of the problems we have are more to do with institutional weakness rather than any lack of technology," he begins. "We could deploy the most advanced technology available but it wouldn't have the desired outcome due to the poor enforcement environment. The ITS manager who recognizes and identifies the links between institutional weakness and ineffective results – and further develops a solution within the ITS project – will stand a better chance of succeeding."

Saunderson has a perfect case in point to illustrate how he practices what he preaches. "I saw early on that traffic enforcement here was very poor, so motorists accumulated many traffic tickets

(Right) **Traffic in Nicosia on Cyprus**
(Below) **Cyprus's Limassol highway**

and warrants without fear of police prosecution," he says. "We worked with the police to analyze where the weaknesses might be and developed an ALPR-based solution to automatically capture the plates of motorists with outstanding tickets. Our proof of concept has been a success.

"Now, in consultation with the police, we plan to place ALPR cameras at each entry and exit point around Kingston. We buy in the ALPR hardware but program the software ourselves. At the same time, I'm ensuring that our underground fiber network will be available at each of the ALPR sites by April 2014. The idea is that if we can first effect change in the enforcement environment, the ITS project will yield greater benefits."

Saunderson has worked on ITS projects worldwide and in 2004 applied his knowledge to oversee the implementation of an ITS project in the Jamaican capital. He soon found out he had his work cut out for him, citing a lack of traffic engineering standards and associated performance measures to evaluate the

performance of the street network and transportation system as major hurdles. "We use the FHWA's *Manual on Uniform Traffic Control Devices* (MUTCD) and rely somewhat on TRB for guidance in traffic signal warrants, signage and road design. The lack of adherence to engineering standards and best practices makes the planning, operation and maintenance program subject to outside interference, which can result in signals being installed that are not warranted and suboptimal operation at some signalized intersections, for instance."

Fiber installation

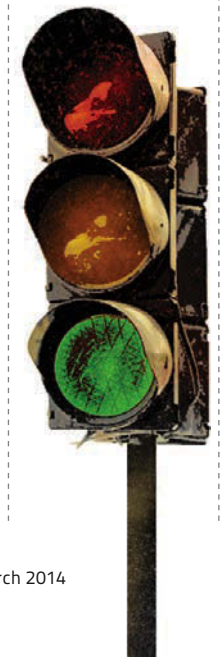
However Saunderson says a great deal of work has gone into improving the roads infrastructure and traffic management in tourist areas. But it's the Kingston ITS project that is the real jewel in Jamaica's ITS crown – a dedicated communication system using fiber and wireless broadband technology. "We completed the project in December 2013 and so far have installed more than 25,000m of underground fiber, while an additional 35,000m of aboveground fiber optic cable has been deployed since 2009, forming an advanced fiber ring around the whole city," reports Saunderson. "We have linked more than 30 traffic signals and 16 cameras to the TMC and we're presently in the process of installing wireless broadband radio links between Kingston (TMC) and Montego Bay, St James; Ocho Rios, St Ann; and Falmouth, Trelawny. All this work should be finished by April 2014."

With the ALPR proof of concept already declared a success, Saunderson says other enhancements will contribute to safety. "We have purchased one speed enforcement camera and two red light running cameras for evaluation," he reveals. "We intend on purchasing an extra 18 ALPR and 18 IP-based CCTV cameras before April 2014."

Other ITS deployments include a single WIM site near a major bridge in Kingston and the installation of a QuicNet 6 ATMS to remotely monitor the operations of traffic signals and Dynamic Message Signs (DMS). "We are in the process of upgrading the ATMS to QuicNetPro and hope to complete the interconnection of the remaining Kingston traffic signals to the ATMS by November 2014. We have not yet purchased a DMS."

(Right) **Wireless broadband communication tower erected at the NWA head office** (Bottom left) **Fiber optic cable ducts being installed in New Kingston, St Andrew, Jamaica**

> The idea is that if we can first effect change in the enforcement environment, the ITS project will yield greater benefits
>
> **Michael Saunderson, ITS specialist, National Works Agency, Jamaica**

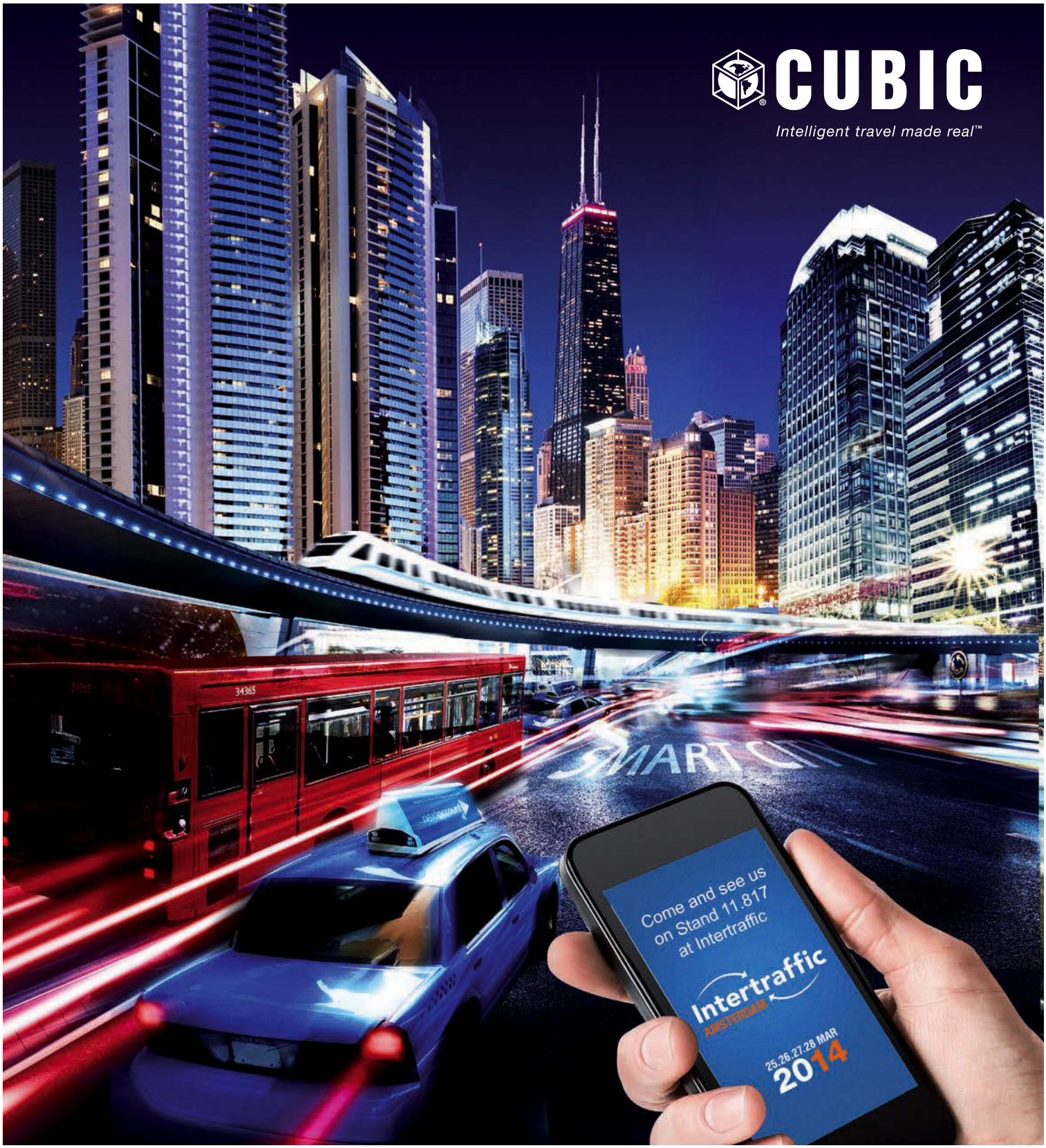


Saunderson has also been busy working on a number of other projects, primarily in the communications technology arena. "We're experimenting with Gigabit Passive Optical Network (GPON) technology for use on end devices geared at linking traffic signals and cameras to the TMC," he says. Other advances in the pipeline involve upgrades to TMC network equipment to include Cisco Metro-Ethernet Switches (MPLS), new workstations and a video wall, while a new mobile application is being developed for streaming traffic-related videos over cell phones. "We are also developing a framework for a next-generation public safety network using 4G LTE, which will be supported by ITS fiber network where feasible."

Financing improvements

When speaking to him, you get the impression that Saunderson would achieve even more if he were at the coalface all the time, rather than banging on doors asking for money! "ITS is not widely seen as worthy of dedicated funding but I have enjoyed most fund-raising success by promoting those ITS components that are mutually beneficial," he explains. "The fiber network, for instance, will deliver benefits for other government departments that need to be connected, so they buy the cable and get access to the spare fiber and we do the installation."

Forcing ITS up the political agenda and joining forces with other stakeholders who can benefit from piggybacking on each other's deployments is a universal goal. Whether they're on a small island such as Jamaica or in a big country such as the USA, that's something that all ITS practitioners should be aiming for.



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Missing link?

The Highways Agency becoming a publicly owned entity is a huge shift for roads policy and the funding of England's Strategic Road Network. But is it sustainable in the longer term? **Duncan Matheson** puts forward an alternative that could tackle wider policy goals and marry road usage and motorists' payments

Illustration courtesy of Patrick George

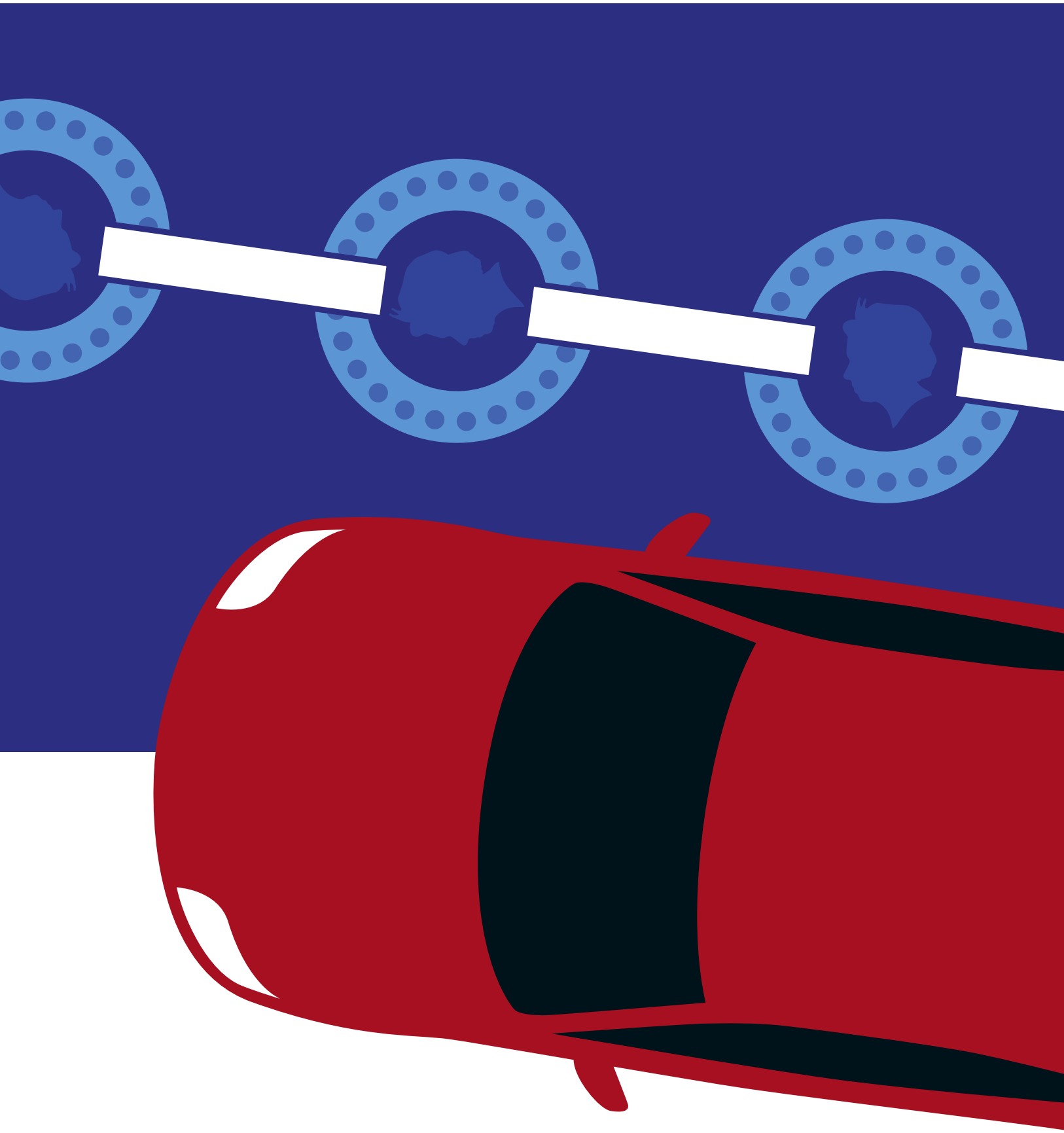
People in the UK drove 304 billion miles in 2011 and contributed £32.3bn (US$53.6bn) in motoring taxes, mainly Vehicle Excise Duty (VED) and fuel duty. That equates to an average tax of 10.6 pence per mile (17.5¢). But only £8bn, or 2.7 pence per mile (4.4¢), was spent on road maintenance and enhancements, which only goes to show that there is absolutely no link whatsoever between motoring revenues and road investment.

In recent years the Highways Agency (HA), which looks after England's strategic road network, has not been funded in a manner commensurate with the scale of investment required. Its varying annual budgets and mode of operation have made it difficult for the organization to deliver its program efficiently.

So following a series of reviews to consider potential solutions – including greater involvement of private finance – there was a reappraisal of roads policy. With the publication of the command paper, *Action for Roads: A network for the 21st century* in July 2013, the government introduced fundamental changes to the way that strategic roads should be built, managed and maintained. Consequently, by 2015, the HA will be established as a government-owned company with increased autonomy. It will benefit from a big increase (three times today's levels) in capital spend over the years 2015/16 to 2020/21, delivering a five-year investment strategy and a new performance framework to provide increased accountability and transparency.

The Office for Rail Regulation will help ensure that the HA uses these extra resources wisely, while Passenger Focus (an independent passenger watchdog) will articulate the perspectives of motorists.

> The Highways Agency's varying annual budgets and mode of operation have made it difficult for the organization to deliver its program efficiently



While introducing the new operating model and delivering an expanded investment program will present substantial challenges, the current reforms have much to commend them. However, there are some long-term problems that haven't been solved, as *Deep-seated problems remain* (opposite) reveals.

Where next for roads policy?

Roads policy has a number of key goals, such as delivering sustainable investment to maintain assets efficiently, expanding capacity and tackling congestion to boost the economy, and encouraging a shift to cleaner vehicles to reduce environmental harm. So how can the government best meet these goals while ensuring fair taxes for motorists? The answer could be to introduce a distance-based charge to 'take up the slack' in declining revenues from VED.

In the longer term, this would replace VED and become the primary source of funding for roads provision and maintenance, broadly representing the amount to be spent on strategic and local roads year on year. Figure 1 shows an example of how it might work (The related assumption is that fuel duty continues to contribute toward general taxation, although this would decline over time.)[2]

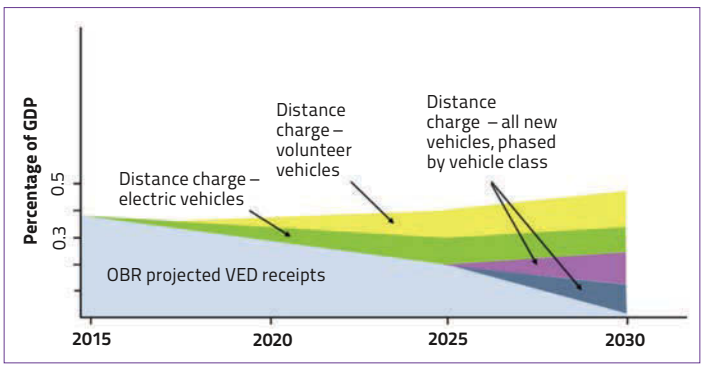
It is envisaged that any transition process would set a cautious path toward pay-per-mile charges to create a sustainable funding base, and facilitate environmental goals by introducing a new distance-based charging regime for electric and hybrid vehicles in the first instance. This would mirror the initiatives being considered in Oregon, USA, and would encompass all newly registered vehicles in the longer term as VED and fuel duties continue to decline.

A 'direct link' between road use and the costs of provision and maintenance would be created in the medium to long term, by hypothecating the revenues from distance charges (and VED while it exists), and earmarking them only for investment in the strategic and local road networks.

New delivery models could be explored for the road network in the long term, with greater involvement of private finance, based on the payment stream created by the new distance charge. This could, for example, involve private operators running the roads in a region within an appropriate regulatory framework.

Such measures would not be without their challenges but should be accepted by the motoring public – provided that they can see a clear path to improved roads and more reliable, cleaner journeys. Without them, roads policy will never achieve the long-term stability of funding required.

> New delivery models could be explored for the road network in the long term, with greater involvement of private finance



(Main) **Taxes extracted from fuel duty and VED differ wildly from what's reinvested into roads** (Figure 1) **Graph shows migration from VED to distance charging**

It's difficult to quantify exactly what the total proposed budgets for local authorities and the Highways Agency will actually be for roads improvement and maintenance between 2015/16 and 2020/21, even with the information referred to in the reference provided the HM Treasury's *Investing in Britain's future*.[3] Taking the headline figures of 304 billion miles traveled and £8bn spent on roads in 2011, we could assume that this equates to something in the order of 3 pence per mile (5¢) at present and that this is likely to increase over time. At the very least, it gives an initial yardstick of what might be expected as a distance charge in lieu of VED.

Adopting a cautious approach

But how might this all work in practice? Any new charge should be related to distance traveled, incorporate a component based upon the greenhouse gases generated (encompassing 'well-to-wheel' impacts for liquid fuels and power generation emissions for electric- and hydrogen-powered vehicles), and a vehicle weight-related element that would impact HGVs the most in the longer term.

Implementation could be phased over a number of stages. The emphasis would first be on introducing this compulsorily for electric and hybrid vehicles (which have attracted substantial tax incentives to support initial purchases). This would reflect the fact

Deep-seated problems remain

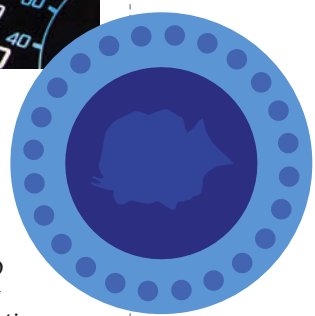
Despite the reforms proposed in *Action for Roads: A network for the 21st century* being a radical change in the way the strategic roads are funded and managed, some deep-seated problems remain. And these are long-term problems that simply haven't gone away.

First, motoring tax revenues are declining due to factors such as increased vehicle fuel efficiency, a greater proportion of vehicles in lower VED emission bands, as well as the slow transition to hybrid and electric vehicles, where duties are currently considerably reduced or non-existent. Such a situation is arguably unsustainable in the longer term so something has to change. Second, it's difficult to raise road taxes further without political ramifications. Motorists already feel they're getting a raw deal due to the mismatch between what they pay and what they receive. Taxes represent the majority of motor fuel costs and it's worth noting that 'planned' increases in fuel duty have already been postponed. Third,

the current mechanisms for collecting revenue are blunt tools when it comes to supporting wider policy objectives for a road network, which include minimizing congestion and addressing the impact of driving on the environment. And lastly, there is the issue of stability of funding. Although an uplift in roads funding has been pledged for the six years to 2021, comparable or increased funding cannot be assumed beyond that period. The absence of an income stream based on road charges also means that it is difficult to bring in private finance.

The government needs to set a medium-term approach to tackling these problems. Critically, it also needs to gain broad acceptance from road users as to the 'rules of the game' – de-politicizing the issue of roads investment as it succeeded in doing for other areas of national infrastructure, including water.

(Left) **In the future, odometer readings could be used to track mileage and driving behaviors, following an introduction of a pay-per-mile scheme**



that there are environmental implications of the use of such vehicles, whether to generate the fuel/energy to power them or through their limited wear and tear on road surfaces.

Second, drivers of unaffected vehicles could be incentivized to install a device to be charged on the basis of distance, for example by discounting or zero-rating VED for participants in the scheme. They would continue to pay fuel duties but there would be other benefits from participating.

Motorists with equipped vehicles might, for instance, receive reports on their driving patterns, their CO_2 emissions, data about the congestion they experience, and ways in which the impact of their driving habits could be changed to reduce costs and lost time. It might also offer the benefits of discounted Pay As You Drive (PAYD) insurance.

These charging and information services should be provided under contract (rather than any public sector scheme) from a range of private providers that would protect users' privacy. These could include cell phone companies, motor manufacturers, utilities companies, and smartphone applications, all of which most drivers would have a relationship with. Payments might even be possible through less conventional models such as iTunes or PayPal.

Third, in the longer term, distance charging would be made compulsory for all vehicles from a prescribed date. This could take a number of forms (again building on ideas from Oregon). In the future, it could include a device fitted in-vehicle to support time, distance and place charging. A device might even be fitted that could support distance charging alone (e.g. linked to the odometer output), or alternatively a portable device (e.g. a smartphone) that could link with the vehicle's systems (e.g. the odometer output). It could potentially involve a fixed fee (analogous to the VED payment); the charges levied would differ so users would be able to make choices based on that.

All this would help incentivize users to change their behavior and use cleaner vehicles. In principle all new vehicles should be capable of carrying such a device – after all, since 2004, all vehicles have had to be equipped with an OBD-II interface that could be utilized (although the fixed fee option might be the only one available for the diminishing number of older vehicles).

The task of implementing such a system need not be reserved for the public sector. Capable private businesses should be able to offer these services to users, collecting charges on behalf of government and being paid a reasonable return for their investment. This would be on the proviso that services would be certified to show they meet minimum performance criteria and provide safeguards for users, etc.

Fourth, over a period of years, the system could be fine-tuned to introduce graduated distance and place charges to tackle congestion blackspots. Traveling in

a designated congestion area at peak times, for example, could attract an additional fixed fee or a premium of 'x' pence per mile. Existing schemes such as the London Congestion Charge might be subsumed and new schemes tackling congested urban areas or particular routes (e.g. parts of the M6) could be added. The principle would be that the user has a single account for all their motoring charges.

Over time, as the UK mix of vehicles changes, becomes cleaner and more efficient, the importance of VED would reduce. And at some point, it could even be abolished, except perhaps for the remnant of vehicles that couldn't support distance-charging technologies (in which case a fixed fee may still need to be applied).

The overall goal would be to create a funding stream that would be substantially hypothecated for investment in strategic and local roads, and potentially to finance congestion-busting schemes for towns and cities. Investment in strategic roads would be managed by the 'new' HA, with its multi-year planning cycle to ensure smooth investment over the period.

Funding development and maintenance of local roads would need to be subject to some form of review and assessment process (potentially more sophisticated than today's local government settlement), which reflected the volume of traffic, the network topology and road condition versus a clearly defined 'standard'. In addition, consideration could be given to creating regional funds to support the management of congestion in towns, cities and local pinch-points through capturing relevant data and through the longer term levying of specific congestion tariffs.

A regulatory body to oversee all this would need broader powers than currently being contemplated by the government to oversee the HA in its revised form (Office of the Rail Regulator). It would act independently of government and have the power to approve (and therefore cap) the pattern and level of distance charges levied on drivers, balancing the need for investment with considerations of user fairness, equity and the environment.

New delivery models could be explored for the road network in the long term, with greater involvement of private finance, based on the payment stream created by the new distance charge.

The transformed HA could even gain further freedoms if a material part of its funding were to come from the distance-based charging regime proposed here, rather than in the form of taxation (VED). This could further enable the organization to strengthen its oversight of the provision and management of strategic roads.

In the very long term, the HA itself could be considered for privatization, using a regulated utility model, for example. Alternatively, other private sector opportunities for the provision and operation of specific new roads could be considered, with the government granting concessions to private companies to build and run infrastructure for a time-limited basis. In such instances, payments for the service could be based upon distance-related charge collections over a wider area, rather than creating concerns about diversion that would undermine specific link pricing.

> Consideration could be given to creating regional funds to support the management of congestion in towns, cities and local pinch-points

(Below) **Distance-based road user charging is widely being seen as one potential mechanism to implement national road-charging schemes**

An ambitious vision?

The path set out in this article looks ambitious, but arguably no more so than the introduction of smart meters in the energy sector where peak pricing and differing tariffs will also become the norm. Adopting this approach would create transparency for road users through introducing a more direct, sustainable link between paying for use and the associated expenditure on roads provision and maintenance. It would enable simple, relatively cheap implementation in technology terms. And it would facilitate the implementation of 'congestion-based' pricing in due course, while at the same time retaining flexibility to increase the involvement of the private sector in the future.

Creating strong links

In every other mode of transport there is a broad relationship between the price paid by the traveler, the length of journey and public demand to travel at a particular time of day. There is also a stronger link between what users pay (in fares and tariffs) and the investment made in the underpinning infrastructure. Roads policy definitely needs to move in the same direction.

• *Duncan Matheson is a transport expert at PA Consulting Group and this article has been written in a personal capacity. For more information, email duncan.matheson@paconsulting.com*

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Answers for infrastructure and cities.

High-tech often gains high praise – and all the attention – when it comes to road safety. But **George Lee**'s mission is to keep the humble pavement marking at the top of the agenda

Interviewed by Saul Wordsworth

George Lee has much to be grateful for. As national director of the Road Safety Markings Association (RSMA) he's overseen continual growth in market funding over the past five years despite the UK government's extended period of austerity. "Sure, there's been a squeeze on highway maintenance but we've been successful at conveying the message to road owners, operators and highway authorities that road markings are a vital safety mechanism," he says.

"The only blip was 2012 when, due to the wet weather, there were added challenges affecting the installation of markings. That year volumes fell by 20%. Otherwise there has been a 2-3% growth in investment. And while we still see many examples of poor maintenance on our highways network, the vast majority of road owners and operators do have an appreciation of markings."

The RSMA is the largest specialist highways trade body in the UK, with its 100 or so members installing 85-90% of all markings across UK highways. The organization is also involved in the delivery of commercial services to members as well as R&D activities, looking at the impact of road markings on road safety and driver behavior. "By virtue of our extensive membership, we have influence on the standard of road markings across the industry," continues Lee. "We know why markings may fail and how improvements can be made by highway authorities at a relatively low cost."

> By virtue of our extensive membership, we have influence on the standard of road markings across the industry

Roads that cars can read

Back in 2011, the Roads That Cars Can Read initiative was established by the European Road Assessment Programme (EuroRAP) and Euro NCAP, the car safety program, the purpose of which was to highlight the importance of road markings across the continent to the overall effectiveness of lane-keeping and other ADAS systems. A major update entitled *A Quality Standard for Road Markings and Traffic Signs on Major Rural Roads* was published in January 2014, which among other things outlined the joint view of the highway industry and vehicle manufacturers pertaining to aspects such as the performance profile of markings.

"I chaired the joint committee on behalf of EuroRAP," reveals Lee. "The focus was on the capacity to marry-up emerging technology in vehicles with basic road infrastructure, so we brought together road marking and vehicle design experts from across Europe to identify the optimal levels of performance that you'd expect from road markings. Although around half of Europe's vehicles will be equipped with the very latest road-reading technologies by 2025, the other half won't so the emphasis needs to be on keeping markings at a five-star level."

The report recognized that the variable standards of road markings and signs could be migrated over a period of time at a low

> Switching the stud to a color indicating accident, icy conditions or general hazard on the road ahead could be instrumental in saving lives

cost to reach a level of standardization across Europe. Part of this was boiled down to the adoption of a simple '150 x 150' standard – i.e. 150mm-wide lane and edge markings allied to markings reflecting light at 150 millicandela in the dry.

"A further focus was on driver demographics," adds Lee. "We know visual acuity deteriorates as you get older, so with an aging population in Western Europe, the emphasis must be on ensuring markings are clearer and better defined than ever."

Stud study

RSMA has also been involved in promoting the work being undertaken in the Europe-wide INROADS project, currently being coordinated by TRL. Its purpose is to develop intelligent road studs – or cat's eyes – that will enhance traffic management and road user information. Each stud will contain lighting, sensor and communication technologies, and will lead to improved visibility and communication with one another as well as a central control. Their greater visibility compared to standard retroreflective studs is a massive safety benefit, particularly on unlit roads, yet they also present a less-expensive alternative to traditional streetlighting.

"A communication system that would, for instance, enable road operators to give road users advanced warning of a change to the road environment would be extremely useful," Lee suggests. "Switching the stud to a color indicating accident, icy conditions or general hazard on the road ahead could be instrumental in saving lives. We were engaged with a similar project a few years ago but at the time the LCD markings installed in the road were a step too far in terms of technology and efficiency."

Matters of concern

Although in many ways Lee believes the road marking sector to be healthy, he remains concerned about specific factors plaguing the RSMA's efforts to maintain a high quality level of marking on UK roads. "Our regular studies unfortunately show a continual decline in performance on the network," he says. "For instance, the maintenance standard established by the Highways Agency states that if road markings drop below 100 millicandela, you need to review and program the marking for replacement. If there is a drop below 80 millicandela, then the marking is deemed a Category 1 failure and in most cases will be programmed for replacement within 28 days. Our findings show 60,000 markings are flagged for replacement. There has been a notable increase in markings that should be programmed for renewal or changed as a priority."

Ultimately, the RSMA director believes the problem comes down to funding and prioritization and on that note he has what he refers to as "grave" concerns regarding the way contracts are issued on the Strategic Road Network as well as the level and pattern of maintenance undertaken by the main contractors. "We feel there needs to be a more efficient mechanism for ensuring the road marking network is maintained," he says. "Not enough pressure is placed on main contractors to ensure markings are prioritized. We've been looking at the way contracts are issued in Ireland, as a contrast, where there is a more realistic pricing for road marking contracts. It seems to drive up the quality of markings for road users."

In late 2013, the RMSA sent the Transport Select Committee a document outlining its concerns. *Life Lines – A survey into the quality of road safety markings on Britain's roads* found that markings are "vanishing at an alarming rate" and that "17% of motorway markings are classified as dangerous", along with flagging up its worries regarding contracting systems.

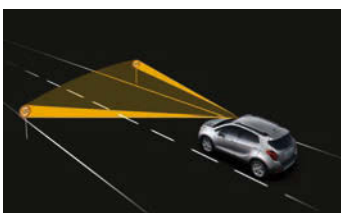
"There is no doubt that the most frustrating thing about the industry is the way contracts are structured," concludes Lee. "Broadly speaking, contracts that currently exist are far too generous to the main contractor and enable them to squeeze specialist sub-contractors far too aggressively. If that wasn't the case we'd have far higher standard of maintenance on our local and national road network."

Nine to five…

Although there is rarely such a thing as a typical day, for George Lee most start at 6:00am with a 5km run and a 30-minute gym session. "I am a mid-life fitness convert and, at 50, in training for a three-week high-altitude (5,750m) Himalayan trek, culminating at Everest Base Camp."

A day in the office for Lee involves getting updates from team members (RSMA employs 10 people) on the status of projects and services they are developing/delivering, followed by dealing with any resulting challenges and a mound of emails. Regular calls from members, client-side representatives and partner organizations, such as the European Union Road Federation, fill the day, as do the regular financial and operational responsibilities involved in a growing business.

"When out of the office, I am often meeting with members, specifiers and highway interest and road user groups. Although this is mostly in the UK, some of it is in Europe. The outcome of these meetings goes a long way in defining RSMA policy and determining the type of support and services we deliver to our members."



(Below) **The correlation between the quality of center lines and the number of KSIs is compelling** (Right) **ADAS solutions will fall down if markings and signs are inadequate**

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Events such as the upcoming ITS Asia-Pacific Forum 2014 are vital to the continued growth of ITS, believes **Peter McCombs**, president of ITS New Zealand

Interviewed by Max Glaskin

Networks are a recurring theme in the life of Peter McCombs, president of ITS New Zealand and founder of Traffic Design Group (TDG). First, there are the physical road systems that he has helped to keep free-flowing. Then there is his web of professional contacts, constructed over a lifetime in traffic engineering, operations and management.

Now McCombs is plowing this experience into making the ITS Asia-Pacific Forum 2014 a success. The event is to be held in his native country, New Zealand, on April 28-30, 2014, and is expected to draw around 400 delegates, 80 exhibitors and a full program of speakers from around the world. McCombs believes the ITS community needs such networking opportunities to continue to flourish.

Different perspectives

"The Asia-Pacific region is diverse in terms of ITS sophistication, from Japan, through Australia, Malaysia and India," he says. "The networking component of such an occasion is tremendously valuable. When you find you have something in common, you swap business cards, exchange emails, and the next thing you know, you have a colleague. I've realized over the years that you can learn a lot from the sharing of experiences and observations. That is a very exciting aspect of the ITS community at large. It is a new engineering science and in some sense it is still finding its way and discovering its whole potential. I think that will go on for a long time."

ITS didn't exist when McCombs started out. His degree is in civil engineering and

> It is a new engineering science and in some sense it is still finding its way and discovering its whole potential

he had an interest in traffic operations and management from the start. At that time, linked arterials and green waves were new techniques. Gradually, computing began to be used for area-wide traffic controls over road networks, intersections and city centers. At around that time, 32 years ago, McCombs founded TDG. The consultancy now boasts 80 staff, seven offices in New Zealand and work all over the country.

"The techniques and methods available have unfolded quite rapidly," he says. "Traffic operations and management have moved away from the arterial networks of cities and into the management of motorways. That has really been the story of the past decade."

Motorway management

McCombs' most recent success in this arena came when he was asked by the New Zealand Transport Agency to act as consultant for the ITS Auckland comprehensive motorway management and traveler information projects. The task encompassed the entire Auckland area, which has a population of 1.4 million and 230km of motorway, portions of which carry up to 200,000 vehicles daily.

His networking skills proved useful right away. "I arranged for a briefing tour of the USA and the UK, which enabled useful exchanges of experiences, abilities and techniques," he reveals. "The challenge was to get more out of the built infrastructure, to get a better standard of service for users, but without spending vast sums building new motorways."

The solution included full ramp signaling covering every ramp at 75 interchanges – a total of 125 sites. "We started with a blank sheet of paper and sought out the best way of going about it," recalls McCombs.

A problem shared

His professional network paid dividends. "The community was forthcoming, very much so," he emphasizes. "I had a lot of ready engagement and conversation with the English Highways Agency and went to look at its motorways. In the USA, there was similar assistance in California and particularly Minneapolis, where the ramp spacing is close to Auckland's – 1.5-2km apart. Operational experience in the UK and the Netherlands was also very helpful."

With new technology constantly being developed, New Zealand Transport Agency works closely with its partners in the public and private sectors, such as Peter McCombs' TDG, to improve the scope and extent of its traffic management techniques and tools

Flexible working

Despite spending his career making detailed proposals, designs and strategies for transport networks, Peter McCombs' daily schedule is rarely predictable. "I don't have a typical day," he says. "You get up in the morning and think you've got a plan for the day and it takes off in all directions. Being able to get things done, delivered and accomplished takes a reasonable amount of self-discipline. It's enthusiasm and energy that helps get it all done."

As part of the motorway management project, 4,500 lane detectors were installed, providing a colossal amount of data. This is harnessed by the traveler information service. "It was done partly because the traveling community was skeptical of motorway management," McCombs explains. "They would question whether to wait for the green light at the ramp's traffic signal to access the motorway, or to take parallel side roads. We'd been told that for the first year of operation, there would be widespread doubt about the merits of motorway management, middling belief in the second year and total support by year three. And that's almost exactly what happened."

More than 140 travel-time signs are now in place. They are updated every six seconds, each displaying current journey times to the three destinations most relevant to that sign's location. "It runs smoothly, automatically," enthuses McCombs. That is more than can be said for the process that preceded the project, which was, by his own admission, politically contentious.

"It came about because there was the highways agency looking after the network, while responsibility for the 75 interchanges was spread across seven local councils and two regional authorities. Each council, mayor and traffic committee chairman had their own understandable concerns and needed reassurance."

Open season

Again, McCombs' communication skills came into play. His team organized 140 local meetings in various communities – up to three a week, some attracting around 250 people. "We were as frank, honest, available and engaging as possible," he says. "For something like that you have to do your homework carefully, making sure that what you say is what you mean. I've also found it helpful to say to people, 'Here's my business card – ring me any time. I'm the guy who's fronting this project and if you've any concerns or queries, call me.' There was no prevarication or stepping away from that, and by and large, I think that being honest, available and doing what you say you'll do is key to earning political confidence."

Global concerns

As well as his presidency at ITS New Zealand and running TDG, Peter McCombs is involved with the Institute of Transportation Engineers (ITE) as a fellow and director for District 8 (International). The latter makes him responsible for ITE activities in 90 countries outside North America. "I go to the board meetings in Washington DC, with the other fellows who look after the USA and Canada, and I say to them, 'You might think that Texas is big, but the sun never sets on District 8!' I keep my end up quite strongly, I assure you!"

Safe approach to critical infrastructure

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The Rion-Antirion Bridge in Greece is the world's longest cable-stayed bridge with a suspended deck. Spanning 2,252m (2,883m including the access viaduct), it limits the crossing time over the Gulf of Corinth to around five minutes. To ensure safety and make quick interventions possible in the event of an accident, the bridge makes use of smart automatic incident detection (AID) technology and thermal imaging cameras from FLIR ITS.

With around 10,000 vehicles crossing the Gulf of Corinth a day, the Rion-Antirion Bridge is an important artery for the region and, being located in the western end of the Gulf region, links the Peloponnese peninsula to the Greek mainland.

The bridge was completed in 2004 and from the outset traffic safety was a big priority for Gefyra, the bridge concessionaire. In 2005, the company called upon FLIR ITS for the installation of 30 video image processing modules, which analyze the video streams of traffic cameras and integrate AID, data collection, recording of pre- and post-incident image sequences, and streaming video in one board. The AID system supports the operator in detecting abnormal situations in the traffic, automatically generating alarms for stopped vehicles, pedestrians, traffic congestion, stop-and-go traffic, slow-moving vehicles, inverse direction and fallen objects.

Thermal imaging cameras

In 2006, bridge operator Gefyra Litourgia decided to combine video analytics from FLIR ITS with traditional CCTV-based visible-light cameras. "The difficulty with this setup was that a lot of false alarms were generated," recalls Bernard Galtier, Gefyra Litourgia's managing director. "This was due to bad weather conditions during the winter as well as the general structure of the bridge, with poles and suspension construction. During sunset and sunrise, the poles cast shadows on the road deck, which was a challenge and difficult to handle for the visible-light cameras."

Although attempts to improve and fine-tune the video detection algorithms yielded good results, another approach turned out to be more effective. At the end of 2012, Galtier decided to experiment with thermal imaging cameras, which detect the heat given off by an object or person.

"We can offer traffic detection video analytics that are perfectly adapted to thermal imaging cameras," suggests Mario Pinto, area manager at FLIR ITS. "The experiment showed that the use of thermal cameras dramatically reduced the

Need to know?

Thermal imaging cameras are helping to ensure safe crossings on a key Greek road bridge

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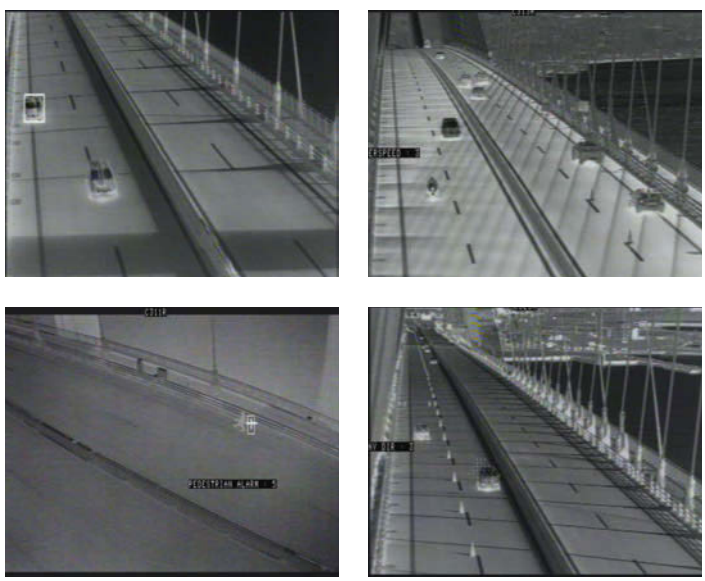

Thermal imaging cameras prove much more successful in circumstances that can be problematic for traditional visible-light cameras, such as at (clockwise from top left) **detecting stopped vehicles, under-speed vehicles, wrong-way vehicles and pedestrians**

number of false alarms and thus improves the performance of the overall AID system."

In 2013, the bridge's camera technology was upgraded with thermal imaging units. The big advantage of these cameras for traffic detection applications is that, unlike visible-light video cameras, thermal imaging cameras are not plagued by sun glare, shadows or wet road surfaces – all of which can 'confuse' the video detection and cause false alarms and missed incidents. And, obviously, FLIR's thermal imaging cameras offer the Rion-Antirion Bridge operator an uninterrupted, 24-hour view of all motorized vehicles, cyclists and pedestrians – day and night – regardless of the amount of light available.

Traffic detection setup

In all, 30 traffic cameras were installed on the suspension construction of the bridge. To cover the entire road deck, a combination of FLIR FC-T Series and SR-Series cameras were installed at a height of 15m. Each bridge pole has six cameras, with three cameras for each direction. The pylons' intermediate distance is 560m, which means that each group of three cameras is monitoring a total distance of 280m. The FC-Series cameras are used to monitor a range of 50m from the pylon, while the SR-Series cameras are used to cover the distance between 50-300m from the pylon. Additionally, three cameras on each side of the bridge cover the two access viaducts as well as the entry and exit areas.

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Every time I look at my iPhone I wonder what else it's capable of. What new app is there that no one's thought of? And every time I come up with one, I quickly learn someone's beaten me to it. My latest idea? What if my cell phone could warn me that a car will hit me if I don't do something?

As it turns out, researchers at Honda have developed the first working prototype for vehicle-to-pedestrian (V2P) technology, enabling phones and vehicles to communicate with each other. If a vehicle detects an impending collision with someone holding a V2P-equipped device, pedestrian and driver are alerted. While it shouldn't replace safe walking habits, V2P could save many lives.

Sweden, a leader in traffic safety, has conceived and adopted Vision Zero, the essence of which is that any loss of life is unacceptable and that roads should be designed to prevent such losses. While the transportation industry has made big strides in reducing the number of traffic-related deaths over the years, these achievements have typically been geared toward protecting vehicle occupants. Technologies for protecting the most vulnerable road users (VRUs) have been lacking. Until now that is.

Around the world, a large number of pedestrians and cyclists are injured or killed by trucks every year. Lateral collisions (where a VRU is caught in the blind spot of a turning truck) are one of the most common types of truck-VRU collisions. Some countries have begun mandating the installation of side underrun protection to prevent pedestrians from falling under the rear wheels. But this only partially addresses the issue and does nothing to prevent the incident from happening in the first place.

To get to the root of this problem, we need to eliminate blind spots entirely. Advances in camera and sensor technologies in the past decade do just that. New gadgets such as Brigade Electronics' Smarteye camera system give truck drivers a complete 360° bird's-eye view of their vehicle in real-time for the first time. In the near future, drivers will have an unprecedented level of perception of their surroundings, which will help prevent many crashes.

Toyota recently announced a new vehicle feature in an effort to reduce traffic crashes involving VRUs. Known as the pre-collision system (PCS) with pedestrian-avoidance steer assist, it is intended to help prevent collisions where automatic braking alone isn't sufficient. The system can detect if there is a risk of a collision and alert the driver. If no action is taken, the system engages the brakes and automatically steers the vehicle away from the pedestrian. Wide adoption of this technology could lead to a major decrease in pedestrian collisions.

If preventing a collision is impossible in a certain situation, the next best thing is to minimize the damage. Volvo's 2013 V40 is equipped with exterior airbags aimed at protecting pedestrians and other VRUs – a first in auto history. The airbags deploy upon sensing an imminent collision with the intention of preventing injuries to VRUs. Hopefully, this technology catches on and becomes standard on all vehicles.

Around 1.24 million people worldwide die in a road traffic crash every year with around half of those deaths being VRUs. Some may rationalize this as the price we pay for mobility, but there's really no way to morally justify the loss of a single life in traffic. As transportation professionals, we need to continually ask what we could improve in our systems to help prevent fatal crashes. There will always be some circumstance where a driver will err tragically. Our transportation system should not. With recent advances in technology aimed at protecting VRUs, we have the opportunity to improve the safety of this aspect of the transportation system and help do our bit in bringing 1.24 million down to zero.

> What if my cell phone can warn me that a car will hit me if I don't do something?
>
> **Sam Schwartz, Sam Schwartz Engineering, USA**

How the network video revolution is changing the ITS market

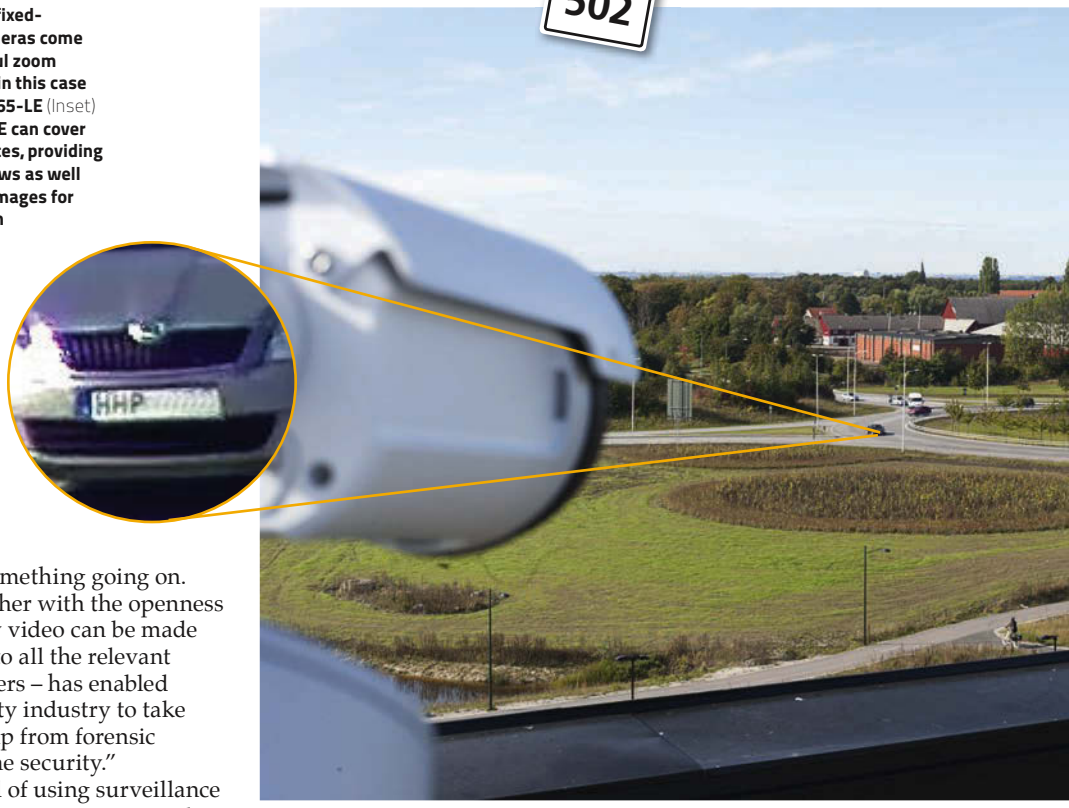
READER ENQUIRY NO. 502

All surveillance cameras were analog 20 years ago. They delivered video via a coaxial cable to a recorder that stored the video on a tape. But in 1996, Swedish company Axis Communications invented the network camera, which made it possible to connect a video camera directly to a computer network. The shift from analog to digital technology has already changed the global security market, and it's starting to change the ITS market too.

According to Patrik Anderson, business development director at Axis Communications, the key factors driving this network video revolution are video quality, camera intelligence and openness. "The resolution of a traditional analog CCTV camera is limited to about 0.4MP," he says. "A network camera can deliver video in multimegapixel resolution, and even in the HDTV quality we have become used to at home. When it comes to intelligence, an analog camera simply records what it sees and that's it. A network camera features a powerful processor that can also be used for intelligent video analysis. And with regards to openness, network cameras are based on open IP standards, enabling secure and flexible access via a computer or handheld device, from anywhere in the world."

Anderson has already noticed how the technology has changed the security industry. "Improved video quality has made it much easier to identify people and objects in recorded video," he explains. "Intelligent camera capabilities – often based on detection, tracking or recognition algorithms – have made it possible for network cameras to alert security operators automatically when there is something going on. This together with the openness – whereby video can be made available to all the relevant stakeholders – has enabled the security industry to take a giant leap from forensic to real-time security."

(Right) **Even fixed-network cameras come with powerful zoom capabilities, in this case the Axis Q1765-LE** (Inset) **The Q1765-LE can cover great distances, providing wide overviews as well as detailed images for identification**



Instead of using surveillance video as an investigative tool to find out what happened hours or days before, network cameras are used as real-time tools to detect, prioritize and respond to incidents.

Real-time benefits

Although its goals differ from those of the security market, Anderson contends that the ITS industry could reap many benefits from the technology. "For a Traffic Management Center (TMC) it is all about enabling road users to get from point A to point B as quickly and safely as possible," he says. "Most TMCs also wish to detect incidents and other deviations in real time throughout the road network. They want to be able to inform relevant stakeholders (commuters, maintenance crews and first responders, etc) about traffic conditions quickly, and also make the right prioritizations regarding variable message signs (VMS) and red lights."

Anderson also points to the technology's benefit in terms of video quality. "The traffic environment can be quite demanding with blinding sunlight, glaring headlights and reflections off wet pavements, which are all very difficult for analog cameras to manage," he says. "At night, it can even be hard to distinguish vehicles from each other as a result of the constant stream of moving headlights. Network cameras can handle these various light levels automatically, to provide TMCs with a better image and a more detailed overview of the situation."

Need to know?

Why the demand for real-time traffic and infrastructure information is rapidly increasing

- TMCs can quickly redirect traffic to minimize congestion
- First responders can quickly determine the best route and see what to expect upon arrival
- Commuters can access live video over the internet and make traveling decisions based on the current situation

(Above) **Instead of waiting for a commuter or other road user to report an incident, an Axis camera can be used to alert the TMC automatically**
(Right) **The TMC operator can use a tactical pan-tilt-zoom camera to get a detailed view of the situation**

Digital delights

Many TMCs also already benefit from the digitalization of video data. "This has made it possible to connect both analog and network traffic cameras to standard IP networks, where the information travels digitally without distance limitations or loss of quality," says Anderson. "It also makes it much easier to share live and recorded video, and to search the recorded video quickly."

Then there are intelligent camera applications. "A network camera not only delivers high-quality video but can provide automatic alerts or traffic data. This enables the TMC to gain an even better understanding of the traffic situation and to take quicker actions to minimize the impact of traffic incidents."

Axis Communications partners with leading video analytics companies to develop applications for its cameras. Applications are available that enable the company's cameras to count vehicles, read license plates and alert the TMC about traffic scenarios such as congestion, stopped vehicles and wrong-way driving.

Future visions

Looking a few years ahead, Anderson believes the number of intelligent network cameras used to improve the overall traffic situation will continue to increase. But he also thinks that as the processing power of network cameras improves, there will be more intelligent capabilities in each camera and even better video performance.

"Some network cameras already provide HDTV video quality in up to 60 frames per second, enabling them to capture detailed images of very fast moving vehicles," he says. "There is also strong interest in flexible and open system solutions that can scale with the operator's evolving needs easily. With this in mind, it is my firm belief that we will soon also see network cameras being deployed in areas such as tolling and enforcement, where today more complex solutions are required." ○

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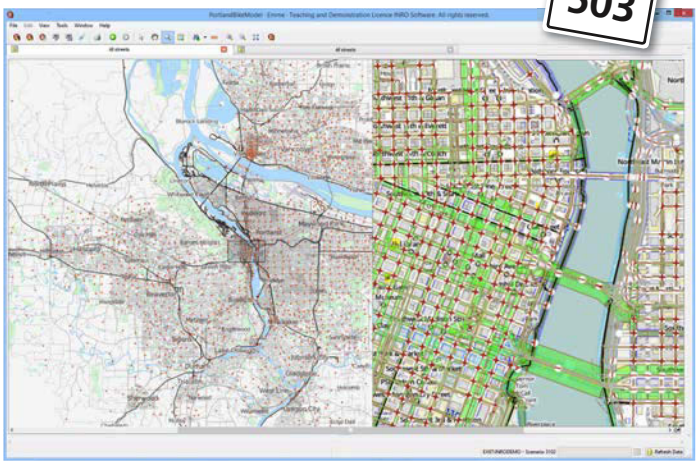
High-performance transportation planning

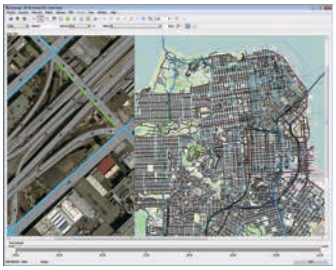
READER ENQUIRY NO. 503

Transportation planners looking to model large regional and urban centers in ever-increasing detail have put huge demands on their software tools in recent years. INRO is rising to this computational challenge with new releases of Emme for transportation forecasting and Dynameq traffic simulation for wide-area networks.

"Native 64-bit versions and more pervasive multi-threading will provide excellent support for bigger models," says Daniel Florian, VP of software and solutions. "But the biggest gains coming in Emme 4.1 are from new traffic and transit assignment features that open up modeling potential for users. Dynameq 3.0 is also getting an update with improved usability, performance and detail."

The Network Expansion add-on for Emme will allow for networks with up to two million links, enough to represent every street in models of even the biggest cities. And the software has been heavily optimized so networks stay responsive in a new 64-bit native version. The Emme Standard Toolbox of model procedures also benefits from a 64-bit native version, as do user scripts and models with new support in Emme Modeller for Python 2.7 32- and 64-bit. The latter has been especially popular in use with activity-based demand models.





(Left) **Metropolitan all-streets model**
(Below, left) **San Francisco simulation model**

Emme 4.1 also introduces the new second-order linear approximation (SOLA) traffic assignment. "The benefits of this algorithm have been well known for years, but INRO's development team has implemented it in a sophisticated manner," explains Mike Florian, the company's president. Despite being a second-order method, SOLA traffic assignment can handle custom volume-delay and turn-penalty functions. Convergence is much faster than the standard linear approximation method, and when used on more than eight CPUs, performance compares favorably to the Emme path-based traffic assignment, a fast-converging method. Additionally, well-converged SOLA traffic assignments exhibit class and path proportionality. All this and speed, too. "Our tests indicate that the SOLA traffic assignment is more than twice as fast as comparable approaches available on the market," adds Mike Florian.

A variant of SOLA, the PToll traffic assignment offers new toll modeling features. PToll has already been evaluated in a Sydney, Australia study of distance-based tolls with capping and distributed value of time. INRO partnered with Jacobs SKM on the project. "PToll provides comprehensive toll modeling capability and SOLA vastly improves both assignment run times and convergence," reports Daniel Harney, team leader for Traffic and Transport at Jacobs SKM. PToll will also provide support for ramp-to-ramp tolling in Emme 4.1.

Emme 4.1 also pioneers multi-threaded frequency-based transit assignment. "Emme transit assignments have always been fast. Now even iterative assignment procedures – applied for years in cities such as London, Hong Kong, São Paulo and Santiago, to capture the effects of crowding on vehicles and platforms – can generate results quickly," says Shane Velan, INRO's VP of marketing. "In tests on a London model, the run-time was reduced by half to 18 minutes on common hardware."

Wide-area simulation

Dynameq 3.0 will feature better network realism, a streamlined network editor, faster dynamic traffic assignment convergence, simulator enhancements and a new Python API for automation. A Dynameq add-on for Emme will be offered, making simulation for wide-area networks more accessible than ever to Emme users. Transport planners can leverage their Emme models to build new Dynameq models suitable for analysis of traffic operations in subareas or an entire city.

Need to know?

An expert in transport modeling is introducing a host of new, user-focused features

- The second quarter of 2014 sees a number of new features being rolled out
- Emme 4.1 introduces a 64-bit native version, new multi-threaded traffic and transit assignments, new toll modeling features, and desktop and model performance improvements
- Dynameq 3.0 brings better network realism, faster DTA convergence, simulator enhancements and a new Python API

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Multi-layered traffic model for Sydney's central business district

READER ENQUIRY NO. 504

Transport for New South Wales (TfNSW) and Roads and Maritime Services (RMS) are developing an innovative, multi-layered traffic model of Sydney's central business district (CBD) to test the impacts of a wide range of projects, particularly the introduction of light rail through the city center. The model spans a large urban area, covering most of the possible rerouting impacts resulting from the light rail. While large-area models are nothing new, the mesoscopic model is one of the first of its size to provide operational modeling in such detail. It is even able to accurately mimic a SCATS traffic control system and offer close detail at intersections, which was previously only possible in small-area microscopic level models. It is the attainment of such breadth of scope combined with such depth of detail that makes the Sydney CBD model so innovative.

The rising use of data mining and predictive analytical techniques to improve decision-making processes means our lives are increasingly exposed to the results of these approaches.

The modeling platform will enable a multi-layered assessment of the transport operation of Sydney's CBD, including in its scope overall regional impacts not only for general traffic but also public transport. Multi-layered means the capability to model at the strategic planning level through to detailed operational assessment. The model is a joint project between GTA Consultants, TSS-Transport Simulation Systems (developer of the Aimsun traffic modeling software) and Azalient (developer of the Commuter nanosimulation software).

Although the Sydney model will enable the testing of transport policy decisions and infrastructure proposals of any size, the main project currently under consideration is the Sydney CBD Light Rail, which is part of Sydney's Light Rail Future project. The city already has 7km of light rail in place, but the new CBD and South East line is being built to reduce bus congestion in the CBD and provide higher-capacity public transport to hotspots currently served only by buses, such as Sydney Cricket Ground and the University of NSW. In contrast to the existing Inner West line, the new route is mostly on-street and follows a similar path to routes used by the former tramway network.

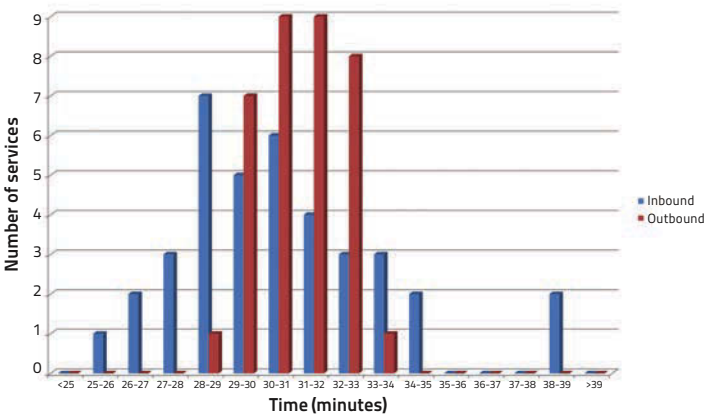
The light rail expansion is set to run alongside a redesigned bus network that will see a reduction per hour of more than 220 buses entering the CBD in the morning peak. Work on the AU$1.6bn (US$1.4bn) project is scheduled to start in 2015 and will take six years to complete.

Approach path

TfNSW adopted a multi-level approach to account for regional traffic diversions resulting from changes in the capacity of the CBD's road network and hence plan for a realistic demand. Iterations with the strategic model were time consuming and of limited accuracy; in contrast, covering a wider area mesoscopically helps to provide updated and time-dependent demand at boundaries, providing a higher order of accuracy. It can also take into account rerouting inside and outside the microscopic/nanoscopic area plus changes in the nanoscopic area that may affect demand at its boundaries.

The starting point for the modeling team was to import the road network from the existing strategic model, known as the Sydney Strategic Travel Model (STM), and information about bus routes and bus stops. As the STM road network covers the entire Newcastle, Sydney and Illawarra statistical divisions, the Aimsun macroscopic model replicated these model extents.

To model between the original macroscopic models and the new mesoscopic level, the team used Aimsun's Python scripting environment to build various tools to make the best



(Left) **Reliability assessment for light rail travel times takes into account the range of potential travel times experienced by light rail passengers during peak times** (Above) **The mesoscopic model study area in relation to the STM strategic road network**

(Left) **SCATSIM with Aimsun for Sydney's CBD**

possible use of macroscopic-level information – e.g. to inform the dynamic model where information was unavailable, or feeding detailed dynamic model information back into the macroscopic-level model (such as updated signal timing information).

To assess the impacts of the proposed light rail and new bus network, the existing condition model was edited to reflect network and operational changes – network and intersection configuration changes as well as traffic signal updates (58 intersections). The model introduced dedicated light rail vehicles with specific vehicle characteristics, service frequencies, stop locations and dwell times.

To ensure accurate assessment not only of the impact of the final design but also the impact of closing lanes or streets for roadworks during the construction period, the team modeled different time periods (AM, daytime and PM). This was achieved in a single model along with current and future demand and supply scenarios for the light rail and bus services in addition to general vehicle traffic, including operation of reversible lanes on the Harbour Bridge.

Need to know?

Sydney's CBD is set to reap the real-world gains of a novel approach to transport modeling

- A multi-layered approach is enabling the modeling team to assess regional impacts of traffic and public transport
- The Sydney CBD Light Rail project is set to greatly reduce bus congestion
- SCATSIM enables a transport simulator to be integrated with SCATS to improve the accuracy of the modeling

SCATSIM

The 'fixed time' model with manual signal optimization was sufficient for the model's intended use as a planning tool rather than an operational model. Although it is widely acceptable practice to use fixed timing in simulation models, it is also acknowledged that the fixed time signal set-up presents a number of limitations in terms of representing the signal timings controlled by adaptive systems and the consequent improvements to capacity those systems provide. As a result of the evolving congestion over time, the need to establish the most efficient approach for optimizing signal timings at intersections was desirable for the next stage of analysis.

As a result, the Sydney CBD project has also involved pioneering work with SCATS (Sydney Coordinated Adaptive Traffic System), which is owned and marketed by RSM, and Aimsun's mesoscopic model. SCATS is a fully adaptive urban traffic control system that enables adaptive phase times, cycle times and offsets that respond to fluctuating traffic conditions and public transport demands and improves the efficiency of individual intersections or a series of intersections within the network.

So far SCATSIM has been used only at the microscopic level but in collaboration with RMS, the TSS team has developed the interface that can operate the SCATS traffic signal system within the mesoscopic simulation environment to provide an appropriate level of precision to examine the CBD road network and its high level of congestion. This approach is closer to reality, where traffic signals adapt to changing demand in a more efficient manner.

Longterm benefits

Given the importance of the project to Sydney and the aim to address future transport needs, the SCATSIM model offers more precise estimation of the magnitude of traffic issues and supports the development of congestion management plans to address the forecast problems.

The model application to date has shown that Sydney has the traffic tool it needs – an accurate, practical, integrated model that is flexible enough to grow in line with the city's planning and operational requirements.

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Wheel and axle detection techniques

READER ENQUIRY NO. 505

(Left) **Light beams crossing the road** (Below) **Old-fashioned pressure detector for wheel size**

Why should we continue using invasive techniques to detect the number of axles and size of the wheels of a vehicle? The short answer is simply, 'We shouldn't!'

The need to count vehicle axles and measure the size of the wheels has become an important feature for a number of traffic statistic applications and automatic vehicle classification (AVC) solutions.

The most common systems for detecting these characteristics are based on sensors installed in the roadway. The asphalt is cut to embed pressure sensors that every vehicle wheel touches. These sensors suffer much degradation and an increasingly lower performance in a relatively short time; more so on roads with heavy traffic. Nevertheless, it is easy to observe on motorways or city ring roads just how many of these sensors are in the roads, indicating their continued popularity.

A further step in wheel and axle detection technology is the integration of optical sensors in the AVC systems. Similar to a 'laparoscopic intervention' on the road, the optical sensors are introduced on the lateral side of the road lanes, avoiding a material intrusion on the road surface. Instead of having sensors crossing the road, in this new situation we find light beams, invisible to the human eye.

The benefits of this approach are soon apparent: there is no sensor degradation caused by the passage of the vehicles, so the road can get up-to-date with its periodic maintenance works of rebuilding, fixing or salt spreading without affecting the sensors.

The performance of the pressure sensors also improves as the optical sensors greatly help to eliminate false wheel or axle detection.

With these types of AVCs, a new functionality is provided: the ability to detect the raised axles found on heavy vehicles, such as trucks and big buses. With road pressure sensors, wheels and axles can only be detected when they are touching the ground. It is not possible to deploy systems that detect raised axles only using pressure sensors; other devices need to be added.

Although the weakest point of optical detection technology is traditionally considered its robustness against extreme environmental conditions such as heavy rain and mud, new developments in LEDs and lenses combined with photocell redundancy integration make an overall system more tolerant to all environmental conditions and improve the performance of AVCs. This is particularly true for roads with ice on them; pressure detectors can suffer from the freezing and from contact with salt, whereas the optical detectors perform better.

All of these points have encouraged several road operators to deploy AVC systems equipped with optical sensors, thereby increasing their degree of satisfaction in performance and long-term maintenance. These solutions have been successfully deployed in countries with vastly different weather conditions, such as Mexico, Brazil, Chile, India, Russia and Spain.

An AVC system performs best when it uses optical sensors with customized logic and algorithms for a particular country's requirements. The technology to do this is available for most of the current AVC traffic applications.

What's next?

At the moment, optical detectors are a good solution when detecting and counting wheels and axles. However, more wheel and axle features can be extracted if pattern recognition conducted on video cameras is also incorporated. This technology is still immature in the field, as the algorithms that need to recognize wheels and axles in all environmental conditions are not fully developed for each type of application. In any case, there is good progress happening and much more to come from this sector in the future.

Need to know?

Vehicle detection tools have already improved greatly; and there's much more to come

- Automatic detection and classification systems allow the identification of vehicles through the measurement of physical parameters, with no need for human intervention, for the purposes of auditing, revenue collection management, statistics generation, tolling, etc
- Tecsidel provides a range of detection and classification systems, including AVC systems with optical sensors

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Comparison of handheld and mobile retroreflectometers

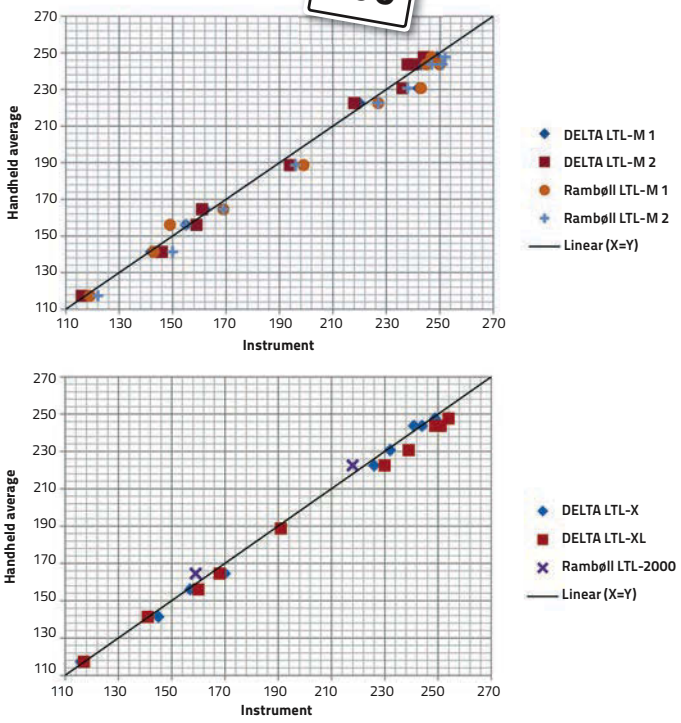
READER ENQUIRY NO. 506

When road authorities, contractors, service providers and others involved in measuring the retroreflection of road markings transition from handheld instruments to a mobile retroreflectometer, very often they are concerned about the correlation between the two types of instruments. The reproducibility using handheld instruments is typically ±5%. The question is, can this level of reproducibility be achieved when a mobile system is compared to a handheld device – and therefore open up the capability of mobile systems being used for contractual measurements?

Need to know?

Tests show a move from handheld to mobile retroreflectometers is not a cause for concern

- LTL-M offers accurate measurements at traffic speed and under all driving conditions
- LTL-M is very easy to mount on a vehicle, to calibrate and to operate on the road
- LTL-M measures as accurately as a handheld instrument – an accuracy never seen previously with a mobile system
- Measurement results are transferred to a PC via USB interface or Bluetooth



(Left) **The LTL-M provides continuous measurement of night visibility at traffic speed** (Above) **The graphs show the correlation between handheld instruments and the mobile LTL-M system**

Testing developments

In October 2013, Rambøll RST and DELTA decided to carry out a test program to investigate this relationship. The tests were conducted on 10 sites around the Swedish city of Kristianstad, including on stretches of road used for the annual certification of mobile retroreflectometers operating in Sweden. Two LTL-M mobile retroreflectometers and three handheld instruments – LTL 2000, LTL-X and LTL-XL – were used in the test program. At each test site, a 100m stretch was measured, and the marking types varied between smooth, drop-flex, long-flex, ladder and checkered.

The sample tests using the handheld instruments were conducted with 2m intervals on continuous lines and with two measurements per line segment on segmented lines. The average of all the handheld instruments was used as the baseline for determining measurement accuracy. For the mobile instruments, each 100m road stretch was measured twice. The average result of the center 5cm of the marking was used for comparison to best correlate with the handheld instrument measurement width.

The two graphs above show the correlation between the individual handheld instruments and the individual LTL-M system respectively, compared to the average of the handheld instrument measurement values.

A number of specific results were calculated for each of the instruments, including absolute measurement error, systematic measurement error as well as repeatability.

Study results

A conclusion from the examination is that both the mobile systems and the handheld instruments have absolute and systematic errors well below 4%, hence provide the same level of accuracy. The tests also demonstrated that there is a very good correlation between the handheld references and the LTL-M mobile retroreflectometers.

Human visual perception of road markings in essence is a result of the retroreflection of the full width and length of a marking, rather than the center value of the stripe. Hence, the full width and length measurements – as can be facilitated using the LTL-M mobile retroreflectometer measurement system – offer a better fit to the human perception than a handheld device that provides spot measurements.

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Reducing the cost of image review in all-electronic toll collection

READER ENQUIRY NO. 507

All aspects of a video tolling system and its processing operations must be tuned carefully to achieve the lowest possible operational cost while delivering acceptable levels of accuracy and leakage. In North America, tolling agencies often specify overall image review accuracies of 99.95% with leakage rates at or below 0.1%. These are challenging but technically achievable goals. What is difficult is delivering the lowest possible operational expenditure (OPEX) when an agency also mandates, arbitrarily, one or more of the following: optical character recognition (OCR) performance levels that are very different from the overall system accuracy desired; video images that are high-quality enough to be read by humans; and statistically invalid OCR performance validation approaches that oblige suppliers to meet much higher performance levels than intended, which increases system cost.

(Right) **The manual review process in a tolling facility can be expensive, error prone and may involve only a fraction of the images actually captured, hence the need for better camera and ALPR intelligence** (Below) **To achieve error rates of less than 0.5%, special attention has to be paid to achieving the right quality of testing technology and statistical support of performance tests**

Defining image quality

Image-review performance and OPEX are highly dependent on the quality of the images input into the system. Poor quality increases OPEX because fewer license plates can be read automatically, more images require time-consuming manual enhancement, and more time is spent interpreting hard-to-read images. Poor image quality also leads to a higher probability of system read errors and revenue leakage, because similar-looking license plate characters are more commonly confused.

Given the unavoidable pipeline delays inherent in any image-review system, waiting until images are reviewed to determine image quality guarantees higher OPEX. Automated processes are thus needed that thoroughly analyze image quality in near-real time, well before video transactions enter the image-review stage.

Many all-electronic tolling (AET) requests for proposals (RFPs) define image quality only in terms of readability by humans. This is necessary for image review, but to minimize OPEX, image quality has to be better than that. The difference in image quality required by OCR engines and humans is commonly exploited by website security tools such as those that combat phishing using CAPTCHA images. These can distinguish humans from computers because no known computerized technique can read all the characters accurately. License plate images can suffer from many of the same quality issues, in which case no OCR algorithm can read them with a high degree of accuracy.

RFPs must therefore stipulate maximized OCR performance. Generally, license plate images must be in sharp focus, have sufficient character resolution (and not be over-compressed), and the characters must have enough background contrast. Failure to specify image quality by non-subjective measures that relate directly to OCR readability decouples the supplier of video images from the goal of minimizing OPEX. An image-review subsystem supplier might then claim that it cannot be held to a certain requirement because the images input into the review system were not of the required quality.

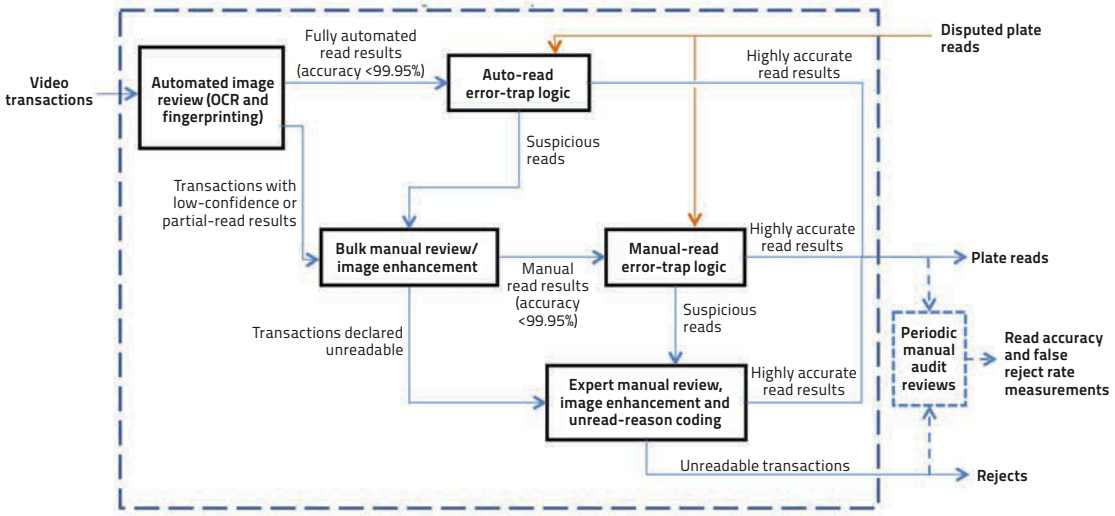
Need to know?

Reducing the cost of image review in an all-electronic toll collection system can yield huge benefits for agencies

- How toll authorities can be harmed by inconsistencies in ALPR performance
- Why inaccurate reading of license plates is losing agency revenue from uncollected tolls
- Things you need to know about specific ALPR performance claims
- How a functional, accurate and cost-effective system for reading plates is critical to public safety and security

OCR performance

The chart opposite details the processes involved in a typical image-review system. Processing begins by sending transactions through OCR and



(Left) **Diagram shows the image-review system** (Below) **Intense cooperation with various tolling operators, enforcement system suppliers and OEM partners has resulted in the experience required to analyze and continuously improve every detail of the OCR process**

fingerprint-matching engines to obtain automated license plate reads. Reads that fall below a confidence threshold are diverted to manual review.

Typically, OCR read results that exceed the confidence threshold do not deliver 99.95% accuracy. To approach this level, OCRs must be specially tuned and the read results filtered using various checks and indicators of previous read errors. Similar to the low-confidence OCR read results, high-confidence read results that do not pass these error traps are also sent to manual review. The OCR algorithm and error trap logic must be tuned carefully as a unit to ensure that the final automated read results deliver 99.95% accuracy without also diverting too many correct reads to review. If the high-confidence read results from the OCR have an accuracy rate far below 99.95%, the error traps must be tuned to trap a lot of errors, the result being that a lot of correct OCR reads will need to be manually reviewed.

To minimize OPEX, it is best to design and tune the

OCR to deliver the highest possible read rate at an accuracy very near to the desired final system accuracy of 99.95%. Not understanding the interplay between OCR performance and error trap performance is where many agencies go wrong. Most agencies in North America, for example, contractually require that the OCR must read 80-90% of all human-readable license plate images at an accuracy of 99% or higher. This seems sensible; however it is 20 times worse than the ultimate read accuracy of 99.95%.

Agencies should concentrate on specifying the average cost per transaction review, the accuracy of the read results and the allowable false-reject rate (to minimize revenue loss). No image-review system can boast zero errors or false rejects, so realistic performance values must be selected. In Florida, USA, for example, 99.95% accuracy at a false-reject rate of 0.1% has been achieved by the Tampa-Hillsborough Expressway Authority.

Validating performance

As seen in the chart, there are only two basic outputs of an image-review system: license plate reads and rejects. Each comes in two varieties: correct reads and error reads; and correct rejects (where there is no readable license plate on the vehicle) and false rejects (there are readable license plates but they are declared unreadable by the reviewers). Read errors also include those transactions where the system provides a read answer for vehicles with no readable license plate. Typically, only human reviewers create false rejects because automated rejects are usually validated by a human.

The only way to measure system-error and false-reject rates directly is to audit, manually, a sample of

image-review results that is statistically large enough. Creating the highly accurate license plate read answers necessary to compare with the output of the image-review system requires a lot of time and multiple data reviews by humans. Truth results need to be many times more accurate than the system's overall accuracy.

Any performance audit must also be preceded by a comprehensive image-quality audit to ensure that the images going into the system are good enough to enable the system to meet its targets. Nearly one million transactions are required to stably compute error rates as low as 0.05%. Many agency personnel believe, falsely, that they can compute performance measures reliably using a much smaller number of test transactions and thereby save a lot of time and money, but small test sets vary dramatically in their outcomes. Reputable suppliers conduct extensive testing using proper statistical sample sets during acceptance testing. Such testing can be expensive and should be performed only when there is good reason.

Every agency needs to regularly monitor whether its system is functioning properly. As an alternative to performance audits, which can be expensive, the system can be set up to monitor input data statistics that correlate with system performance outcomes, automatically.

Initially, the system must be tested against the specification across a large, statistically representative set of input transactions. As such, if the statistics of the inputs remain the same as when the system was last fully tested, then the system outcome will be the same (on a statistically similar basis). So a good way of reducing the OPEX of auditing is to monitor the statistical nature of the inputs. If these have not changed much since the last full audit, than a full re-audit is not necessary.

What to audit regularly

System inputs can be monitored automatically on a regular basis and need to be measured anyway before any full audit is conducted, to ensure they are not the cause for a drop in performance levels.

There are three primary aspects to audit on a regular basis. The first is how frequently license plates occur by state and license plate syntaxes within each of these states.

(Top left) **Performance monitoring at all levels is crucial for tolling authorities** (Top right) **There are many smart ways agencies can reduce the OPEX involved in the image-review process, but are they well known?** (Above) **High levels of ALPR read reliability can be achieved with a range of sophisticated image processing approaches, not least OCR**

The system is trained to read the most commonly occurring license plate styles and if these change greatly from what the system was originally tuned for then it should be re-tested with this new statistical distribution of license plate types (and subsequently re-tuned if necessary).

The second thing to ensure is that automated image-quality measures are produced regularly. If the input image quality is nearly the same as the quality the system was acceptance-tested on, then there is no need to re-audit the overall system performance.

The third thing to audit is the average read error rate for each human reviewer. This can be measured automatically using various techniques during the image-review process.

With the help of a well-informed tolling customer and an expert image-processing system supplier, OPEX for AET systems can be reduced dramatically. ○

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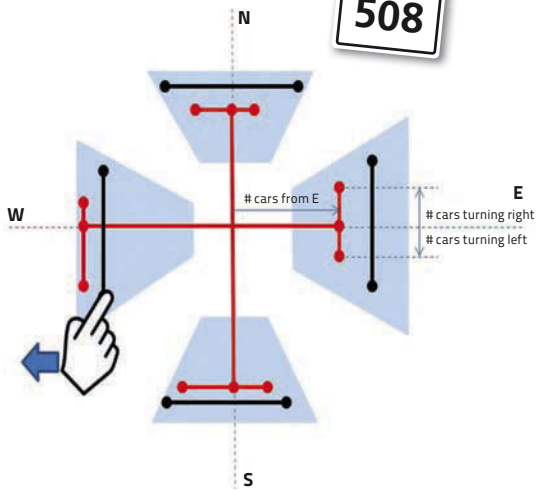
Game-like control interfaces for traffic signal operations

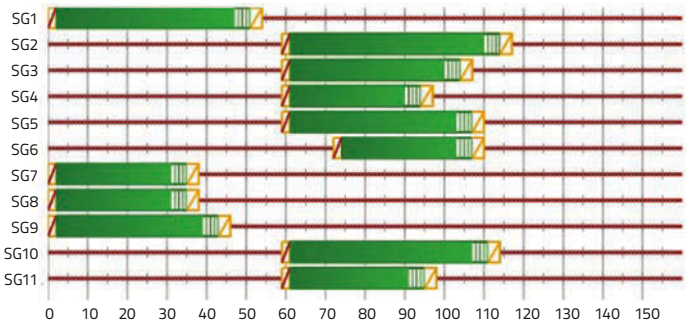
READER ENQUIRY NO. 508

Taking a snapshot of the traffic flow from an arbitrary intersection as provided by Google Maps or any other provider of floating car data (FCD), a human operator with only average skills could immediately tell you the proper traffic control strategy that should be deployed.

An illustration of a typical situation can be seen in Figure 1. The intersection of traffic node 1 is saturated and a jam has been produced, which is propagated into the northeastern direction, even if there was enough flow capacity in the western and southern directions. So the right control strategy for the traffic lights at that intersection would simply be increasing or optimizing the throughput from the north eastern direction. To resolve the jam in the traffic line of the nodes 3 > 2 > 1, it would be beneficial to reduce the outflow of node 3 into the western direction to bring the whole line quickly out of saturation again.



(Figure 1, far left) **Exemplary traffic flow pattern** (Figure 2, left and below) **New HMI design for traffic control. Red lines are measured traffic flows, the black lines show the capacities of the traffic signal green times. The aim is to move the black lines outside of the red lines. The resulting coordination plan is also represented, showing the green times corresponding to each signal group**



Need to know?

One expert's attempt to make traffic control as easy as playing a game is paying dividends

- Andata supplies control algorithms for traffic nodes (node control objects), which calculate the best traffic control parameters such as turnaround and green times, taking arbitrary control targets for a given traffic situation into consideration
- Possible control targets can be: reduced travel and lost times, reduced congestion, improved or determined flow rates and environmental criteria

Turning targets into action

Such simple patterns for a fuzzy and intuitive formulation of the control strategies and targets can be similarly found in almost every normal traffic situation. Although it may be easy to formulate the right control targets, it is anything but trivial to turn these targets into the corresponding optimal control actions in a general way. This means finding the best possible traffic light coordination for any kind of traffic situation, control strategy and targets in a general way. In addition, this ought to be done in real time.

This is where the engineers at Andata, which specializes in the development and application of artificial intelligence solutions, come into play. With Andata's patented traffic control software, a traffic management operator – or even an automated network traffic control system – can define his/its control targets in a fuzzy and intuitive form, as described above. They'll get the best green times in real time for the selected control strategy dependent on the current traffic situation, without having to know about any of the details, architecture, coordination plans, etc, of the underlying intersections. And the control actions are not even limited to green times of traffic lights. Additionally, the coordination of future autonomous or highly assisted vehicles by V2I communication has already been incorporated into the solution.

A game-like app

One way in which the described solution has been implemented is in the form of a web-based, interactive game-like app. The principle of the interactive graphical user interface (GUI) can be seen in Figure 2. The lengths of the red lines represent the current flow rates of the measured traffic in the according direction – e.g. coming from FCD or any arbitrary traffic sensors. The blue trapezoids show the possible capacity ranges of the given traffic lights including different coordination plans. The capacities of the current coordination plan and green time settings are shown by the black lines. Of course these also depend on the traffic situation (represented by the red lines). In the given example, everything seems alright for the direction N, E and S, because capacities are bigger than the demanded traffic flow (black lines are outside the red lines). In the direction W, the demanded traffic flow is greater than the capacity. The consequence would be congestion in that direction.

In a dialog one can then pick the black line of direction W and pull it outside of the corresponding red line within the blue domain of possible capacities. The result of such a move would be that the black lines of the other directions – and to some extent also the blue domains of possibilities – will also move dependently. Perhaps one of the other directions can get out of reserve then. An operator should shift the black lines until there are enough reserves in all directions (enough distances of the black lines outside the red lines). And if that is not possible, at least the directions can be weighted according to the requirements of the traffic managers. It's worth noting that these dependencies and the couplings of the movements are slightly different for each different intersection and traffic situation, and that there are couplings and feedback loops in all the elements of the graphic. Of course, with all the movements in the GUI, the according green times for the right realization of the requested flow rates are immediately calculated and represented in a graphic, as can be seen on Figure 2.

Finding the best green times for an intersection is radically easy with this new style of game-like interface. And not much imagination is required to see how such a unified interface for any kind of intersection could leverage network-wide traffic control systems.

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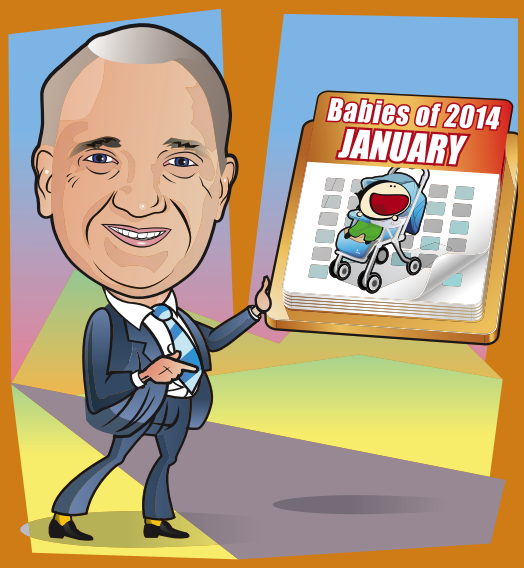

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Every New Year's it's fun to read all the predictions for the upcoming year. This year, I saw an interesting piece in *Money Talks* written by Stacy Johnson, entitled *25 Things Babies Born in 2014 May Never Know*. Items included were bank tellers, parking meters, phone booths, car keys and cursive writing. Interesting was the number seven prediction: toll booths. It really made me think. Is it truly possible that, by the time children born today drive, toll booths will be part of history? That's only 16 years away! In 2030, will anyone be driving? And, if we are, will the roads be on the ground or in the sky?

I have no doubt that technology a decade from now will support the antiquation of toll booths; I believe that we are there today. But, how will we get to all-electronic tolling (AET) or mileage-based user fees (MBUF) everywhere in 10 to 16 years? How will that evolve? How will we solve the mountain of challenges in getting everyone interoperable? What technology will we be using by then? And how many technology changes will we have endured? Will the answer be a device embedded in the vehicle? Will it be a wearable device of some sort? How about the back-office operations and the business rules that will need to cooperatively work out?

The year 2013 saw great leaps forward in interoperability. Multiprotocol readers are now joined by multiprotocol tags. Five years ago, talking about either may have prompted legal action. IBTTA's interoperability committee (IOP) is close to publishing back-office standards. And more importantly, serious discussions are being held with all levels of any agency that wants to participate.

In 2014, enforcement will continue to evolve. We as an industry need to share information better on what works politically and economically, as this could become the hot issue in 2014. We cannot let our differences in opinion delay our mission. The Alliance for Toll Interoperability will start up its North American Hub, utilizing what was developed by the IOP. This Hub will provide a means for sharing transactional information between agencies and eventually full back-office operations. The lack of sustainable transportation funding will continue to promote AET, and managed lanes will continue to be deployed in both greenfields and conversions.

Our customers are demanding the evolution of the tolling industry, and we must continue to stay ahead of demand. With the baby boomers aging out of consumer influence, the 'cashless' generation will continue to demand that their ever-expanding technology eliminate their need to stop, slow down at or even see a toll booth. I see 2014 as the year of evolution for tolling and interoperability. Consumers will continue to put pressure on us to make their toll road experience better, faster and easier. And we will strive to stay ahead of the curve. Who knows, perhaps Johnson was wrong. Maybe toll booths *are* one of 25 Things Babies Born in *2005* May Never Know!

> Who knows, maybe toll booths are one of '25 Things Babies Born in 2005 May Never Know'!
>
> **James Eden, director of tolling, Aecom, USA**

The role of ITS in the move toward smarter cities

READER ENQUIRY NO. 509

The global market for intelligent transportation systems (ITS) is estimated to reach US$40bn in 2015. Consequently, there is currently a host of suppliers setting out to help operators run smarter cities via the deployment of smarter and sustainable mobility solutions.

One of these suppliers is Cubic Transportation Systems, which has a vision it calls NextCity. The key element of the vision is that in the city of the future, all modes of transport will be linked and interoperable. Public transport operators will receive second-by-second information that will enable them to regulate demand by setting appropriate fares across trains, buses and trams.

(Above) **A key aim of the ITMS business is to enhance communication between TMCs and drivers** (Left) **Hazard warnings can be switched on automatically**

Cubic also envisages NextCity enabling citizens to manage how they travel by providing them with actionable, predictive and personalized information – whether that travel is by train, bus, taxi, private vehicle or bike.

This vision is not too far away from becoming reality. Increasing numbers of cities are adopting policies to create integrated travel networks. With a limit on the amount of road and rail networks that can be built, how we manage our existing networks is crucial to how we move people and freight around our urban landscapes.

Cubic recently acquired Serco's Intelligent Transport Management Systems (ITMS) business. The company believes ITMS represents a new and vital capability underpinning the NextCity vision.

With the acquisition, Cubic gained more than 300 dedicated staff, located in the UK and Australia, making its ITS portfolio far broader than it previously was.

The new expertise lies in three areas. The Transport Management Systems business designs, implements and supports traffic control and information systems. The Enforcement Solutions business is the power behind much of the UK's road safety camera network. In addition, 60% of the English and Welsh police force and 100% of the Scottish police force are customers for the ITMS back-office solution. Finally, the Field Maintenance business maintains ITS infrastructure in London, Scotland and Belfast.

Need to know?

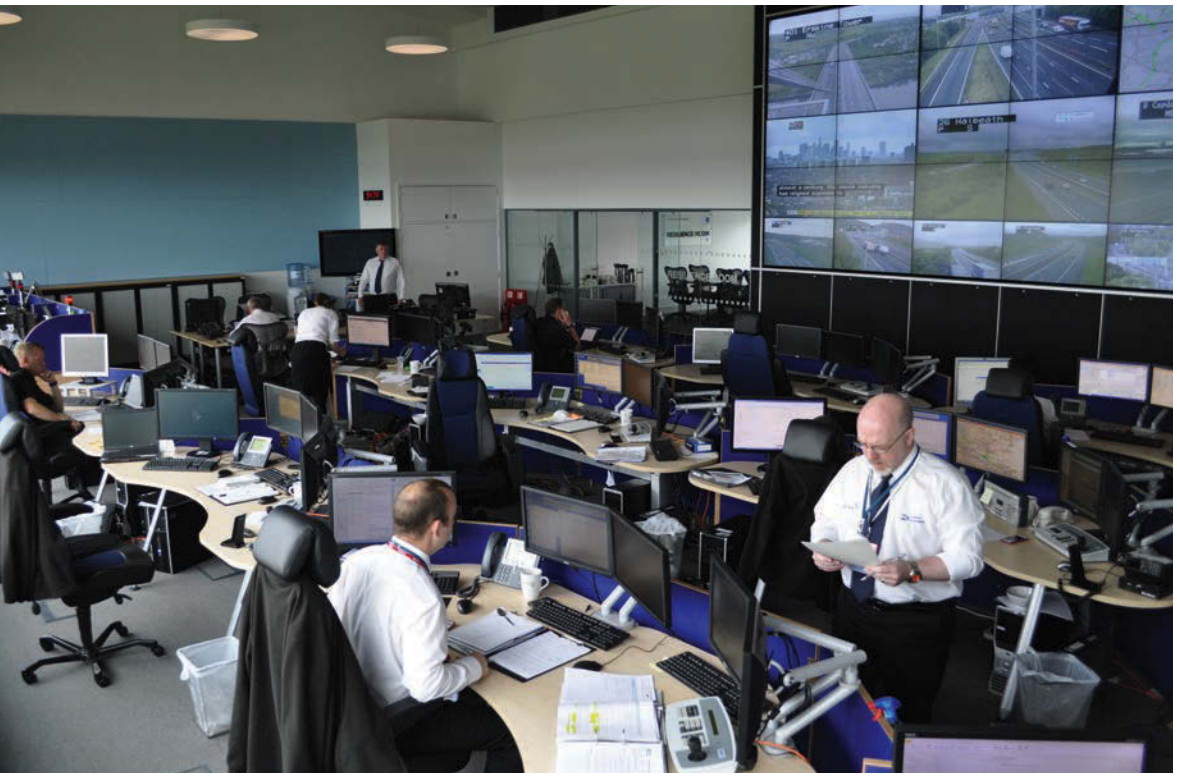
A recent acquisition is proving fruitful for a mobility expert that's now finding its niche in the ITS sector

- NextCity will be a platform of systems that can integrate with the payment and information systems of other modes of transport without the need to replace any of the existing infrastructures
- City planners will benefit from a clearer traffic picture, better incident response and integrated charging policies

Real-world projects

The scale of the ITMS contribution to Cubic's transport strategy can be seen in the range of diverse projects that have been implemented throughout the UK.

Transport Scotland has been a customer for more than 20 years. The ITMS team developed the traffic control system for its entire motorway network, and recently completed work on the new National Control Centre. The team is also implementing a complex management



(Left) **TMC operators receive decision support data from the ITMS tools**

system around the new Forth Crossing, near Edinburgh.

In Glasgow, Cubic is working with the council on its 'digital cities' initiative, as well as a new operations center designed to make the exchange of information between various local operations easier. Furthermore, the company is delivering and maintaining the city's tracking, traffic signal priority and real-time passenger information for bus routes across Glasgow.

South of the border, ITMS is contracted by Transport for London (TfL) to be responsible for the maintenance and infrastructure upgrades for one-third of the capital's traffic lights and 11 road tunnels. It also provides TfL's digital CCTV system.

A good fit

ITMS technology fits perfectly with NextCity, particularly with regard to the information side of the vision. The ITMS traffic management system collects information from the road network in a variety of formats. Solutions span everything from sensors and CCTV cameras to alert notifications from travelers. The data is transmitted to operators to assist them in making decisions about how to deal with incidents on the network.

The system even makes some choices for operators. Hazard lights can be switched on automatically, for example. It can also offer operators potential solutions, which they can accept or enhance. Some recommendations are tactical (such as how to route drivers around an incident) and others are strategic (such as suggesting alternative routes to divert traffic that's headed toward an incident). Once the final decision is made, the information goes out to the various stakeholders and drivers are advised of the actions they need to take.

This example neatly showcases the 'similar but different' expertise that the ITMS strand of the business adds to Cubic. Where the company's focus to date has largely been on the urban, public dimension of transportation, the bulk of the ITMS work has been in the inter-urban road environment. The key feature of the work with Transport Scotland is managing the inter-urban road network, not only between cities but also where the inter-urban and urban networks meet. This is something ITMS also handles in Sydney, Australia.

A new dimension

The NextCity vision can be leveraged to educate various transportation stakeholders about the benefits of integrated, whole-of-transport payment and information systems.

Examples of what NextCity can achieve in the UK can be seen in the beginnings of projects in London, Greater Manchester and Glasgow. These, along with several other areas, are seeking increased coordination and communication between different modes of transport and wider services, making it easier for travelers to make informed decisions on their entire journeys. The company is helping support stronger and more innovative visions and is starting to bring its latest ideas and technologies to customers to turn these visions into reality.

Change is happening in all technology-focused industries at a rapid rate. In most countries citizens now live with a global 24-hour news cycle. We expect news about politics, sports and even celebrities to be delivered to us almost instantly. The transportation industry is quickly realizing that it's no different with travel updates: network users are expecting an equally swift response.

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The many and varied uses of the latest in prismatic sign technology

READER ENQUIRY NO. 510

London Heathrow is one of the largest airports in the world and in 2012 almost 28 million visitors passed through its grounds, arriving by all modes of transport.

The road network around the airport takes the highest percentage of visitors, so managing the traffic around the terminals is a high priority. Heathrow already had a 15-year-old variable message sign (VMS) system in place, but it was unreliable and required maintenance, hence the decision was made to upgrade to a modern, efficient and reliable solution. Triplesign was chosen as the airport's new supplier together with its UK partners SignSol and Signway Supplies.

(Above) **A critical part of the Heathrow project involved providing accurate info for truck drivers** (Left) **Variable speed zone signs are proving popular outside schools, where they can reduce speeds during term time**

The Triplesign VMS system is a cost-effective solution with a low power consumption and flexibility to adopt an existing control system.

The Heathrow project included 40 VMS units that each have multifaced control built in; each sign can have up to nine face control options.

In another UK application of this technology, Balfour Beatty Mott MacDonald used Triplesign VMS to replace some aging signs on the A21 road in Hurst Green, East Sussex. The scheme covered a section of road with temporary speed limits in place. To maintain awareness of a reduced speed, it's critical to signal the temporary limit in a way that attracts the driver's attention. It is also crucial to allow a higher speed when the reduction isn't necessary. An LED sign would consume energy 24 hours a day to display the speed limit, whereas a rotating prism VMS only consumes power when it's changing the posted limit. The power consumption during rotation is less than 20W/hr (excluding any additional illumination or 'wig wags').

The project involved the supply of Highways Agency-approved signs for the legally enforceable temporary reduction of speed from 30mph to 20mph.

Need to know?

From airports to schools to remote locations, prismatic VMS are bringing intelligence to the signs sector

- Applications of prismatic VMS span everything from airports to school zones, lane closures and incident management
- Compared with LED-based VMS, prismatic signs offer many benefits in both cost and operation
- Future deployments of prismatic VMS include using them on toll roads and at customs stations

Variable speed zone sign

In a third application that showcases Triplesign solutions, the company's variable speed zone (VSZ) sign is being used outside a number of schools. To maintain awareness of the temporary reduced speed, the wig wags are set to flash during times when the temporary limit is being deployed.

The VSZ sign can be pre-programmed with school opening and closing hours and can reduce the speed according to a preset schedule on a five-year plan, which can be updated locally with a memory stick. The standard settings are to reduce speed during morning rush hours, lunch hours and afternoon school hours, and have the regular speed limit in place between the reduced periods – and at weekends, evenings and other times when schools are closed (such as bank holidays).

The sign can be fitted with up to four wig wags that can be controlled individually or in pairs (left/right, up/down or in a cross pattern). Communication options include the Triplesign internet management (TIM) system (accessible from a PC,

(Far left) **Variable speed zone signs feature 'wig wags' that flash to alert drivers to a reduced speed**
(Left) **Prismatic signs are easy to install and they have very low power requirements**

Mac or smartphone) and/or the common gateway interface (CGI), Modbus/RS485, Serial RS232. The communication can also be adapted to fit existing systems.

New developments

Looking ahead to the future, Triplesign predicts that the increased demand for flexible ITS tools will develop both the technology that goes into VMS and the applications the signs are used for.

One future application is to use prismatic VMS as lane closure signs. In this type of setup, VMS would be deployed on each traffic lane to deliver the closure information effectively. Traditional lane closure signs are primarily used in urban areas with traffic flows that regularly exceed the capacity of the network. Deploying a VMS-based lane closure sign system – rather than traditional, non-dynamic signage – has a number of benefits. Firstly, as well as closing lanes, it can also open up new ones. A VMS can deliver a message to say that a hard shoulder is open to low-speed traffic during a traffic jam, for instance. Another benefit is that a lane on the opposite side of the road can be opened up to traffic during an incident via information delivered by the VMS. Temporarily separate lanes for HGVs or public transport can also be created. Certain lanes can even be redirected to other roads.

To meet the demand in this area, Triplesign has developed a new range of prismatic VMS for lane closure operations. Visually, the signs look like a regular static traffic sign. But appearances can be deceptive; there are actually several signs built into each unit. The idea is that there is one sign for each lane of traffic on a multiple-lane road. Each lane can be independently operated by the traffic management system.

When comparing prismatic VMS with LED VMS, a number of benefits associated with the former approach are apparent. Obviously there is a drastic difference in investment costs between LED-based VMS and prismatic signs. But there are operational benefits too. Prismatic VMS display the traffic information at all times, while LED VMS require a constant power supply to be able to expose the information. If there is a power cut, the LED VMS units will go out, unless they have an costly uninterruptible power supply (UPS) system. In some scenarios, a static 'reserve' sign is placed next to the VMS so that some information can still be displayed during a power cut. Prismatic signs do not require any of these additional solutions and their associated costs.

Comparing the two sign types on a long-term basis, the prismatic signs also appear more favorable than the LED ones. The power consumption of a Triplesign prismatic VMS is extremely low. In standby mode the sign requires either no power or almost no power, depending on the traffic management solution it's being used for. The power needed is so small that Triplesign prismatic VMS can be solar operated as standard, which avoids expensive power supply installations and promotes a greener environment.

Remote installation

The capability to have prismatic VMS installed in remote locations that do not have access to mains power is opening up further applications for the technology. For instance, signs could be installed before charging stations on a toll road or they could be used ahead of border control to prepare the driver for what lies ahead.

Road weather stations could also be connected to the VMS to provide warnings for heavy rain, snow or ice. And truck control stations could be efficiently operated by using a prismatic VMS to instruct the truck driver to drive off the highway and into the control station in good time. Finally, prismatic VMS can be used to redirect traffic, for example due to accidents or traffic jams.

Triplesign is looking forward to embracing the needs of a dynamic market that is seeking cost-efficient and innovative ITS solutions.

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Moving beyond alphanumerics for vehicle identification

READER ENQUIRY NO. 511

When you speak with camera experts in the high-end vision world, they all tend to agree on one thing: the ITS sector is one of the most challenging and demanding markets around. Selling into such a complex sector takes a great deal of dedication, technical expertise and commitment.

Tattile has specialized in the development and manufacture of ALPR cameras for ITS since 1988, to the extent that it is now among the most established players in the marketplace. Not wanting to rest on any laurels, the company recently announced the launch of its new Vega Color family, designed to detect the color of the license plates themselves.

The development process for Vega presented a new challenge for Tattile – to provide a high-tech solution able to fulfill the ITS demands emanating from specific areas around the globe, particularly in the sophisticated markets of the Arab world, where users are requesting not only the identification of the alphanumeric string that makes up a license plate but also the identification of its color.

Some countries permit more than one vehicle to share the same license plate number or letter combination, so in such instances quite often the only difference between the plates is their background color.

The capability to read the plate data and identify the color is thus paramount in enabling the end user to have immediate access to a vehicle's unique identification information.

Responding to the challenge, Tattile devised an all-in-one solution without the need for an external white-light illuminator. The Vega camera's color sensor has been integrated with a white light LED illuminator (saving installation, energy and maintenance costs), which integrates built-in software capable of automatically adjusting its intensity according to the external light conditions. At the same time, this ensures high-quality images that are focused on plate number and color identification. The system can even identify color at night or in dark conditions.

Tattile's new Vega family for tolling, traffic monitoring, vehicle tracking, enforcement and more

Need to know?

A new camera range to cater to the increasingly complex demands of traffic surveillance

- Vega HD Color has a 2,560 x 2,048 CMOS sensor (75fps); the Vega Color a 1,920 x 1080 CMOS sensor (25fps)
- Image capture and processing triggered by Ethernet command or digital signal
- Configuration and monitoring through TCP/IP; installation and configuration by web server on board
- Waterproof IP66 housing with bracket included

In line with Tattile's overall philosophy, Vega Color is an all-in-one system featuring embedded technology – that means no extra PCs, software licenses, etc, are required to operate the camera. The solution also boasts onboard OCR, meaning that images are processed and converted directly in the camera. It's a totally plug-and-play solution so installation is simple and inexpensive. And being a standalone system, the camera can operate even without a previously set-up data connection and saves the events on its onboard micro SD. Finally, the onboard web server enables an easy and immediate camera setup and software update, which reduces maintenance costs considerably.

Part of the family

Tattile's new family includes the Vega Color and the Vega HD Color cameras. The former is a perfect fit for all of the most common urban applications, such as vehicle tracking up to 140km/h (87mph), parking and access control. The Vega HD Color, on the other hand, has been developed for free-flow and high-speed tolling applications, for highway tracking and for all those applications where high-speed vehicle detection and plate recognition is a real challenge.

As a result of its 5MP sensor (working at 75fps), the Vega Color is able to detect vehicles up to 250km/h (155mph) without any external trigger due to the fact that sophisticated blob motion software has been deployed inside the camera, which an auto-trigger commands.

Vega Color covers more than one lane so it can perform detection and plate reading of cars traveling in between two lanes, avoiding any lack of detection.

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The role of automatic license plate recognition in the Smart City

READER ENQUIRY NO. 512

Any urban area with ambitions of becoming a Smart City needs a number of essential elements in place before it can consider adopting the title. Although not limited to these measures, accurate control and knowledge of traffic conditions, an increase in safety and surveillance and improved incident prevention and management should be top among the priorities.

Automatic license plate recognition (ALPR) plays a key role in the planning and control of modern cities and can be deployed for a variety of applications, some of which are obvious but others less so.

Public safety is one of the growing applications for ALPR, with it becoming increasingly commonplace to link video surveillance cameras with license plate recognition solutions. This extra back-up increases security in a city as it enables alarms to be launched automatically when vehicles that may be of interest to authorities are detected.

ALPR is also a powerful tool when it comes to counts and statistics. Data such as average speed calculations and even instant speed calculations can be provided efficiently and non-invasively. Hence adjustments or corrective actions can be taken based on the data collected, as well as the creation of various graphs, comparisons and trend analyses, which all help managers to improve traffic control and flow.

Urban congestion charges have been implemented in several cities with the goal of reducing traffic in city centers. Others use the license plate to determine which vehicles should be permitted to drive into the congestion charge zones and on which day – for instance based on odd and even numbers. ALPR technology can be central to both approaches for the automation of payment and location of offenders.

(Above) **ALPR is critical in helping to monitor the flow and movement of vehicles around a road network** (Main) **In-vehicle ALPR is helping police officers intercept suspect or wanted vehicles**

Safety and access

License plate recognition systems are integral to traffic safety cameras that have the capability to automatically fine vehicles jumping red lights, exceeding given speed limits or even entering restricted traffic or parking areas.

On the subject of the latter, bollards and arm barriers can be vital dissuasive elements to prevent unauthorized vehicles entering restricted or off-limit areas. But what happens if these mechanical elements break down or someone loses the ID card permitting them to enter legitimately? What if an emergency vehicle wants to enter the same area but cannot, as it lacks the appropriate clearance method?

One of the most simple solutions would be to remove the mechanical elements prone to failure or which can even result in damage to vehicles (a frequent occurrence when drivers don't notice rising bollards, for example). ALPR cameras could replace barriers or bollards so if a vehicle is unauthorized, the ALPR system will notify the driver directly, potentially issue a fine or – if necessary – inform the nearest police patrol of the detected infringement.

In the regulation of surface parking in controlled zones, ALPR cameras or OCR engines have helped to completely or partially automate many previously manual operations. Now systems can detect the entry and exit of vehicles in the controlled zone and apply the rate according to the time parked, charging the amount to drivers' accounts or credit cards (pre-registration required). If there is no pre-registration, the

Need to know?

The growing adoption of ALPR for multiple safety and traffic control applications in today's modern, smarter cities

- As cities strive to become smarter, the popularity of ALPR technology is rising – as are the number of diverse applications it can be used for
- Today companies in the fields of mobility statistics generation, traffic light management, security (video recording and analysis), and more are embracing ALPR solutions

ALPR is already widely used at traffic intersections and will become an inherent part of Smart Cities

license plate can be entered using a phone app or street parking meter just before leaving the parking lot. The system then calculates the rate and requests payment using a credit card, in cash or any other form of payment, and even grants a grace period to vacate the controlled parking zone. Attendants only have to take a photo of the license plate on their handheld device (replete with internet connection to the central database) to establish the vehicle's payment status online.

Law enforcement

One of the most impressive and also demanding applications for ALPR is when cameras are fitted in-vehicle in police patrol cars. The cameras are constantly scanning license plates and comparing them with their databases, which are constantly updated on a central server.

Urban applications of this technology include searching the database for stolen vehicles, vehicles wanted in relation to crimes, etc, and searching for vehicles without compulsory insurance. Other popular applications include the identification of vehicles in reserved lanes (such as bus lanes) and in restricted areas (pedestrian zones, for instance).

Vehicles can also be checked to ensure they have passed the relevant technical inspections, with the consequent reduction in defective vehicles driven in cities reducing the number of deaths and injuries due to accidents caused by mechanical malfunction.

Law enforcement agencies around the world see ALPR as a powerful tool to reduce crime and increase police efficiency and arrests. Vitally it achieves these goals while maximizing the security of police resources and reducing inconvenience to drivers to a minimum, as officers only stop vehicles that are flagged up by the system.

However, effective police management requires more than just keeping an up-to-date database. There are many other factors that can potentially impede the correct operation of an ALPR system.

For manufacturers of these solutions, in-vehicle law enforcement represents one of the toughest, most demanding working environments for ALPR. Unlike other applications where the camera, the vehicle, or even both are stationary, in the case of a patrol car, the OCR has to overcome three main challenges.

Changing light conditions for one – not only due to weather but also due to the movement of the police vehicle, which will pass through well-lit areas, poorly lit areas, will encounter shadows (from trees, for instance), unlit areas such as tunnels and bridges, and is exposed to sun from all angles. Second, the technology also has to tackle changing sizes and angles of the license plate characters. And last but by no means least, there is the short response time required, a factor given the relative speeds of the vehicles to be read are constantly changing.

Faced with all these challenges, the design and implementation of an ALPR system requires a number of goals to be met. The right choice of hardware such as camera, lens and lighting is a prerequisite. Similarly, a good vehicle recognition engine that can work with images that may be less than perfect (as some images inevitably reach the engine with little contrast, out of focus or other problems) is non-negotiable. Lastly, advice that only the OCR developer can provide through intimate knowledge of the engine's requirements is invaluable.

Budget-friendly technology

Many cities face futures with rising costs and lower incomes and increasingly limited budgets for law enforcement. But technologies are available to help optimize, manage and improve the resources available for traffic control and safety. Hence there is much interest in developing and implementing these types of technologies in both large and small cities, hence engineering is being attracted from fields that were previously unrelated to ALPR.

What's critical but under-appreciated is having a partner as a consultant on all aspects affecting ALPR – a vital factor in achieving the accuracy rates that make systems useful.

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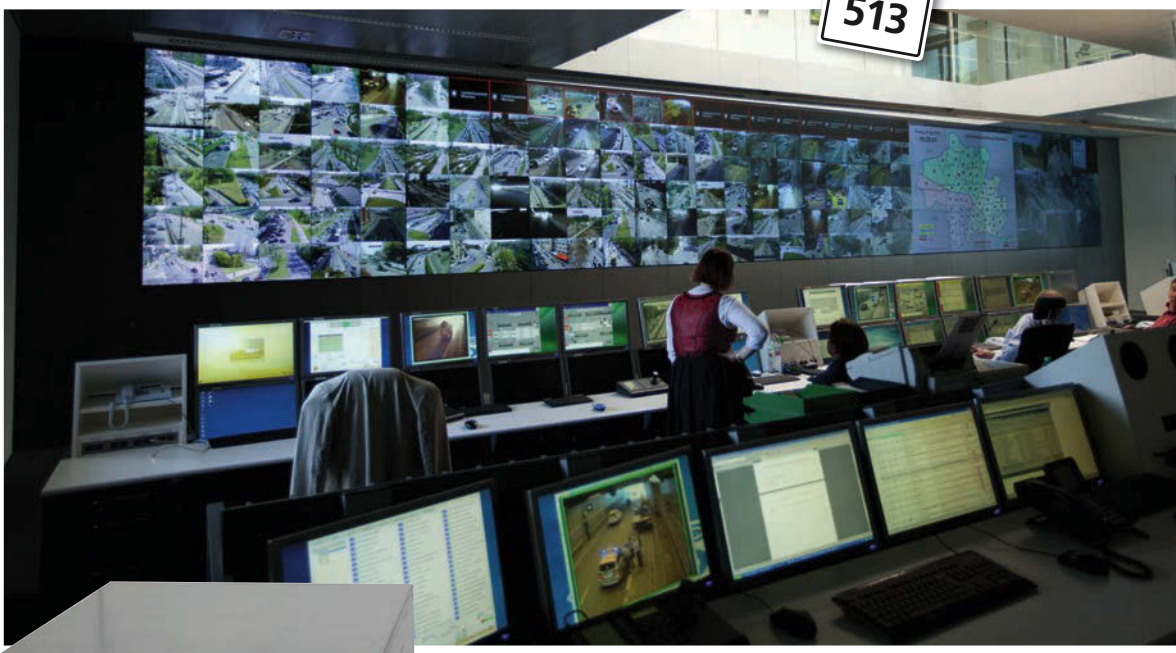
Intelligent networking and visualization comes to the TMC

READER ENQUIRY NO. 513

With control centers generally increasing in complexity, the requirements for the audiovisual (AV) technology that goes into them has also become ever-more complicated. In the field of traffic control and security, for instance, single control rooms are being phased out in favor of integrated control centers. Hence the AV technology has to be able to manage additional tasks and an increasing number of signal sources.

Following this trend, Société Anonyme d'Economie Mixte d'Exploitation du Stationnement (SAEMES) – a semi-public parking system operator for the city of Paris – has built a central control room that operates more than 90 car parks in the city, and which features a 7m² videowall from Eyevis, upon which signals from the operator's CCTV cameras are centrally displayed.

Something in the region of four million visitors use the SAEMES parking facilities each year and the control room staff answer all service requests and emergency calls from clients in the car parks, so no physical presence is necessary in the car parks themselves.



(Main) **Munich's traffic control room features Eyevis AV technology** (Left) **With Eyevis's new EPU displays, all image processing electronics are integrated into the display** (Inset) **The new netPIX 4900 graphic controller**

Need to know?

The increasingly complex requirements of control rooms means AV vendors must offer flexible, integrated tools

- The new netPIX 4900 graphic controller is the centerpiece for large-scale video installations
- It generates a coherent desktop interface out of single outputs that can be used for the presentation of network data, video and graphic sources
- All input signals can be moved, scaled and placed freely on the video wall

To build such an integrated control center, IT systems, visualization solutions and network architectures that transmit, process and display diverse input signals are needed. High-quality videowall and display systems, such as seamless rear projection cubes and LCD displays with LED backlight for high brightness, full HD resolution, brilliant color representation, and 24/7 capacity, are already standard. But modern TMCs require more than just high-quality visualization systems. Complete solutions that enable an uncomplicated installation and flexible enhancement are a prerequisite. The basis for that is the network architecture for signal distribution and the control of videowalls and single displays. This has to be flexibly adjustable to changing demands and easily expandable where necessary. Especially for larger control centers and those that are separated from the monitored objects, a simple real-time transmission of data through networks, the internet or the cloud must be possible.

Providing flexibility

The potential for centralization and combining control rooms depends on the available hardware and network architecture. Multiple signal sources are often used in the traffic control sector, which includes signals from security cameras (often both analog and digital) as well as street diagrams and layout plans. Within the control room, those signals have to be collected and presented on a videowall in a standardized format. To flexibly position and scale the input

(Above) **The next-generation IPD-32HQ IP streaming video decoding solution from Eyevis** (Left) **Vinci's A89 Highway Control Centre boasts a suite of Eyevis solutions**

signals on the videowall according to specific demands, the application of a graphic controller such as Eyevis's new netPIX 4900 and wall management software such as eyeCON V5.1 is necessary. From the single signals, the netPIX 4900 generates a connected desktop interface for the presentation of network data, video and graphic sources. It makes the input and output processing of 4K/QHD signals possible, as well as the transmission of audio through HDMI. With eyeCON V5.1, presets for the presentation of alarms on a videowall can be set up – a pop-up window with detailed information about the alarm, for example.

With the help of Eyevis's streaming solutions, such as the eSTREAMERn eS100 and eS200 or the eyeGATE, input signals of video cameras, for example, can be converted and transmitted over standard IP networks. And via a decoder such as the IPD32HQ – a board able to decode up to two 4K signals simultaneously – those signals can be received at any point on the network and (through a graphic controller) be displayed on a videowall or a desktop computer. This system can be installed on a redundant basis, which improves data security as well as availability. The solution is also useful if a control system needs to stay extendable. With streaming solutions, a network-based routing matrix that can be optionally extended is much more cost-effective than classic signal processing. The compatibility of encoder and decoder with the applied camera also has to be considered, particularly for the transmission of IP camera signals. Here, decoders such as the IPD32HQ (which through the ONVIF Profile S-Standard supports more than 2,500 camera models from different manufacturers) are suitable.

Interconnecting videowalls and single displays

For larger traffic control systems that include several control rooms and adjacent conference rooms, a graphic controller is often unable to manage all input signals and reproducers. In such cases, wall management software that provides central and uncomplicated operation for the entire system beyond the limits of a single graphic controller is required. For this reason, Eyevis has equipped its eyeCON wall management software with the MetaWall feature. eyeCON MetaWall 2.0 is a flexible system for signal transmission and the control of videowalls and single displays. Several videowalls and single displays can be interconnected to a single user interface above the limit of one graphic controller. In addition to graphic controllers of the netPIX series, eyeCON MetaWall 2.0 also supports the new intelligent Eyevis EPU displays of type EYE-LCD-xx00-LE-EPU. In these EPU displays, image processing electronics are integrated into the display through the Eye Processing Unit (EPU).

Combinations of the streaming solutions, graphic controllers and the new intelligent EPU display series mean that operation of almost unlimited videowall and display installations is possible. Input signals are transmitted via network, internet or the cloud and are pulled out of the network according to the installation of graphic controllers or intelligent EPU displays. Management, scaling and assignment of all input signals is controlled through eyeCON V5.1, which visualizes all sources on a desktop surface and enables the uncomplicated distribution of the signals to the single reproducers as a result.

The fact that the new EPU displays with direct control and videowall displays with operation through graphic controllers can be integrated into eyeCON MetaWall 2.0, it offers flexibility for integrators. All necessary components can be combined with each other as needed, which guarantees the highest possible efficiency and benefit for users. Moreover, eyeCON MetaWall 2.0 can easily be integrated into existing systems.

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Using intelligent radar detection to dim streetlights

READER ENQUIRY NO. 514

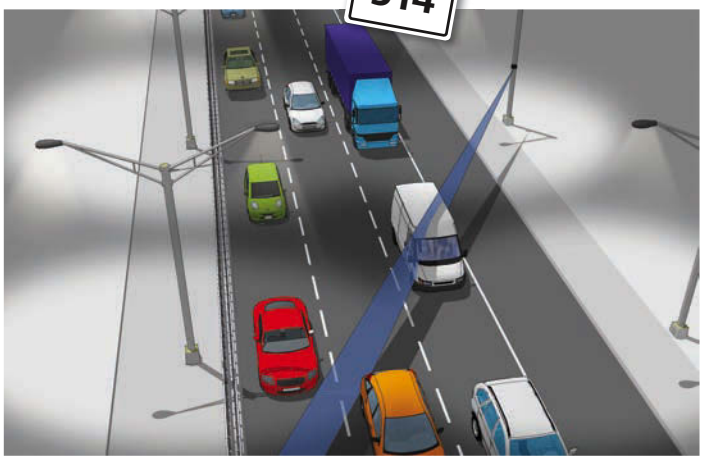
Streetlights have become a hot topic in recent years as pressure mounts on local and city authorities to improve energy efficiency. The European Commission, as an example, is targeting a 20% reduction in EU greenhouse gas (GHG) emissions (from 1990 levels) and a 20% increase in Europe's energy efficiency by 2020, while the UK has a target to reduce GHG emissions by at least 80% by 2050. With energy prices rising, road traffic authorities are also under pressure to make substantial cost savings.

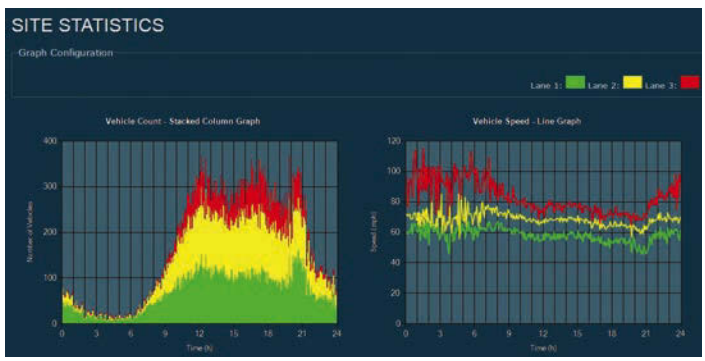
In response to growing demand from authorities for solutions to help them achieve energy-efficiency and cost-saving targets, AGD Systems is applying its intelligent radar expertise to the lighting sector. With more than 120 million streetlights in Europe, they are a natural focus for energy efficiency improvements.

AGD's latest intelligent radar detection systems provide vehicle target speeds and positions, vehicle counts and occupancy information, congestion detection and cycle and pedestrian detection – for applications in urban and inter-urban environments.

Intelligent lighting

Using its radar technology, AGD can help authorities and lighting manufacturers to reduce the energy consumption of streetlighting systems by providing dynamic streetlighting control; ensuring that lighting levels can be adjusted safely depending on traffic volume. One big advantage is that radars already deployed for vehicle detection and traffic flow monitoring can also be used to control light levels – a sizeable cost saving over installing a new streetlight control system with dedicated sensors.





(Left) **How a streetlight-mounted radar detector operates** (Below left) **Vehicle counts, time and vehicle speeds gathered by the radar detectors**

Need to know?

The benefits of putting proven traffic technology to use in new applications for smarter streetlighting

- Intelligent, adaptive streetlighting is a key trend as authorities try to save money and become more energy-efficient
- Well established, radar-based traffic detection technology can be deployed to control streetlights and deliver bespoke traffic information

A fully interactive intelligent lighting scenario can be achieved. For example, the system can be programmed so that when the radars detect consistently high volumes of traffic, the streetlights operate at full brightness, dimming to a defined safe level at other times, in accordance with the amount of traffic.

Authorities can choose the level of complexity they wish to deploy. For example, they may wish to install a single low-cost radar detector per luminaire, or a more sophisticated single radar that links to a series of interconnected streetlights.

Simple but effective

Different customers have different requirements for intelligent radar detection and dynamic streetlighting, depending on the nature of specific locations. Some authorities may simply want to detect approaching or bidirectional vehicles and illuminate streetlights accordingly. This highly accurate means of vehicle detection can yield big cost savings. Streetlighting typically accounts for 30% of a city authority's expenditure. The business case for dimming streetlights at quieter periods of the night, when traffic flow is minimal, is very compelling.

In France, AGD is deploying its 307 radars to control streetlighting in various regions, in partnership with a major lighting manufacturer. Using a simple opto or relay output per detect, the radars have enabled the French authorities to control lighting safely in response to traffic.

AGD's 307 model operates in the K band at 24GHz, the preferred band for lighting manufacturers, making it suitable for installations around the world. A compact, Doppler vehicle radar, it is designed to be robust, cost-effective and offer versatile detection performance.

The height of sophistication

Some customers require a more sophisticated approach to assist with traffic management and streetlighting control, perhaps wanting to gather extra data –

such as detailed vehicle counts and average speed measurements in one or multiple lanes, over set periods of time.

In these cases, AGD recommends its latest 24GHz FMCW radar platforms. By adapting an existing low-power traffic management radar, AGD can provide a vehicle detection solution mounted to existing street infrastructure.

These solutions provide data on approaching and receding traffic flow, vehicle counts in single or multiple lanes, and average speeds on a per lane basis, plus provide remote detection of congestion in real time. Traffic information can be sent remotely via wireless communications on request to traffic or lighting control management centers, so lights can be dimmed or brightened. The radar can send the information to nodes in the streetlights to facilitate this, or deliver data to the lighting control center for appropriate action to be taken.

Tailormade solutions for specific applications

Radar data outputs can be adapted to deliver bespoke traffic information in whatever formats and frequencies clients prefer. For example, some may wish to receive data every five minutes, others every hour, depending on traffic flow; and while some may want to know exactly what is happening on every section of road, others may prefer more general trend information, provided by intermittent reporting.

There is an option to link directly at a local level with the lighting control infrastructure's digital addressable lighting interface (DALI) or similar interfaces, so authorities can either receive the raw traffic data and make lighting decisions themselves, or delegate decision making to the radar at street level.

The solution also includes remote trapdoor access for upgrading radar settings and firmware and performance monitoring, eliminating the need to send engineers to the radar when implementing new settings, thereby saving money. Each radar also emits a heartbeat message to confirm it is active.

The decision of whether to deploy a standalone boxed radar solution or a more integrated radar solution incorporated within the lighting infrastructure lies with the manufacturers, but AGD can accommodate both approaches, as demonstrated in other sectors, namely vehicle-activated speed (VAS) signage and speed enforcement. This design service may be particularly beneficial in conservation or tourist sites, where authorities want radar technology to be in keeping with existing street furniture. Recent lighting industry dialogs suggest that both requirements need to be considered.

Responsive and responsible

Intelligent radar detection ITS solutions with lighting control systems turn static streetlighting into flexible and dynamic solutions that can respond to the changing transportation landscape. AGD's solutions – with their direct interface to DALI control systems, remote wireless communication capabilities and rigorous testing regimes – offer an accurate, cost-effective and energy-efficient dynamic lighting solution. And the company is currently working on radar designs that will address requirements for even lower power detection.

(Left) **Real-world deployment of the light-mounted detectors in France**

"Road and streetlights make a crucial contribution to operational efficiency and road safety," says Pete Hutchinson, managing director of AGD. "Today's transport authorities are faced with diminishing budgets, high maintenance outlays and ever-growing pressure to increase sustainability. AGD has experience working with different departments in city and regional authorities to provide complete, integrated solutions that meet all ITS requirements. This holistic approach is key to improving energy efficiency and achieving operational cost reduction by using the existing traffic infrastructure wherever possible. Our radar solutions make this a reality."

AGD will be at Intertraffic Amsterdam 2014, which will be held from March 25-28, showcasing its radar expertise and dynamic streetlighting control capabilities.

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Smart IP surveillance makes railroad crossings safer

READER ENQUIRY NO. 515

Highly trafficked railroad level crossings remain a safety concern globally, despite the widespread use of active warning systems to clear the tracks for oncoming trains. Although most train-car collisions are preventable, real-time status updates and images from the crossing area – as well as warning devices – are required to help car drivers and pedestrians, railway operators and local authorities avoid accidents, as well as to perform root cause analysis in the wake of a crash.

IP video surveillance technologies are increasingly being deployed to provide real-time information and advanced data-acquisition systems to offer more complete and accurate information.

The surveillance systems for these railroad crossings require three key elements – real-time obstacle detection, around-the-clock asset monitoring and non-stop network video recording (NVR).

Advanced CCTV cameras designed for harsh, outdoor environments are used in smart level crossings to provide 24/7 surveillance for the clearance zone. NVR are also installed in the wayside cabinet to store video streamed from the cameras so investigators can replay events leading up to any collision and identify the cause.

Key ingredients

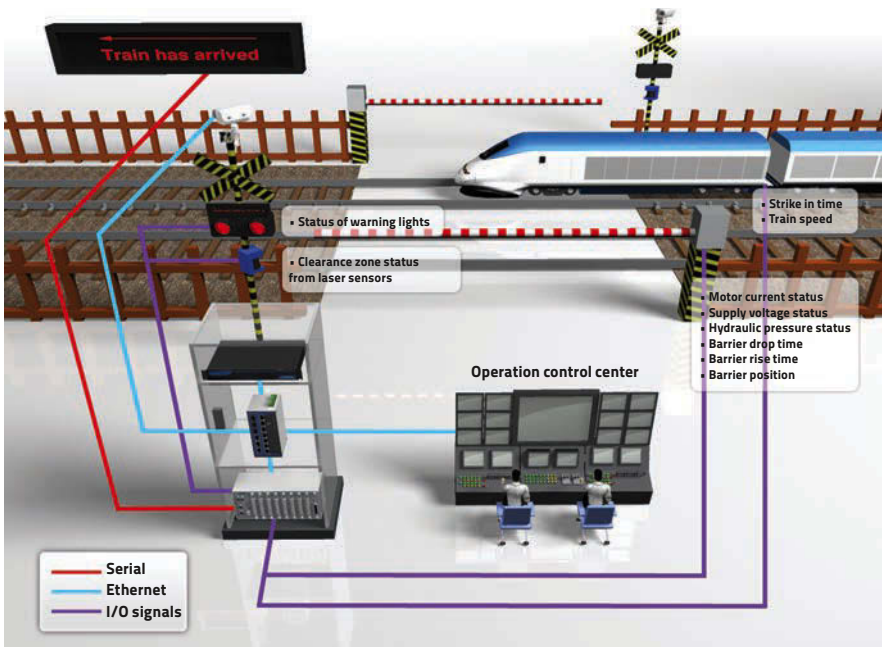
In such a scenario, Moxa's VPort 36-1MP rugged IP cameras are used to capture and encode real-time video of the clearance zone, which is then streamed to an MxNVR-IA8 industrial NVR within the wayside cabinet. In addition, Moxa's IVA (intelligent video analysis) software increases efficiency and protection coverage by using a variety of triggered alarms. These include 'Camera Tamper', which is triggered when the camera lens is blocked, redirected, defocused, or painted. Meanwhile 'Virtual Fence' enables a virtual tripwire in the camera frame to trigger an alarm whenever motion across the line is detected. With the 'Alert Zone' function, any motion detected inside the detection zone will trigger an alarm. A 'Removed Object' feature sees the camera detect objects removed from the frame, and will trigger an alarm after a certain user-defined time threshold. While the 'Unattended Objects' function tracks moving objects in the camera frame and detects abnormal loitering.

Although the principal image-processing technology that makes the above solution so 'smart' is Moxa's IVA software, the CCTV cameras and NVRs deployed also need to be ruggedly designed. They must have a wide operating range of -40 to 75°C, be industry-certified to EN 50121, EN 55022, UL/cUL Class 1 Division 2, ATEX Zone 2 and NEMA TS2 certifications for electrical equipment used in railway applications. They also have to provide IVA for

Need to know?

Smarter, safer level crossings need a mix of better surveillance and data acquisition

- Railroad crossing accidents claim the lives of roughly 300 Americans and 400 Europeans every year
- They're the largest single risk of catastrophic train accidents in the UK
- One-third of the 8,000 crossings in Australia have active warning systems
- UK regulators set aside £110m (US$182m) after nine deaths and 400 near misses in the year to October 2013



(Left) **The diagram illustrates how remote terminal units, rugged IP video cameras and industrial network video recorders can be used to create a smarter and safer level crossing** (Above) **Providing information at the right time can prevent needless train-car collisions at level crossings** (Inset) **The VPort 36-1MP series is an industrial-grade, H.264 box-type IP camera**

automatic obstacle detection, such as people entering the crossing at any time or any moving object other than trains identified on the track.

Advanced data-acquisition systems for railroad crossings require accurate, complete and precise data for historical analysis. They also require provision of real-time status of active warning devices as well as monitoring of railway assets around the clock.

Smarter approach

To make level crossings more intelligent, Moxa's ioPAC 8500 modular RTU controller is used to monitor the status of all the active warning devices, including the warning lights and bells, electrical boom gates, laser sensors and nearby track circuits. Apart from its compact size, the ioPAC 8500 RTU controller's modular design supports a versatile collection of I/O modules – including digital inputs, digital outputs, analog inputs, resistance temperature detectors, thermocouples, HSPA and serial modules – to connect all the different interface precision instruments and sensors used to monitor the active warning system.

Tailor-made for railway applications, it offers railroad crossings millisecond-level timestamps for more accurate data analysis and kHz-level analog input sampling rate for precise data acquisition. It also offers pre-recording of analog input to prevent missing data.

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I hadn't been to the Transportation Research Board's (TRB) Annual Meeting in several years and wanted to go back to catch up on the current state of research, so I made it to DC for the 93rd Annual Meeting in January – which was also the last one to be held at the trio of hotels: Marriott, Shoreham and Hilton. Next year it moves to the DC Convention Center and not a moment too soon. The hotels can barely contain the thousands of participants and the bus shuttles are getting a bit tired. They are also a lot larger than the old jitneys. Next year we act like a real conference, in the DC Convention Center. Bye-bye long lunch lines on Connecticut Avenue!

This year and perhaps for many other years, the best reason to attend TRB was to see old friends. There are the formal meals that we arrange, the informal coffee dates and the totally unexpected meetings in the halls and on those silly buses. The numbers might be increasing but it's still a family and it's always nice to see distant relatives. It used to be possible to grab a seat in the Marriott bar (still known as Wardman Park by the old-timers) and meet everybody, over the course of just a few hours. Now that's a week-long activity with a huge demand for the bar seats.

But then there is the program, and what a program it was! This year it weighed in at 360 pages, or the size of a small city's phone book. I don't know how many attendees there were at TRB but those who contributed to the program alone would make up a fair-sized conference. The topics covered the gamut from pavement to apps and everything in between. I do, however, need to give a shout out to two particular sessions – 'There's an App for That' and 'The ITS Industry Overview'.

Back at the beginning of the ITS business, applications that might run on mainframe and then mini computers were shifted to PCs. Today there is nothing more personal than a smartphone and they are becoming ubiquitous.

Apps are surely roiling the transportation business and are no longer small time, with Apple and Google buying the more successful companies. The session presented parking payment, parking location and way-finding apps. I bookended the session with a chat I had with a researcher about the lack of standards for in-car applications and the safety hazards they present. This is a sea change from when ITS was under the exclusive control of the DOT.

Perhaps the biggest news of all was one the best attended sessions of all. *The ITS Industry Overview* drew a standing-room-only crowd of more than 300. It wasn't all that long ago that ITS was hardly the headline yet today it is the story – good news for readers of this magazine!

I have all of the papers on a memory stick and to make up for poor attendance at the sessions, I promise to put aside a day next week to read them. No old friends, no bar, but great reading on the state of the industry.

> It used to be possible to grab a seat in the Marriott bar and meet everybody, over the course of just a few hours. Now that's a week-long activity
>
> **Larry Yermack, Wendover Consult, USA**

Visualization and networked distribution solutions

READER ENQUIRY NO. 516

With the global population increasing, the quantity of goods and people on the move is rising too. Experts at the 2011 OECD International Transport Forum estimated that the current global fleet of 800 million vehicles would grow to as many as 2.5 billion by 2050. How will road networks absorb that traffic? Communication, collaboration and intelligent transportation systems will be vital.

One of the keys to smart transportation is real-time information. The more data, the better the solutions: combining databases and sensor information can provide a better understanding of the situation. A good example is urban mobility: while in the past, drivers had to search for a place to park, they can now follow electronic signs directing them to the nearest empty space.

The importance of data

Smart solutions spread traffic load more evenly, by giving personalized directions to drivers based on a wide range of information, in a two-way stream. As well as parking guidance, smart systems can provide information on real-time traffic flows, the number of cars hunting for a parking space and possible roadblocks. By combining data intelligently, a road network can be utilized at its maximum capacity, in doing so minimizing congestion. In other words, data gathering, distribution and monitoring are extremely important.

As one of the leading providers of visualization and networked distribution solutions, Barco understands today's transport challenges and the company is constantly developing new solutions to smarten up traffic control.

(Main) **Barco visualization solutions in a TMC**
(Above) **Operators have the data they need at their fingertips and can quickly zoom in on areas of interest**

Need to know?

Network-based visualization for operational excellence and increased flexibility

- Network technology enables more and rich visual content to be centralized with higher quality levels from any remote location
- Sharing and exchanging visual content between control centers is possible
- Control room display systems have direct network connectivity and hence deliver optimal end-to-end digital access to all networked visual information

Highlights of its offering include video walls and user-friendly controllers and wall management software, to display real-time signals from sensors, GPS systems and other ITS clearly. The company's networked visualization solution enables the flexible distribution of numerous video and data sources – not only in the control center, but worldwide, using the existing TCP/IP network.

Barco's systems are also designed for modularity. The networked visualization system, for example, can be expanded easily by plugging in an extra input or output node. In this way, any content can be distributed over any distance, to be displayed at any location. Furthermore, Barco says its universal approach, building on standard protocols, ensures seamless integration into all ecosystems. The system's flexibility even enables traffic managers to share data over separate private networks, in doing so fostering collaboration between departments and public services.

Help is at hand

Barco provides the building blocks for reliable visualization systems, both inside and beyond the TMC. Its systems help more than 2.5 billion commuters every day; including those in the Noord-Holland province of the Netherlands, where a new central traffic control center was launched in 2010 and expanded in 2014.

With the capital city of Amsterdam at its hub, the Noord-Holland province is a densely populated area with busy traffic. Over the past few years, great efforts have been made to smooth traffic flows and improve road safety. Yet, no matter how efficient the traffic lights, dynamic message signs and cameras, they were not enough to keep a firm grip on the fast-growing traffic.

The new central traffic control center is a big step forward. On Barco's LED-lit OL-521 video wall, operators get a clear overview of the traffic situation. The network-centric Transform N controllers and CMS management software help them configure the wall to display diverse images and applications. They can zoom in easily on areas of interest and share critical information with field operators or other agencies, enhancing safety.

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Applying simulation software to road and tunnel management

READER ENQUIRY NO. 517

Two leading technologies have recently been combined in a bid to provide highway and tunnel operators with a unique training and management tool.

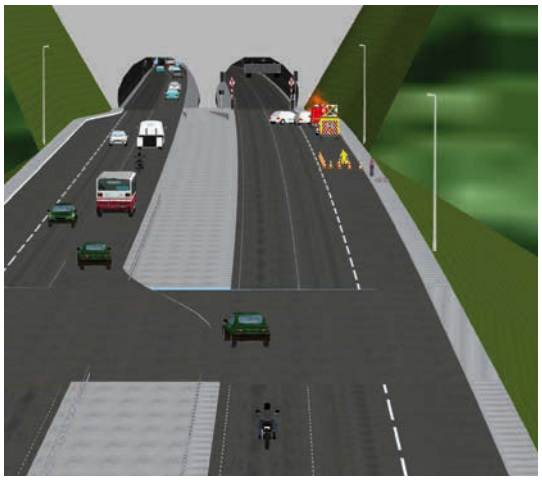
Forum8, the Japanese 3D visual interactive simulation specialist, and French traffic consultant BMIA, have worked together to investigate a number of inherent problems within highway and tunnel operator training and management.

One of the many hurdles associated with training road operators in managing complex traffic events is the inability to accurately visualize an event and its components in the classroom. BMIA has been working on this problem for many years and now believes it may have the answer.

The proposed solution, G'Val, involves the use of real-time 3D visual interactive simulation software to produce realistic and accurate visual simulations that allow communication both internally with the project team prior to and during the evolution of the project and externally with stakeholders and the media.

Driven by the real SCADA system, G'Val allows tunnel and road operators to be trained in a realistic environment thanks to the use of the real operational HMI. The virtual reality is built upon the representation of the real geolocated infrastructure, while all equipment is in an external SQL database.

The visual simulation of a wide range of scenarios provides the user with the ability to evaluate and assess the impact of every conceivable potential traffic emergency incident as well as the capability to interact with them while immersed in the VR by using the driving/pedestrian facility.



(Left) **Incident simulation** (Above) **Operator training using 3D VR tools**

Need to know?

A real-time simulation solution is set to revolutionize road operator training

- G'Val offers 3D real-time simulation, taking into account a project's specifics
- There are many benefits to training, including realistic simulation exercises, conducting training on the real HMI and online trainer intervention
- The solution is also a useful communication tool, facilitating discussion around a project and generating easily understandable video clips

The ability to generate simultaneous virtual incidents enables the user to study the efficiency of the different ways of resolving difficult issues (management of busy traffic, congestion, accidents, fires, security situations, etc).

Customized to accurately reflect each project, the solution should provide major benefits at every stage of the project, from initial study to final operation.

For example, operators can be taught the various operating rules used to manage different scenarios, such as an accident in the tunnel, lane closures and slow traffic, fire, flooding, congestion, etc. Because of the realistic nature of the 3D simulation and its inherent interactivity, the trainer can analyze the trainee operator's ability to react to a range of different situations – within the safety of the classroom. Finally, at the end of the training session the trainer is able to produce a detailed evaluation report.

Modular approach

G'Val is composed of five modules. The Visual Simulator simulates the traffic in a visually realistic and interactive 3D environment and provides images from fixed or mobile cameras into the virtual 3D space to local CCTV screens or video walls. The Trainer Module permits the instructor to 'pilot' the simulator in parallel to operating the various tools. It can activate a whole series of scenarios and incidents as well as generating a variety of reports. The SCADA interface allows the simulator to exchange data with the SCADA through an OPC protocol and simulates the behavior of the equipment. The Communication Simulator handles phone, radio and emergency calls as well as synthetic voice generation. Finally, the Driving Simulator allows the trainee to enter the virtual reality and interact with it as a driver or a pedestrian (opening a door or extinguishing a fire, for instance).

A library of street furniture, vehicles and easily integrated characters in a realistic 3D environment enables the user to produce a visual simulation that delivers images comparable to that of the real cameras from highway or tunnel. Each vehicle in the simulator has an embedded intelligence.

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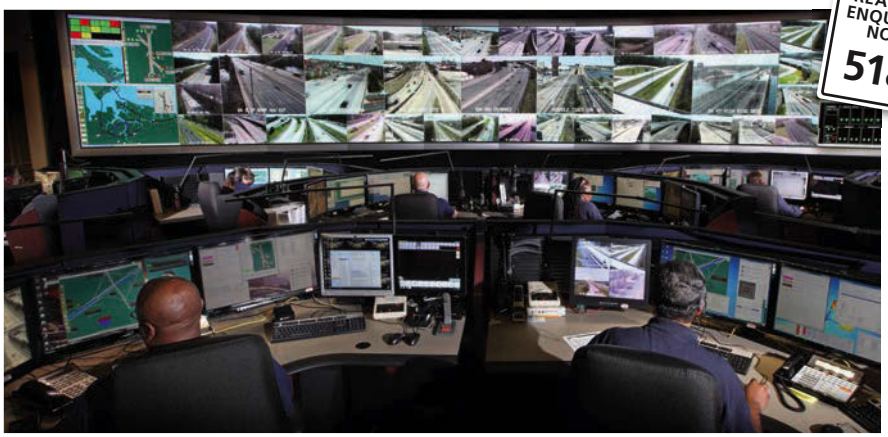
Versatile approach to data acquisition

European Parliament and Council Directive 2010/40/EU indicates the need to enhance several aspects relating to transport systems operation, such as efficiency (including energy), mobility, optimizing trip planning and other vital elements that fall within the EU's priority actions.

Modern TMCs demand a constant flow of valuable traffic data to work efficiently, while managing traffic on a network of national roads, motorways, municipal roads – as well as on the edges of those areas – often requires accurate data from areas beyond the roads that are equipped with any ITS.

To obtain precise and current data collection, the necessary measurement sensors must be distributed optimally on national roads and in cities, which presents a challenge. Naturally in our cities and on our motorways, there are elements of infrastructure that are useful for data collection – ALPR cameras and induction loops deployed at intersections for instance. But more often than not, the complexity of the road network is such that more standard monitoring points are required than is financially feasible.

The quality of delivered data is also vital. Knowledge about journey routes – valuable from a traffic modeling and management point of view – can only be acquired via a few solutions. Restrictions to gathering such data include the need to build gantries, access to the power grid, as well as the cost of investment and ongoing maintenance, all of which are elements applicable to ALPR cameras. And although induction loops or radar sensors are relatively cheap and simple to install, they cannot identify specific vehicles, so the collected data is much less useful when compared to license plate recognition technologies.



READER ENQUIRY NO. 518

APM's MTMS sensor offers the best of both traffic data collection worlds for managers, without the deployment challenges

Need to know?

2.4GHz-based sensor technology to gather and deliver valuable data about traffic conditions

- Low-power mote technology for traffic data collection that can be easily deployed anywhere users want
- On Dynamic MTMS provides traffic data including the source-destination traffic matrix
- The sent data is safe due to the dispersion of the information spectrum and cryptographic algorithms

The multimodal traffic monitoring system (MTMS) from APM, known as 'On Dynamic', offers the best of both these worlds by enabling the measurement of valuable traffic parameters as well as individual vehicle identification.

System architecture

The system operates in real time and can be installed at almost any site within the road network as it requires just a few watts of power and access to a wireless network (e.g. GSM). Sensors monitor at the 2.4GHz frequency of popular wireless interfaces, commonly used in vehicles (items such as cell phones, laptops, tablets, etc, also operate at this frequency). A benefit of such an approach is the high efficiency level of detecting wireless devices.

Advanced inference systems mean it is possible to estimate traffic parameters and build a picture of the underlying traffic pattern based on partial data. The MTMS can cooperate with different types of traffic sensor, including ALPR and radar – encrypted data from these systems is forwarded to a database server and the aggregated data is processed by intelligent software based on previously input mathematical models. The capability to estimate traffic parameters and the traffic picture on the basis of measurements and referential data is a big advantage of the MTMS. But the system is also scalable – i.e. the network area where it's implemented can easily be expanded. "In such systems, the versatility of the used sensors enables data collection on the weather or air pollution, which greatly aids in environmental protection efforts," says Witold Konior, head of R&D at APM.

Where can it be used?

Knowledge about road traffic has many beneficiaries, not least to TMCs for congestion management. Such data can also be used by GPS systems to effectively optimize route calculations on the basis of the current traffic situation, which is useful when it comes to potential obstacles. Data provided by the MTMS can also be valuable to freight companies for better route management, while it can even be employed in traffic modeling and merged with historical data. These are just a handful of the potential applications. "The possibilities of using the data collected by the MTMS are endless, creating a massive potential to increase ITS efficiency," adds APM's CEO, Aleksander Konior.

And with the 2010/40/EU Directive recommending privacy protection and anonymity in the context of ITS, Konior points out that MTMS sends collected data via what's known as 'lossy compression' by dispersing the information through the use of line codes in multivalent logic and cryptographic applications. That way, any relevant privacy regulations are adhered to.

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Dutch invention makes roadworkers safer

READER ENQUIRY NO. 519

Roadwork demarcating tends to be done manually in the Netherlands. For the most part this is a dangerous and physically challenging occupation, to say the least.

It's shocking to consider that in the year 2014, roadworkers place traffic cones manually by using a truck, the back of which is filled to the brim with traffic cones. A worker inside the truck has to hang outside the vehicle balancing on his knees, holding on to the side boards and using one arm, while the truck moves at a speed of 25km/h, to put down or to pick up the 5kg-heavy traffic cones, one by one. The many attempts to remedy this situation that were made in the past, by engineers, roadwork specialists and inventors worldwide, were never really up to the challenge of changing this hard labor. It is about time to wonder why this unorthodox, dangerous approach of placing cones to demarcate roadwork still exists. The question we need to ask is, what argument could we possibly make, in regard to roadworkers' health and safety, for allowing this situation to continue?

The Dutch answer

Gerard is the Dutch traffic cone handler, that, for the first time, can actually change this existing undesirable situation for the better. The concept involves the use of a semi-automated process of placing and picking up traffic cones, while preserving workers' jobs – the aim is not to remove workers from the equation altogether.

This automated traffic cone handler addresses the issues of physical overload, roadworker safety and the ergonomic implications that derive from manually placing cones. Backed up by studies performed by accredited research institutions, Omega Infra's new system has been improved, altered and tested to comply with roadwork safety regulations, physical strain requirements and economic efficiency. Using the machine, a worker no longer leans out of the truck to place or retrieve the cones, making him far less vulnerable to passing traffic. He no longer needs to kneel down on both knees, overstretching himself while trying to maintain balance, with a heavy cone in hand. The worker only needs to place the cones at the top of the placing system, which automatically moves back and forth. The Gerard machine is simply built into the open cargo area of any model of truck and is easily collapsible, making room in the cargo area that can be used for other purposes. The distance between the cones is adjustable, from 8m to 50m at a speed of about 25km/h. Placing and picking up cones automatically on a bend is not a problem.

(Far left) **Workers remain in a safe position throughout the cone placing task** (Left) **The Gerard machine places the cones at a preset distance**

Need to know?

One man's vision to improve roadworker safety and efficiency is now being brought to life

- The current system for placing road cones is antiquated: it's dangerous for workers and not particularly effective either
- Omega Infra's inventor Gerard Verheij was personally inspired to try and improve the situation for roadworkers but sadly died before his vision could be realized
- Verheij's team has finalized his work and bestowed his name upon the Gerard system

Gerard's wish

The name of the product is a tribute to its inventor, Gerard Verheij, who gained inspiration for the idea when he was driving on a highway one night in very bad weather conditions. As he was driving he noticed two soaking wet men in the back of a truck – one of them hanging out – placing traffic cones manually, and he decided he wanted to end this charade. He thought the enterprise was unworthy and unnecessary. Passing away in 2009, he unfortunately wasn't able to finish his work.

Since then, the team at Omega Infra has perfected the machine and one of the largest infrastructure companies in the Netherlands recently ordered Gerard to modernize its fleet.

Now, the company aims to convince other decision-makers across the world to help realize Gerard's dream.

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The next step for tolling: in-built redundancy

READER ENQUIRY NO. 520

The highest aspiration of any toll system is to ensure the detection (and associated payment recovery) of any vehicle moving under its sphere of influence. If, in addition to that, the system reliability and availability achieved is 100%, welcome to the perfect system!

When the goal is to guarantee 100% up-time (availability), it should be approached via the use of stable and well performing software, high-level hardware and what's known as a 'fully redundant' solution.

Multi-lane free-flow (MLFF) tolling is popular because it eliminates the need for toll booths and keeps traffic flowing well, as users do not have to slow down to go through any charging points (CPs). But on the other hand, MLFF has a major disadvantage in the possible reduction of income if the system being deployed is not 100% reliable. In free-flowing traffic, there are no second chances to identify a vehicle.

In a fully redundant solution, every subsystem (detection and classification, OBU reading, video enforcement and system management) is designed to be 100% reliable, via the construction of new algorithms, software architectures and hardware developments.

In its standard configuration, an MLFF system already has sensible redundant aspects within the most critical elements used for recovering information. Why not apply this concept to all components then? Why not consider that a small investment in terms of technology and equipment may be recovered in just a few days of operation?

For a well-known tolling expert, Tecsidel, its modular architecture concept for standard MLFF helped it to find the best technological solution to create a fully redundant MLFF system.

(Main) **ETC relies on gantry-based equipment that must be available at all times** (Below) **Free-flow toll technology must have redundancy built in**

Need to know?

System downtime is unacceptable in free-flow tolling, so complete redundancy is a must

- In free-flow tolling applications vehicles do not have to stop at toll booths, which means they must be accurately identified while traveling – there is simply no margin for error
- Creating a fully redundant solution involves tailoring software, hardware and the interaction between the two
- Dual-concept tools play a key role in building fault-tolerant systems

It was obvious to Tecsidel that fully interchangeable equipment at all CPs within a tolling system was critical to achieving reliability.

The company's main objective is to support the maximum feasible degree of system degradation. It does this in a variety of ways across numerous key parts of an overall system.

How to build in redundancy

Tecsidel has re-designed its electrical rack to power-isolate equipment during any potential power supply disruption or electrical surges.

The company has also built in fault-tolerant network connectivity using an automatically managed dual-balance connection point on every server.

Dual communication (wire as main, wireless as backup) channels between different levels from lanes to the back office is also a key part of Tecsidel's system.

It is also important to ensure that vehicle detection and classification can still be done even if some detectors fail. Every vehicle not detected equals a loss of revenue. Likewise, for MLFF systems that rely on reading toll tags in vehicles, Tecsidel ensures that all of its OBU-reading technology is dual-concept.

To prevent the loss of images when a video processor fails, all cameras related to one direction of travel are connected to one image acquisition processing (IAP) unit, and additional units are introduced as hot back-up (also known as dynamic back-up) to replace any IAP unit that's out of service. In addition, each lane features a double camera system (two front-shot and two rear-shot cameras for each lane) and double video switch to guarantee a fully redundant IAP system.

Every CP is equipped with a double fully redundant charging point controller (CPC) that serves as a stand-by module for the primary CPC, since this represents the heart of the toll collection system in terms of roadside equipment. The back-up CPC is the same kind of embedded system as the primary one and is equipped with the same peripherals.

Finally, in Tecsidel's system, the software is designed and developed to support the hot back-up and load balancing of all subsystems.

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Paving ways to traffic safety

READER ENQUIRY NO. 521

With traffic law enforcement projects generally increasing in complexity, it's paramount that cities, municipalities, metropolises, countries and even private and public institutions have strong partners upon which they can depend. After all, the success or otherwise of a road safety initiative can hinge on the variety of demands placed upon the technologies applied, applications proposed, systems available, equipment installed and services offered.

Monitoring traffic at numerous locations and recording and documenting violations in high quality and with high reliability requires a wide range of solutions. These run the gamut from front-facing speed and red light enforcement systems in mobile or stationary form to more specialized installations in tunnels or on bridges. Point-to-point measurement (average speed over a set distance) is now also a part of the enforcement mix, while there's ALPR to consider, systems for complex intersections and on multilane roads as well as invasive and non-invasive options. And behind the scenes, there are back office solutions, scalable software for incident processing as well as a complete portfolio of services to contemplate.

To maximize benefits for customers, products must not only be capable of utilizing different technologies but be executed by a reputable partner following well-established protocols. A survey of the current infrastructure, for example, will need to be carried out and specific needs evaluated. The right mix of systems and services required to meet specified traffic safety goals will also need to be ascertained. Comprehensive speed and red light monitoring

(Above) **The award-winning TraffiTower 2.0** (Right) **Jenoptik solutions can cope with harsh conditions** (Below) **Traffic at an intersection in Saudi Arabia**

systems and complete incident processing solutions will have to be delivered, too, while hardware and software will need to be installed on-site. Complete system operations and all related services such as installation, commissioning, training and maintenance will therefore need to be guaranteed. And, of course, ongoing service and support is a prerequisite.

Evaluating needs

"The trend in the Middle East market is a move away from traditional hardware supply toward fewer, larger projects and added-value, end-to-end solutions including services and expertise," reveals Ralf Schmitz, Jenoptik Traffic Solutions Division. "Clients in the region want full turnkey solutions: they want the road

Need to know?

Traffic enforcement is optimized as a result of requirements being individually tailored to a customer's needs

- Owning all its sensor technologies, Jenoptik can offer traffic enforcement technology to suit specific environments
- Scalable modules and systems for project planning, collection, analysis and data preparation for traffic enforcement ensure the problem-free execution of all processes

technology, communications and processing software, as well as an understanding of the whole process."

The environment in which systems are to be deployed can also be a challenge. "The limitations that some other enforcement systems experience in such environments are not a problem for the products in our range," states Schmitz. "If one type of technology experiences problems due to regional conditions, we can propose alternatives. When it was discovered in the mid-1980s, for instance, that hot temperatures affected the performance of piezo sensors, they were no longer deployed in the Middle East. Similarly, in regions regularly affected by fog and dust – which can limit the performance of laser scanners – we promote the deployment of radar, which isn't adversely affected by such phenomena," adds Schmitz's Jenoptik colleague, Elias El Hage, sales representative, Middle East.

There's also the actual infrastructure and extremely varying traffic situations to take into account. In some parts of the world, for instance, a four-lane road can see six lanes of vehicles lining up, hence any solution supplied must be able to observe (classify) multiple lanes of solid lines of cars and various objects simultaneously.

At intersections on the vast and modern streets in the western region of Saudi Arabia,

vehicles line up bumper to bumper across multiple lanes of traffic. Further exemplifying the challenge, at one intersection in Jeddah, the area between the traffic signals measures 105 x 50m – the size of a soccer pitch! To monitor all violations at (and after) the signals, the intersection is equipped with 28 masts, replete with cameras, radars, flashes, housings, etc.

This Jeddah intersection is just one of 100 that are monitored by around 400 red light enforcement systems in total, which are a part of Saudi Arabia's Automated Traffic Violations Administering and Monitoring (ATVAM) traffic safety project. Around 60 stationary and approximately 80 mobile speed monitoring devices are also deployed. In all, these Jenoptik MultaRadar SD580, MultaRadar CD and TraffiStar SR491 solutions feed into an integrated back office processing system, Jenoptik's TraffiDesk pro, at the ATVAM Violation Processing Center located in Jeddah.

Although the number of incidents processed via the mobile and stationary systems deployed across Jeddah, Mecca and Medina can range from low to extremely high, the back office was still required to reliably process up to 80,000 speed/red light incidents a day. This back-end part of the system includes acquisition of offense data, pre-processing, archiving, recognition of offending vehicles and retrieval of owner data through an online interface to the Al-Elm vehicle owner database. This provides the necessary data to register the culprit and start the violation process and collection of fine.

(Above and left) **With TraffiTower 2.0, air-conditioning or heating elements can be added to ensure an optimal working temperature in extreme climate zones**

The need for ATVAM overall was demonstrated by more than one million traffic offenses being recorded and processed just a short while after the project went live, despite the fact that not all the enforcement devices were operational at the time. And Saudi Arabia isn't alone in embracing such technology to improve its traffic safety record.

Modern inside and out

In 2011 Qatar's Ministry of Interior ordered 70 speed and red light enforcement systems from Jenoptik. The attractive housing, the latest generation of digital cameras and the non-invasive sensors utilized, which require no incision into the road surface, are clues as to the innovative nature of the project.

Qatari authorities decided to expand the initiative's scope further in 2013, by which time there was a choice of two non-invasive systems: one based on radar (TraffiStar S39x); the other on laser scanner technology (TraffiStar S350). Both systems can be housed in the 'designer' cabinet, TraffiTower 2.0, which combines aesthetics with high performance to meet the needs of current developments and future challenges in Qatar's ever-expanding traffic infrastructure. (The TraffiTower 2.0 received an iF product design award in early 2014.)

Optimizing customer benefits

While aesthetics increase in importance, especially in the Middle East, Jenoptik's Ralf Schmitz thinks solutions that are inherently flexible will rise in prominence in the future, hence the company's strategy of offering a laser scanner or a radar unit in a mini rack on all applications (fixed and mobile). With the capability to be removed from the TraffiTower 2.0 and easily placed in a vehicle, container or on a tripod, the mini rack is a new option that greatly expands traffic enforcement possibilities.

Aside from the enforcement system itself, a modern human-machine interface (HMI) enabling easy operation is a must. Covering the operating unit and user interface, HMIs should be designed as a highly configurable suite for the creation of individual graphical user interfaces (GUIs), while the GUI should reflect the needs and role (tasks) of users. As deployments in Qatar and Saudi Arabia show, whether in setup and configuration, bringing devices into service, software uploads, measurements, maintenance or even capturing data from measurement sites, success is more likely when these interfaces are optimized to the requirements of the task.

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RWIS goes mobile: the future of non-contact sensors

READER ENQUIRY NO. 522

Through the use of road weather information systems (RWIS), it is possible for highway authorities to accurately measure parameters such as road surface temperature, low ambient temperatures, water film height, road conditions, freezing temperatures, grip and other environmental data. Once this information is linked to intelligent software-based decision support systems, RWIS makes a proven contribution to enhancing road traffic safety. Both built-in and non-invasive sensors are employed.

Passive evolution

The first passive road sensor produced by Lufft was the IRS20, introduced in 1999. This was followed by the IRS21 in 2001, and the IRS31 in 2007. Finally, in the fall of 2013, the Fellbach, Germany-based company launched the IRS31Pro onto the global stage. All versions of the IRS series are capable of measuring surface and below-ground temperatures, detecting road conditions and salinity, and displaying water film height.

Built-in sensors are embedded in the middle of the fast lane on the highway, which means the road surface must be opened for installation. But this can be negated through the use of non-invasive sensors, such as the NIRS31-UMB, which measures all data using spectroscopy or optics and is mounted, for instance, on bridges above the road. This easy-to-install road sensor was introduced by Lufft in 2011. Both sensor types are fixed and only evaluate the conditions at the respective location. The non-invasive technology is suited to road sections with particularly high traffic levels and high accident-risk locations that are sensitive to microclimatic conditions.

(Left) **Lufft's non-invasive NIRS31-UMB road sensor** (Below) **The intelligent and active IRS31Pro-UMB road sensor**

However, one factor to bear in mind is that road conditions can change quickly and there can be substantial differences between one point on a road and another just a few miles away. For this reason, mobile, non-invasive sensors mounted onto vehicles – which measure the road conditions while driving and send all the information to the driver or to a central station – are best suited to delivering comprehensive data. Mobile systems of this kind can bring huge benefits.

Winter maintenance service departments, for instance, will be able to determine the need for salt as well as the route to be taken in real time, so will work more efficiently and economically. With the aid of mobile data, it could even be possible for public transport services such as buses and taxis to be navigated safely on the roads and to determine their exact travel times. The same could be said for trucks and private vehicles, as judging the weather conditions and calculating journey times will no longer be at the driver's discretion – it will be based on data. By using mobile weather stations, meteorological services will be able to systematically eliminate the black holes on the map and finally produce comprehensive forecasts. There are practically no limits to the potential applications of the new mobile road and climate measurement technology.

Data on the move

To meet these needs, Lufft is introducing a solution that will extract weather data directly from vehicles and transmit it via Bluetooth to an iPad, for example, that could evaluate all measurement data in real time before sending it to the cloud. This next evolution in the measurement of meteorological and road condition information – while driving, 100 times per second – will soon become a reality and will be unveiled at Intertraffic Amsterdam.

Need to know?

An expert in RWIS is set to launch a new mobile variant of its popular measuring technology

- As technology and strategy has evolved over the years, the RWIS sector is abandoning invasive, disruptive solutions in favor of easy to deploy, non-invasive tools
- Roads and public transport authorities rely heavily on weather data in their daily operations, and technology vendors are tasked with finding improved ways of delivering this data
- Vehicle-mounted units are set to be the next big trend

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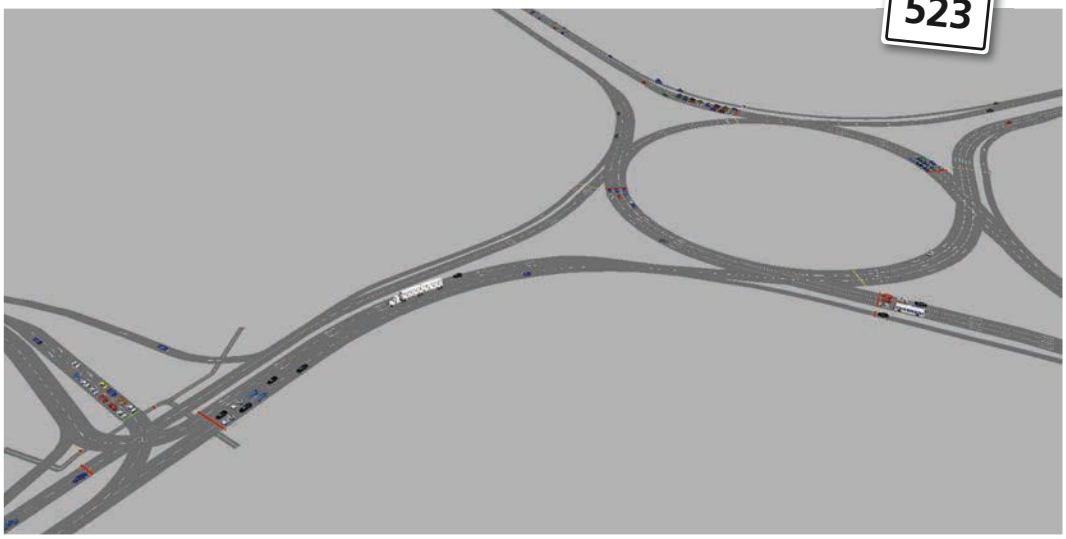
Modeling helps transform traffic flow and safety at Bunbury blackspot

READER ENQUIRY NO. 523

The traffic lights were switched on at the Eelup Roundabout in the early hours of May 21, 2012, making it the first signalized roundabout in Western Australia. What the public had previously seen only in a simulation was at last a reality. The simulation software package PTV Vissim proved to be an essential part of the planning phase.

The Eelup Roundabout is on the northern route into Bunbury and links up four highways, with 40,000 vehicles passing through every day. "Before the upgrade, this roundabout was the state's worst blackspot, meaning it had the highest accident rate of the whole state," reveals Graham Jacoby, transport modeling analyst for Main Roads Western Australia. And even though most of the accidents were minor, the total cost added up to several million Australian dollars a year. "Signalization of the roundabout was our main solution," Jacoby adds.

On top of the signalization, modeling requirements were made more complex by the need to factor in additional lanes and slip lanes for left turns. "We needed a software package that could model in sufficient detail to show vehicle interactions as well as modeling complex signal logic," Jacoby continues. It was also important for Main Roads that the software was able to realistically model heavy vehicle behavior. "In PTV Vissim, we knew we'd found a tool that met all those requirements."



Need to know?

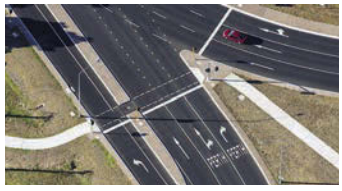
The ideal way to present planned traffic measures to decision makers and the public

- Whether comparing junction geometries or considering the effects of certain signaling, PTV Vissim enables users to simulate traffic patterns precisely
- PTV Vissim displays all road users and their interactions in one model
- Rounded off with comprehensive analysis options, creating a powerful tool for the evaluation and planning of urban and extra-urban transport infrastructure

(Above) **3D Vissim model of the Eelup Roundabout** (Left) **Delays at the roundabout have improved since the signalization project was completed** (Below) **The roundabout before** (Bottom, left) **One of the potential options being modeled**

Turning targets into results

First of all, Main Roads modeled the existing traffic situation by collecting data about aspects such as turn movements and queue lengths, as well as by taking aerial photos. This information helped the team create a base model. "Next we developed different project cases, involving signalization as well as adding an extra circulating lane and slip lanes." Additional project cases were developed to test the impact of different cycle lengths and coordination with another set of signalized intersections nearby.



Main Roads also paid special attention to traffic-heavy periods such as the Easter break. Many cars pass through the roundabout during this period with people traveling south from Perth, Western Australia's capital.

Main Roads used the Vissim module VisVAP (Visual Vehicle Actuated Programming) to program the signal logic, which provides traffic engineers with a library of commands for their flow logic and then translates these into code. During the simulation, VAP interprets the

program commands of the constructed flow logic and generates appropriate switching commands for the traffic signals. The flow logic itself is then represented as an easy-to-understand flowchart. The user can then follow the control logic step-by-step during the simulation, identifying and optimizing any discrepancies.

"The great thing about the control logic and cycle times that we modeled was that we could use them outside of the final signalization project," explains Jacoby. "The simulations were also useful for showcasing the project and demonstrating to the general public how the signalized roundabout would operate. This really helped us to win public support for the initiative."

Satisfaction all round

"The signalized roundabout has been in operation since 2012," says Jacoby. "This means we have been able to validate the model's results against the real-life outcomes. And as the model predicted, queue lengths and delays have improved dramatically. Queues that used to stretch back for kilometers every morning are now a thing of the past."

Significantly, the number of accidents has also been reduced. Where there were around 150 accidents a year before the upgrade, there are now less than 50. "The resulting crash cost savings are around A$2m a year," concludes Jacoby.

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At the venerable Transportation Research Board's 93rd Annual Meeting – held each January in Washington DC – I was offered the dubious honor of debating as a proponent of the declaration, 'Full automation under all road and weather conditions will emerge in the next six to eight years'. The definition dictates no driver intervention – completely reliable 'home James' chauffeur-driven trips. Under this definition, your car may fetch a pizza at the flick of a switch. Preposterous! Yet for nearly half an hour, I suspended belief and argued…

To begin, the prescribed definition of full automation is liberating. The most difficult aspect of vehicle automation or any active safety intervention is transition of control from a smart and very aware car to a possibly smart and potentially very unaware driver. Full automation circumvents this difficult-to-solve problem as the very definition disallows transition of control. In the event of a fault, the car could simply stop. In my mind, when I played this trump card, the audience cheered!

Then I offered other arguments – first of all on the theory that disruption causes, well, disruption. Eight years ago, we never knew we needed a new smartphone every two years. Nowadays we demand exactly that.

My next argument was based on the theory that the underpinning technology is nearly upon us: evidence comes from the very recent Consumer Electronics Show's manifold displays of self-driving vehicles and the unveiling of compact computational platforms (Nvidia's zFAS), plus the marriage of OEMs and others with Google's Android (in the form of the Open Software Alliance). To add, there is impending regulation on pedestrian crash avoidance and with that ever-maturing and eminently reliable pedestrian-detection technologies will be upon us soon enough.

My biggest bugaboo was my opponent's argument. "How could any automated vehicle even come close to matching the relatively safe driving record of humans?" If we measure driving failure by fatality rate, in the USA there is roughly one failure for every 100 million miles driven. A vehicle-machine, bound by programming rules and a confounding large number of detection, recognition and processing possibilities would presumably fail at a substantially higher rate than that.

Wait, I say! Consider where and how human driving errors occur. According to the NHTSA, the predominant crash fatality problem is single-vehicle road departures. In the rural USA, 'run off the road' accounts for 80% of fatalities; in urban areas 56% of fatalities are the result of this type of crash. Automated vehicle technologies within our collective grasp offer an elegant solution. A self-driven car doesn't get drunk (as alcohol is a co-factor in approximately 30% of all fatal crashes). It doesn't speed (oh, that's another 30% co-factor). And it won't look at its smartphone (where distraction may cause up to 20% of all crash fatalities).

I layer other arguments. Chief among those is that consumer demand is palpable, and it will increasingly grow due to the advent of relatively wealthy, tech-savvy baby boomers who will age in their current suburban comfort, replete with drives to the grocery store and – of course – to the doctor's surgery.

There were no winners or losers in this TRB debate, just thought-provoking discourse. But I did raise eyebrows (in a good way). And I hope I raised yours.

> The most difficult aspect of vehicle automation or any active safety intervention is transition of control from a smart and very aware car to a possibly smart and potentially very unaware driver
>
> **Jim Misener, transportation and technology consultant, USA**

The latest in EVP technology

READER ENQUIRY NO. **524**

Emergency Vehicle Priority (EVP) technology is an intuitive, dynamic ITS solution that enables traffic signals to turn green in a safe and controlled environment ahead of the emergency vehicle's arrival.

The technology improves safety for both frontline officers and the general public, reducing the number of times an emergency response vehicle needs to cross intersections against a red traffic light. This reduces the number of unpredictable reactions by drivers who attempt to move out of the way of emergency response vehicles while in a queue at a red traffic light.

The solution leverages existing technology to deliver an intelligent solution without adding complexity to the workload of frontline officers. The result is faster travel times and a safer work environment with minimal detrimental impact to other road users.

Emergency vehicles can attend incidents safely and quickly with EVP

Leading ITS solutions provider Transmax played a key role in the Australian development of this technology and was proud to accept both a state and national iAward for the innovation with Queensland Government project partners at the 2013 AIIA iAwards. The iAwards are Australia's leading technology awards program recognizing the most innovative companies and leading individuals.

Transmax CEO Jason Wagstaff says: "This award win is a wonderful achievement and we are proud of the collaborative approach that was taken to develop this new technology that is helping save lives, and we are hoping to extend the success of EVP so that other states in Australia can benefit from this innovation."

He added: "Transmax worked collaboratively with its government project partners to develop this technology in Australia that reduces travel times for emergency services vehicles and improves safety for both frontline officers and other road users."

A trial of the EVP solution in Queensland, Australia has been very positive, with results showing improvements in travel time of between 10-18% along major routes. EVP is the first system in Australia implementing an ITS solution that automatically manages traffic signals and intersections before and after an emergency response vehicle passes.

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Advanced solutions for traffic enforcement

READER ENQUIRY NO. **525**

When it comes to traffic enforcement technology, it pays to take some expert advice before buying and installing any equipment.

One such expert is the Swedish enforcement specialist, Sensys Traffic. All of the company's systems are based on its multi-tracking radar technology, developed for the most demanding enforcement applications.

Sensys has delivered thousands of systems to approximately 30 countries and is a leader within the Nordic traffic enforcement market. "We are very proud to have been selected by the Swedish Transport Administration for the replacement and expansion of Sweden's successful enforcement system program," says Magnus Ferlander, business development director.

"In fact that is just the beginning. Our new system platform for red light and speed enforcement allows for major customer-specific adaptation in terms of the size, shape and color of the system cabinet," adds Ferlander.

(Above) **Sensys's safety cameras** (Left) **Crystal clear images are needed for enforcement**

The customer is at the forefront of Sensys's development work. Ferlander explains: "This means that we offer our customer whatever is necessary to fulfil his specific requirements. For instance, if 'top class image capability' is vital for the customer and his project, then our recommendation is likely to be based on our 36MPix camera and the HD video. Add to that the flexibility we offer to tailor the enclosure for the customer's specific needs."

Ferlander predicts that the coming years will be especially busy for his company. "In cooperation with our customers I expect that we will see a number of both innovative and good-looking systems being rolled out in the near future." Ferlander says that providing customers with total freedom of choice is the top priority. "That is why we are announcing tailored design solutions. Customers can select Standard units that provide a robust and cost-effective solution, while the Modified Standard range provides options in size, color or mounting. However, with the Custom Design option, we will work with our customers through the process of designing their own solution, optimizing both the looks and functionality to fully meet expectations."

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How can DOTs and road authorities work with technology providers to advance intelligent transportation systems in a mobile world?

Answer the Burning Question via our LinkedIn group page at www.traffictechnologytoday.com

"I think this is already being done but not to the extent that it should be. We seem to have forgotten the reason we founded ITS America and its State Chapters. It was to provide a better union for the development and roll-out of ITS in the USA and collaborate on testing and results across all the states. It seems that states don't include either ITS America or their State Chapters... or the State Chapters don't collaborate sufficiently with ITS America. As a result, the sharing of ideas and results does not occur as a normal course of action but by exception – or only when federal grant monies require those reports. It seems to me that we need to go back to the basics and get state DOTs working more closely with their State ITS Chapters so that they are included in the testing and roll-out of ITS in the state. Furthermore, the State ITS Chapters should be coordinating more closely with ITS America to log what testing is planned or budgeted and what the results of that testing were. We are living in a time period of slashed budgets and scarce resources. Sharing and collaboration is more important today than it ever was in the past. Some may think that budgeting for their state ITS involvement in planning or undertaking testing of ITS is wasted money, but it isn't. It is necessary to share and collaborate among ourselves if we are ever going to roll-out ITS technology across the expanse that is the USA."

Jack Opiola
managing partner and president, D'Artagnan Consulting, USA

"The key to the success of ITS in a mobile world is interoperability. Without interoperability, we are down to local (state) systems that stop working outside the local environment. Which is similar to how smartphone apps are limited to one airport or one public transit operator. As interoperability requires standards, open interfaces and agreements between operators, the first step is for state DOTs to work together with the USDOT and the standards community. This means that the 'advancing ITS' should be based on open standards and national operational principles brought into large-scale tests involving technology providers. I would caution against deploying any brilliant ideas coming from local technology providers unless they are fully committed into the interoperability and standardization path."

Knut Evensen
chief technologist, Q-Free, Norway

"This is already happening today. ITS America provides for industry forums and conferences that link technology providers, state DOTs and end users – all focused on moving ITS into the next century, which by definition includes the mobile world. Meanwhile, the USDOT Research and Innovative Technology Administration (RITA) is driving the Connected Vehicle program, which includes V2V and V2I mobility applications that are focused on the creation of a data-rich mobile travel environment. Kapsch TrafficCom is an active participant in both of these organizations, delivering not just the onboard units and reader components but also pioneering the use of these components in real-world applications such as commercial vehicle screening and truck parking availability. Both of these applications were delivered utilizing 5.9GHz technology. We have worked – and will continue to work – with the federal DOT, state DOTs and industry organizations to provide compelling solutions to advance ITS in a mobile world."

Erwin Toplak
chief operating officer, Kapsch TrafficCom, Austria

"The power of mobile devices is not in the device itself but the software apps. Further, the communications capabilities of the average car are increasing with each new model release. It is this 'smarter vehicle' that the DOTs must connect with. DOTs should be considering how these smarter vehicles could be used to transmit and receive data and further the agenda of providing safer and more efficient highway transportation. The average vehicle has a great deal of information on board its computers that can be used in a myriad of applications."

Harold Worrall
founder/president, Transportation Innovations Inc, USA

"In order for ITS to expand in consumer technology markets, there has to be a financial incentive for the provider such as a service fee or broad market to invest in, and an attractive business proposition for the driving public – something attractive to buy. This will take education and imagination to show the mutual advantage in varied markets. We are starting to see some of this with large corporations now investing in tolling and ITS, but at this point few have a broad image of the potential global market."

J J Eden
director of tolling, AECOM, USA

Readers are invited to answer the Burning Question for the April/May 2014 issue:

Do you foresee a shift away from roadside message technologies to smartphones in the years ahead – and are there ways to minimize distraction?

email answers to: louise.smyth@ukipme.com

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