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Jack Opiola,
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Bern Grush

August/September 2010

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on ITS all mapped out

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Intelligent Transportation Systems

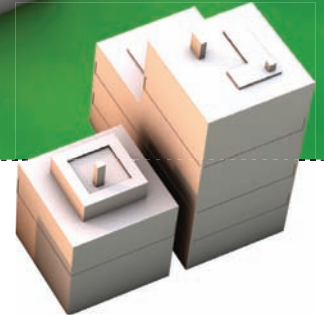


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Foreword



Of all the wonderful things to do in Beijing, sitting in a traffic jam under a thick carpet of smog (which I recall Chinese state media referring to as 'overcast and hazy skies') wouldn't feature too highly. I refer, of course, to the record-breaking traffic jam, which at the time of writing has entered its eleventh day and at one point was over 100km long, extending between Jining in Inner Mongolia and Huai'an in Hebei province, north west of the Chinese capital.

The big trouble in China kicked off with roadworks on the Beijing-Tibet Highway, the congestion from which was exacerbated the following week when a road circling Beijing was closed. You certainly wouldn't want to be in Zhang Minghai's shoes, director of Zhangjiakou city's Traffic Management Bureau. But being stuck in that jam for (according to some reports) four days is no walk in the park either – one truck driver transporting coal didn't even move for five hours! On the flipside, though, the bumper-to-bumper jams provided a number of entrepreneurs with the opportunity to make a quick yen, meandering their way in-between the standstill traffic to hawk their noodles and soft drinks.

Certainly the story has been a source of amusement for much of the world's media, a welcome departure from troubles elsewhere, but you don't have to scratch far beneath the surface to unearth some worrying aspects.

Although the 'monster jam' (as it's been dubbed) was initiated by roadworks, China's roads are chronically overcongested and only heading in one direction, at least until the country's massive road building program can catch up with its gargantuan auto sales, which last year surpassed the USA with 13.6 million vehicles sold. China's roads also suffer an unrelenting pounding from hundreds of thousands of (sometimes illegally) overloaded trucks – especially those on the coal routes from Mongolia to the ports south of Beijing.

Our article on developments in the weigh-in-motion sector (*page 24*) is nothing more than a welcome coincidence, although as Eugene O'Brien, president of the International Society for Weigh-In-Motion, puts it, the enforcement of overloaded trucks in particular could provide a big growth area for WIM suppliers in the future.

It's self-defeating for authorities in China to be spending billions on new infrastructure if it's going to be ripped up in a matter of years by a bombardment of dangerously heavy trucks. But there's a further serious undertone to the intensity of this mobilization. Poorly trained drivers on badly maintained roads equals? You don't have to be a professor to figure that one out...

Anyway, as 10 weeks of gasworks begins right outside my house, causing localized chaos in the process, I will spare a thought for those in China. Fingers crossed, they'll be free from the gridlock by the time our next issue is published...

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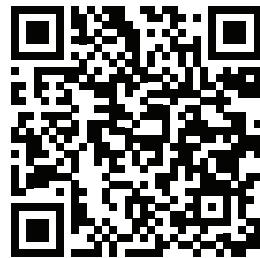
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Gone in a flash?

The media has been awash with stories of the death of speed enforcement resulting from the UK government's budgetary cutbacks. **Nick Bradley** asks if it's time for the private sector to step in to save lives, save local authorities money and save an entire industry

Illustration courtesy of Magictorch

Detractors claim they're the hallmark of what's become an Orwellian state – Big Brother's beady, all-seeing, all-knowing eye on the traffic – while industry experts maintain they're an invaluable tool to save lives and reduce injury. Either way, a familiar sight on UK roads appears to have had its day. With £38 million (US\$59 million) of a total budget of £98 million (US\$153 million) being slashed from Local Authority budgets for road safety programs – and the new Conservative-Liberal Democrat coalition leadership fulfilling a pre-election Conservative pledge to cease funding for fixed-site cameras – the anti-enforcement brigade can claim a victory. Safety camera programs up and down the country are being shelved, cancelled and in some cases the Safety Camera Partnerships are closing altogether.

The Great British switch-off

Oxfordshire was the first this year to join the great switch-off, shutting down 72 of its fixed-site cameras as well as 89 mobile units. Interestingly in this instance, what drivers in the county didn't realize was that some cameras were left active as an 'experiment', and over a period of five days recorded an 88% increase in the number of people speeding, causing much angst in the corridors of the county's Safety Camera Partnership. (No prosecutions will be brought against these errant drivers however.)

Road safety experts are adamant it's only a matter of time before violations such as these turn into fatalities, and with them a reversal of years of steady progress as far as reducing KSIs is concerned. So as the vocal minority raise their champagne glasses, how long will it be before we're counting the cost of these cutbacks in terms of more road deaths? Perhaps the champagne should be kept on ice, as ironically the cessation of government funding could lead to the privatization of safety cameras, with equipment suppliers adopting business models from other countries – funding, deploying, operating and maintaining systems on an outsourced basis?

"We believe the problem of expenditure in this area has not been thought through too clearly," suggests John Harris, Redflex Europe's business development director. "If they don't make the right decisions now, in the longer term it will cost them dearly." Harris has been in the industry long enough to not get his hopes up when it comes to the 'right' decisions being made at such levels, citing as he does the UK's ageing safety camera infrastructure that is perhaps just a few years from obsolescence, as well as a draconian approvals process that prevents new, potentially more cost-effective and efficient life-saving technology from making it out onto the streets. If Safety Camera Partnerships today cannot pay for themselves, some of the blame can certainly be directed

What cost is a life?



You would be hard-pushed to find a positive news story about safety cameras in the mainstream press, but if you're inclined to search on the internet, it won't take you long to discover a surprising level of support for their usage among the general public. Angry residents of Wiltshire, UK, for instance, staged a protest in August at the county council's decision to switch off the cameras in 2009. In its defense, Swindon Council has said that shutting down the cameras has had no detrimental effect on traffic safety in the area – fatalities have remained static. However, road safety charity, Brake, says that statement has no scientific basis. In a release, it said that no academic evaluation has been carried out. Swindon has only collected six months' worth of casualty records from its four fixed camera sites. Six months is too short a period to draw any meaningful conclusions. Contrast this with a four-year national evaluation of speed camera effectiveness published in 2005 by University College London, which found a 70% reduction in speed at fixed sites, a fall of 6% in average speeds and a 42% reduction in KSIs. It also reported a cost to benefit ratio of 2.7:1.

Recent
research showed that 63% of Greater Manchester's motorists think fewer collisions will occur on roads with safety cameras

“This is where the private sector should step in and say, ‘Okay, we’ll be the bank; we’ll provide a new technology and let the revenue stream pay for itself’

Jim Tuton, American Traffic Solutions, USA

toward the use of outdated technology. “Around 70% of the cameras are between five and 10 years old, while 57% of the red light cameras are in excess of 10 years old!” he says. “Over the next three to five years, wet-film technology will be completely redundant, making 90% of all the safety cameras in the country totally inoperable.”

“Wet-film has been obsolete for years!” responds Jim Tuton from the Arizona-based American Traffic Solutions. “The reason we got out of the intersection safety business in the late 1990s was because we wanted to wait for the advent of real digital technology, until it was workable, which didn’t really occur until 2003.” That authorities are still using wet-film in this day and age is, in his eyes, ridiculous. “First of all, film’s getting harder and harder to get hold of and soon enough you won’t be able to source it at all,” he reveals. “Film adds cost and complexity that digital technology eliminates. Film has to be procured, managed, stored and processed. You have to go out to the cameras to supply the film, pull the exposed film, bring it back again, put it into a developing machine somewhere, process, fetch, review and digitize it – you’re adding such a huge amount to the cost, maybe as much as US\$10 or US\$20 per citation that otherwise would go directly from the camera to the back-office workflow.” Switching to digital, this pioneer in the enforcement scene feels, is entirely self-sustaining. “Whoever thinks they don’t have enough money to upgrade the technology hasn’t done their homework properly!”

Resulting from a period of “hypergrowth” at ATS (see page 32), Tuton admits to not following UK events that closely, although he is certain that the Safety Camera Partnerships would be more viable had they moved with the times in

terms of technology. “This is where the private sector should step in and say, ‘Okay, we’ll be the bank; we’ll provide a new technology and let the revenue stream pay for itself.’”

Private investigations

To privatize the safety camera business in the UK, though, would potentially lead to more outrage among the ‘vocal minority’ than if operated by the Safety Camera Partnerships. That said, one of the country’s top policemen thinks it might be the only way to maintain a decline in KSIs. Gwent Chief Constable Mick Giannasi, also head of roads policing at the Association of Chief Police Officers (ACPO), has recently recommended that the issuing of tickets and the collection of fines be privatized to remove the burden from the police forces and magistrates’ courts that currently administer the penalty system. Mirroring Tuton’s belief, such a strategy would also be an ideal way to bring in more sophisticated and cost-efficient solutions. “I’m working with the government to persuade them that action needs to be taken to protect the system for the future of our road safety,” Giannasi told BBC Radio recently. In a separate article with *The Times*, he further stated that “if nothing is put in place, speeds will rise and casualties will grow”. The UK’s top traffic cop also suggested the future of speed enforcement is most likely point-to-point, whereby a citation is issued if you get from A to B faster than X.

This is music to the ears of Geoff Collins from Speed Check Services (SCS), which already has both feet firmly in the UK average speed enforcement market, with its SPECS3 system seemingly as commonplace in workzones as traffic cones. “There’s definitely a huge backlash against cameras at the moment,” he agrees. “And it’s come at a time when there’s not much money around, so it’s an obvious thing to cut. But I do

In 2009,
across all road users
speed-related factors
were cited in relation
to 586 road deaths –
accounting for 25%
of all fatalities on
UK roads



Beating the backlash

If the enforcement sector in the UK is to have a future, one thing it will need to improve is its PR. Surveys both in the UK and the USA consistently show the majority of people, when asked, are in favor of safety cameras. “But the intensity of the vocal minority is extremely loud,” admits ATS’s Jim Tuton. There is a general belief that everybody hates enforcement, when in fact the opposite is true. “If you’re going to shift the model to private assistance, you have to precede that with a public awareness campaign, outlining the problem and how safety cameras can help,” he says. “You have to stress how this life-saving technology shifts the burden from the taxpayer to the violator, yet the benefits are felt by all. A big risk in our

industry and also for the movement of using cameras to improve public or road safety is communication, and we’ve got to get better at it!”

“Some media outlets are just on a mission to discredit safety cameras in whichever way they can, but the majority of people know there isn’t a profit taken out of safety cameras by Safety Camera Partnerships,” agrees John Harris from Redflex Europe. “Partnerships have been encouraged to monitor public attitudes toward safety cameras,” he says. “Support has been consistently high with 70% of people questioned agreeing that ‘the use of cameras should be supported as a method of reducing casualties’. Public attitude surveys also showed overall positive support for the use of

cameras, stemming from the fact that cameras were in place to save lives, with 68% agreeing that this should be the primary motivation.” Overall, support as reflected by averaged figures in six national surveys was 74%.

“It’s the squeaky wheel,” Tuton observes. “I’ve been doing this for 20 years and it always amazes me how the vocal minority can shape public policy. You can have a city of 400,000 people yet 10-15 show up at a council meeting, shake their fists, and councils shift. We’ve got to be very careful that critical life-saving technology isn’t worked out of the system because the vocal minority hijacks it. We’re probably two of three years away from being over the hump and these guys move onto something else.”



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Balancing act

 Recent reports suggested that the Scottish Safety Camera Partnership was losing more than £3 million (US\$4.6 million) a year, which was expected to rise as the amount of fines generated declined. According to the *Herald Scotland*, the running costs of the program, around £6.5 million (US\$9.9 million), surpassed the £3.33 million (US\$5 million) collected in fines. Unsurprisingly the revelation was reported in such a way that it represented an added burden for the taxpayer, which they could do without in such an economic climate. "It was quite strange reading that article, because they used to say that cameras are making too much money for the government and now the criticism is that they're losing money," comments Geoff Collins from Speed Check Services. "I think this is actually a good news story as it means that the cameras aren't actually covering their costs because they're working. The net saving to the economy is significantly greater than that £3.5 million, which is around 1.5 fatalities." Playing devil's advocate, though, Collins also suggests another theory: "Reduced fines doesn't necessarily mean fewer speeding drivers; it might also mean they're detecting fewer because they don't have the resources to do it properly."

Average
speeds at speed camera sites operated by Safety Camera Partnerships in the UK have fallen by 10%, while KSIs have fallen by 35%



Despite the high-profile stories relating to the switching off of speed cameras, many (less reported) counties have come out in support of their continued usage

feel that spot-speed has had its day. And I definitely think a new business model is needed, which is something we realized a long time ago. The cameras that have been used in the UK in the past are quite one-dimensional; a blunt tool to address a problem at a location without necessarily thinking about other interacting factors and things that happen up and downstream." Collins often uses roadworks as an example, at which SCS's average speed systems were initially installed purely to mitigate the risk of casualties and collisions, but soon started being used as traffic management tools – to smooth traffic flow, increase mobility, and consequently reduce emissions.

Although most of the major suppliers in the industry have a point-to-point system available, Home Office Type Approval is required before it can be used for enforcement purposes in the UK. "But the process of bringing new safety camera businesses into the UK market is very difficult," adds Redflex's John Harris. "It can take six years for equipment to receive the necessary Type Approval, by which time technology could have moved on so much that what you're trying to get approved is out of date. Something is desperately wrong, but I do know that ACPO is looking at ways in which new industry can be encouraged to come into the marketplace in order to improve the technology deployed." Currently, only SCS's SPECS3 system and the RedFusion system from RedSpeed have this 'seal of approval', although other suppliers are expecting to be able to support the market with their own variants soon. "We actually have the world's longest point-to-point system operating between Melbourne and Sydney," Harris reveals. "But where other systems can only operate as point-to-point, or multipoint-to-multipoint, ours works as a spot-speed system as well." As an outsourcing operation, this means that Harris's colleagues in Australia can process three times as many violations." Overall, there is much evidence to suggest more acceptance of average speed systems, seen by many to be a fairer, more transparent way of governing speed. So, in actual fact, far from being the death of speed enforcement in the UK, both Harris and

Tuton suspect that recent events could present opportunities for organizations that outsource. "My view is that you will see additional funding going into section-controlled systems and additional funding for portable equipment, with mobile vans moving around to keep drivers on their mettle," Harris predicts.

And while Tuton states that he has plans to move into Europe at some point in the future, it won't be any time soon. "We're so focused on what we're doing at the moment," he says. "At the end of 2008, we had around 800 cameras and maybe 400 staff; today we have over 2,200 cameras in operation, another 800 being implemented or installed, and almost 900 employees – and we're expecting to double again next year." But that's not to say he hasn't got advice about how the UK can maintain casualty reductions with safety cameras at no cost to Local Authorities and central government. "You have to understand the problem and how to solve it," he says. "We would be able to leverage the technology more effectively and efficiently than the public sector, but you have to be able to demonstrate that. The business model has to make sense. If the public sector wants to deliver it more effectively, we can teach them how to do it and give them the tools. If we can do it more efficiently and at a lower cost, there are hybrid solutions that make sense. As the private sector, first and foremost you have to deliver safety results; you can't focus on pure revenue. Equally, though, there has to be a cost benefit and a value proposition that meets the needs of the people, the public sector, the agencies, and us."

The last word

Who knows, maybe the dawn of intelligent vehicle technologies will ultimately end the debate. "I don't think so," concludes Geoff Collins, with the last say on the subject. "British people have such a love affair with their cars and their own personal space, they're simply not going to accept something that's controlled externally, and I don't think people will accept individual tracking systems everywhere either. There will always be a place for roadside monitoring equipment. But I also hope the 'boys in blue' will still be out there as well. It shouldn't all be automated!" ○



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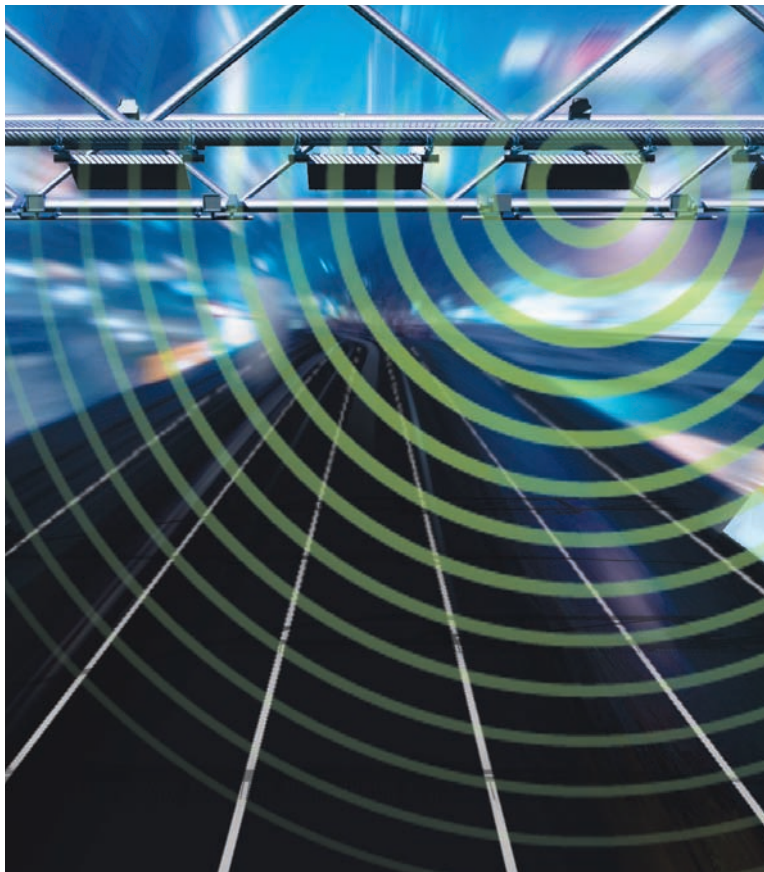
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Currently, there are 25 agencies spread across 14 states making up the E-ZPass IAG

A new law in town?

Jack Opiola assesses what impact the new 18000-6C generation toll tags could have on the ETC sector. Seemingly ticking many boxes, their presence in the technology mix is sure to ruffle some feathers

In his famous prediction, Dr Gordon Moore, co-founder of Intel, proposed a rule that has guided the microprocessor industry for the past 40 years – that every two years, processor size will shrink in size by half, double in capacity, and drop in power demand. Although many have questioned if the microprocessor industry can continue on this challenging, innovative route, the rule has held true – so much so, the size of the etched lines in silicon has reduced from the size of a human hair to just thousandths of a diameter of a human hair. Maybe the only limit, Moore suggests, will be when we are miniaturized to the level of atomic particles.

These innovations have not been lost on the electronic tolling market, as the size of toll transponders has correspondingly shrunk. The original shoebox-sized prototypes gave way to paperback novel-sized transponders, subsequently replaced with a playing card-sized housing, and most recently with matchbox-sized plastic cases that fit neatly in the crevices between your rearview mirror and the windscreen of your equally shrinking car.

Over the past several years, we have also seen the rise of ‘sticker tags’ in the market, where the electronics from the hard-case tags appear to be placed in shrink wrap, plastic floppy sheaths, bumps and all. These sticker tags, while not winning any aesthetic awards, did offer a price-saving over their hard-case cousins. At the range of US\$10 per sticker tag over the US\$20 per hard-case tag, many toll authorities in the USA saw value in operational savings due to the capital cost budgets that are necessary to stock, distribute and replace tags in their client’s inventory.

The focus of these agencies on capital costs often overwhelmed consideration of the increases in operating costs brought about by lower read rates and increasing video transactions to compensate. In addition to additional operating costs, some agencies saw an increase in replacement tags by a threefold factor over the more fragile sticker tags. This results from the fact that due to the more flexible form factor of the sticker tags, when they are removed from the client’s windshield, the antenna connections to the processing chips breaks. Hence, account changes, closures, vehicle change of ownership, or any movement of the tags from one mounting to another renders the tag inoperable and requiring replacement.

The economics of the above situation may not be lost on the suppliers. Statistical research suggests that such tag-changing events occur between 2.4 and 2.8 times in the estimated eight-year lifecycle of a transponder’s life.^[1] Therefore, a US\$10 tag may translate into a US\$30 investment, while a US\$20 hard case tag might ultimately appear to be a bargain to a cost-conscious toll agency.

Generation next

But the application of Moore’s Law has progressed to a new generation of sticker tags. The RFID industry has produced a new 18000-6C generation of tags, which includes technical improvements over the older generation of 18000-6B tags (the technology used for the above referenced sticker tags). The newer ‘C’ tags appear to provide greater sensitivity, longer read

Moore to come in the future?



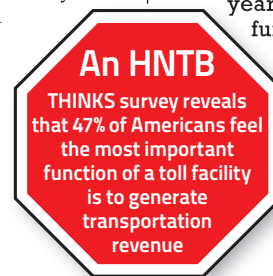
When Intel introduced its 4004 microprocessor in 1971, it featured just 2,300 transistors. Fast-forward some 40 years and the computing giant’s next-generation Itanium processor (codenamed Tukwila) has two billion transistors. Moore himself has stated that he doesn’t see such exponential progress continuing over the next four decades, however. In April 2005, in an article entitled, ‘Moore’s Law is dead, says Gordon Moore’ he told



Image courtesy of Intel


Dr Gordon Moore, Intel’s founder, in 1971

Techworld, “In terms of size [of transistors] you can see that we’re approaching the size of atoms, which is a fundamental barrier, but it’ll be two or three generations before we get that far – but that’s as far out as we’ve ever been able to see. We have another 10 to 20 years before we reach a fundamental limit. By then they’ll be able to make bigger chips and have transistor budgets in the billions.”



An HNTB
THINKS survey reveals that 47% of Americans feel the most important function of a toll facility is to generate transportation revenue

The price is right

 The benefits of Moore's Law are not limited to making better microprocessors for home computers. In fact, it has helped make our modern, connected, data-rich world a reality. This has been brought about not just by the ubiquitous nature of microprocessors in our cell phones, iPods, digital cameras, making our mobile lifestyles technically possible, but much more by the fact that they are now affordable. All of the options provide different price and performance to meet a wide range of choices and support a greater choice for toll agencies and users alike. These service offerings better match our personal lifestyles and support our mobility. Now, Moore's law is making the tolling and road user pricing market a reality for wider interoperability, EVR and greater application of the user-pays principle in our daily lives.

In 2012,
India's Ministry of Road Transport and Highways will switch to 18000-6C standards to ensure seamless travel, as well as plug ETC leakages

“ The new range of technology options driven by Moore's Law allows a richer choice of technologies for interoperable applications

range and higher security (32-bit) over the older 'B' tags, some of which were not open standard but proprietary. The greatest attraction, however, may be the price. Judging from a recent procurement in the state of Georgia – and cross-referenced with research in Brazil and Mexico – the newer 'C' tags have a price point in the range of approximately US\$2 to US\$3 per tag. This new price point has not been lost on the industry.

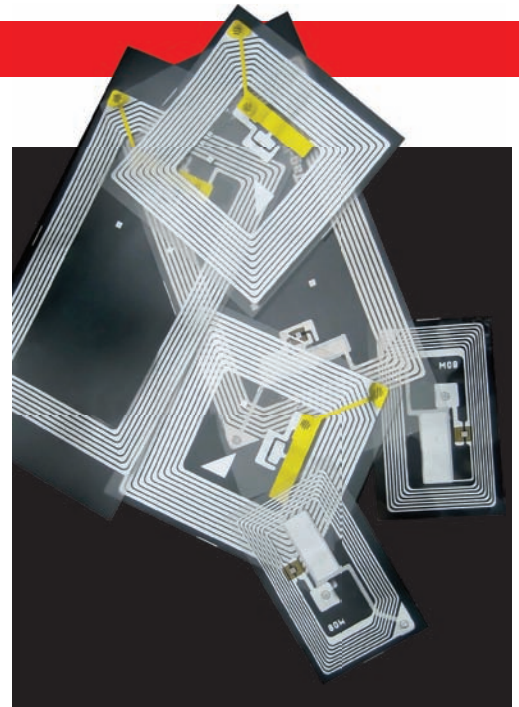
Many of the new RFID applications appear to be shifting to the use of the newer 'C' tags. Ford Motor Company, for example, has implemented an ITS application for its new F-150 pick-up truck, for which Ford offers an electronic 'inventory' feature. Truck owners can tag their cargo with 'C' tags and have the readers embedded in and around the bed of the truck automatically poll and read the tagged items to automatically produce an inventory of critical items. To a painter, plumber, carpenter or survey engineer – who has a large investment in tools and equipment – this feature has great added value in time (spent searching for tools) and capital replacement cost-savings (by preventing forgotten assets).

In countries such as Brazil and Portugal, the advent of such RFID technology may usher in a new generation of semi-automatic vehicle registration, inspection and insurance-checking. The concept of electronic vehicle registration (EVR) is taking hold. Issuance of an inexpensive 'C' tag over a more costly 'B' or hard-case transponder provides Motor Vehicle Registration Authorities a simple and affordable means to check, verify and automatically scan key road junctions and intersections for unregistered or uninsured vehicles. When combined with an ALPR system, enforcement and evidentiary trails can be established to ensure greater compliance, safety and protection of assets.

A value proposition?

The tolling industry may also see a further impact from the application of Moore's Law. The 'C' tag transforms the lifecycle economics stated above, as a 'C' tag – even at a high US\$3 per tag price – could operationally be used for tolling, HOT lanes, EVR and possibly regional or national tolling. As an open standard, the 'C' tag could provide inexpensive interoperability to tag all registered vehicles. The Motor Vehicle Registration departments or the police to enforce and uphold vehicle registration, inspection and insurance laws of the state or region may best undertake such a program. Clearly, such a movement may cause alarm from individuals and groups concerned with the privacy protection and anonymity rights of individuals, but that legal argument notwithstanding, the technology is moving in the right direction.

Likewise, tolling agencies may see value in the new technology. Using the factors above,



RFID technology has gone through a boom in recent years, with many industries using it in one way or another

even a US\$3 tag over its eight-year life may actually be worth US\$9 in its true life costs. A US\$2 tag would suggest a lifecycle comparative of approximately US\$6. Compared with a 'B' sticker tag, lifecycle cost of approximately US\$30 or a hard-case tag of US\$20, the arguments for capital and lifecycle cost-savings are obvious.

The choices for technology available to agencies for implementing electronic road user pricing have increased. Previously, paper-based solutions, video or ALPR, DSRC, and GPS or GNSS-based solutions have been available. To this mix we can now add RFID. A passive, read-only 'C' tag may provide yet another viable candidate for certain applications that are price-sensitive or capital cost constrained. The wider list of choices may also allow more customization of market segments where sophisticated, high-end users may opt for the GNSS- or GPS-based solution for navigation and distance-based charging, while a user who only travels on a single facility opts for the low-cost 'C' tag. In the middle are the older interoperable 5.8 CEN278A1 hard-case tags or the newer 802.11p WAVE 5.9GHz transponders with proper bandwidth, range, security and distance to dramatically change the service offering. What's certain is the new range of technology options driven by Moore's Law allows a richer choice of technologies for interoperable applications. ○

References

^[1] Author data compiled from research on automobile, insurance, real-estate and Motor Vehicle Registry data on changeover events

Jack Opiola is the senior partner of D'Artagnan Consulting LLC, which specializes in transportation policy, planning, ITS and road user charging. For more information, please email jackopiola@me.com

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always one step ahead

Up and running

With its first anniversary fast approaching, the Slovakian GNSS-based truck-tolling scheme is seemingly going from strength to strength, with revenues increasing and the technology running like clockwork

Images courtesy of SkyToll

“ In the first six months of its operation, the system yielded more than €63 million for the state

Of the total number of trucks registered, just 16% are from Slovakia. The highest proportion are from neighboring Poland

Under a contract signed on January 13, 2009 with the Slovak national highway company, Národná diaľničná spoločnosť (NDS), toll road operator SkyToll was tasked with designing, developing and operating what was to be known as the ‘Complex Service of Electronic Toll Collection in the Slovak Republic’. The new toll collection system was launched into operation on January 1, 2010, after construction of the whole system was completed within a very impressive 11 months. The timescales involved did present a difficult challenge for SkyToll and its partners that supplied the requisite technology, but was nevertheless a challenge that was successfully met. Without doubt, Slovakia’s system is one of the technology trailblazers.

First-class service

In addition to the motorways and expressways, the SkyToll system covers nearly 1,800km of first-class roads (no other European country currently levies tolls on its first-class roads to such an extent). A highly advanced GPS/GSM-based satellite technology for toll collection helps deliver total flexibility, allowing the operator to accommodate any increases in the volume of road freight transport as well as expansion of the toll road network in the years to come. With this technological setup, SkyToll is readily and easily

able to include new sections in the existing toll road network at will in response to the requirements of the government authorities as and when necessary. Flexibility is one of the huge benefits of a GNSS-based ETC system. With no additional investment and in very short timeframes, adjustments can be made to where tolls are charged on individual sections. In other countries where microwave technology is used, similar alterations would be more difficult, and such modifications would be costly in terms of both time and money. With microwave systems, positions of new toll gates must be defined, construction permits and authorizations to lay power cables obtained, toll gates built, and data in the central information system updated. In short, each new toll section requires a new gate.

All in all, it seems a job well done. Operating in full compliance with the terms and conditions of the tender documentation and the contract concluded with NDS, revenues seem to be very positive, despite VMW being down globally. In the first six months of its operation, it has yielded more than €63 million for the state. In 2009, when the toll was collected from vehicles over 3.5 tonnes through highway stickers, the total toll collected amounted to €50.6 million. To this date, the state has earned €13 million more than in the whole of 2009. Not just that, more than 182,000 carriers had registered for the system as of June 30, 2010, 65% of which were foreign vehicles. ○



(Above) Toll data is continuously collected through the OBU using GNSS (Left) Around 65% of users are foreign trucks

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Sticking points



While a US Federal Surface Transportation Reauthorization is likely still a year away, several facts loom large.

Firstly, as of February 2009 – simply due to inflation – the federal gas tax had lost 33% of its purchasing power since it was last increased in 1993.

In addition, auto executives and political leaders are actively promoting progress in vehicle electrification. Nissan and General Motors are in the process of releasing production-model EVs. Fuel tax receipts will continue to erode as fuel efficiency increases and driving habits change.

With little hope for an increase in fuel taxes at the federal and state levels (combined with stimulus-related debt), most state DOTs in the USA are looking at growing funding uncertainty and dramatically scaled back programs in 2011 and beyond.

In 2013, NHTSA plans to issue a regulatory decision that may mandate IntelliDrive safety equipment and applications in all new vehicles.

IntelliDrive's biggest stumbling block is the lack of a viable business model. Many in the industry laud its potential to dramatically enhance safety, yet this focus has left



GM's Chevrolet Volt plug-in hybrid electric vehicle, due to be launched in November

officials struggling to find a way to pay for it. Although the greatest safety benefits will be realized when a critical mass of infrastructure is deployed, funding issues will hold back substantial deployment unless a revenue source can be found.



Intelligence led

Jim Barbaresso from HNTB Corporation believes implementing IntelliDrive will initiate a change in the way that US transportation is funded and delivered

Main image courtesy of Joe Justice

There is a perfect storm brewing, yet I've noticed many surface transportation professionals turning their radars off at just the wrong time. We know our industry is at a tipping point: the rising price of gas, funding shortfalls, environmental disasters such as the oil spill in the Gulf of Mexico, the electrification of automobiles and the inevitable degradation of the fuel tax as a primary funding source demand our immediate attention.

In the USA, political leaders have publicly said a vehicle miles traveled (VMT) user fee is off the table as part of the next Federal Transportation Authorization Bill, now more than a year overdue. For me, attending recent ITS conferences seems to have been exercises in futility as we focus on the technical aspects of implementing ITS that we cannot afford – while ignoring the fact such systems can be used to generate revenue and pay for themselves.

IntelliDrive is the USDOT's multimodal initiative to create an integrated system of connected vehicles and roadways. Although still under development, interoperable networked wireless devices will allow communications among vehicles, the infrastructure and passengers' personal communications devices. This will enable hundreds of applications to improve safety, mobility, the environment, and

– with the right focus – introduce a sustainable funding mechanism.

Deployment scenarios must consider the opportunity to leverage IntelliDrive technology to supplement or replace outmoded fuel taxes as the primary source of transportation funding. Onboard equipment will be able to log the number of miles driven and the jurisdictions in which travel took place. The data would reside in the vehicle for a certain, limited period of time until the vehicle passes the next receiver or based on a certain collection cycle. A fee would then be charged per mile driven. Not only does such a scenario offer benefits for long-term transportation funding, but the ancillary benefits of safety, mobility and environmental sustainability come along for the ride.

A shift in thinking

Let's also understand the potential impact of NHTSA's regulatory decision regarding vehicle-to-vehicle safety in 2013 – the enabling technology for a mileage-based user fee application will be in our cars and trucks this decade, making such fees a potential game-changer sooner rather than later.

The model for a national roll-out of IntelliDrive can be based on innovative financing and public-private partnerships



A gas tax raise is not an option to decrease the funding gap

that already are used for large infrastructure deployment projects around the world. For example, state DOTs might use a design-build-finance model or obtain competitive proposals from concessionaires. This is possible if mileage-based user fees are adopted as a primary objective for deployment. In essence, the infrastructure is financed and built by the private sector. As revenues are collected by the system, the private sector recoups the initial investment with added profit. Toll facilities have done this successfully for decades.

When it comes to the governance of implementing such projects, a number of options are available. First, states could use P3

contractors to not only finance the infrastructure but maintain it. This may require concession agreements with the contractor teams. The public sector may also wish to maintain the infrastructure, just as they currently maintain traffic and ITS devices, especially with safety and mobility objectives in mind. States may even establish a separate authority to maintain the infrastructure and process the revenues generated (similar to current toll authorities).

In any case, since the governing body is receiving revenues from the system, the pricing model must take into account the need for ongoing system maintenance and operation.

Legislation would be required in many states to allow these approaches. Regulatory oversight will be required for separate authorities or concessions similar to those required for current concessions and public utilities. The federal role would be that of facilitator here. Of course, a portion of mileage-based user fee receipts could be apportioned to federal coffers, similar to current fuel tax receipts, for national initiatives and support of federal transportation programs.

Identifying a balanced way forward

The primary concern with doing it in this fashion involves conflicting objectives between revenue generation and improvements to safety, mobility and the environment. Such an effort must include state DOT and local agency oversight to ensure that infrastructure is deployed in a manner that optimizes safety and mobility benefits while meeting mileage-based user fee requirements.

A systems engineering approach should be utilized to establish a concept of operations, clear roles and responsibilities, and the procurement approach within each state. A business plan must be part of the proposals from concessionaires or contractors.

A secondary issue is the privacy concerns many in the general public raise when introducing mileage-based user fee concepts. However, the data required for this does not necessarily require tracking or logging specific driver locations. Certain pricing applications (such as congestion pricing) may require more data granularity than others, but simple mileage-based fees would not.

The bottom line is that IntelliDrive deployment can be self-funded and self-sustaining. However, this requires that we step outside the gas tank and look beyond the current funding scenarios for infrastructure deployment. The key is to consider IntelliDrive as the enabler for mileage-based user fees. ○

Jim Barbaresso is the national ITS practice leader for HNTB Corporation. Since 2005, HNTB has been involved with a growing number of projects related to the national IntelliDrive initiative, including designing and building one of the first IntelliDrive testbeds with Michigan DOT

“ The model for a national roll-out of IntelliDrive can be based on innovative financing and public-private partnerships that already are used for large infrastructure deployment projects around the world

According
to the AAA, auto accidents in the USA cost US\$164.2 billion, which is around 2.5 times more costly than traffic congestion

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Strong theory, weak dialogue

Bern Grush & Tim van Gelder ask if a technique from the social sciences can help us tackle the 'wicked problems' of road pricing

Main image courtesy of George Clerk

Road pricing has as many stakeholders as use or benefit from the use of roads. But the history of the public debate on road pricing is made of equal parts of mythology and mathematics and is wrapped in as much confusion as common sense. We have not yet established a shared understanding of the sustainable transportation problem we wish to solve and rational consensus around the most appropriate solutions. And we can't effectively apply engineering to a problem of which we do not have such understanding and consensus.

Overwhelmingly, cities have failed to deal adequately with their congestion problems, despite decades of awareness, vast research, and endless, unsustainable attempts to keep ever-increasing volumes of traffic flowing. Congestion is the quintessential 'wicked problem', which resists resolution through standard problem-solving methods and political processes due to its multi-dimensional complexity, range of stakeholders, and shifting nature.

The wickedness of the problem is compounded by a kind of intellectual gridlock. The road traffic community seems unable to reach rational consensus on the best frameworks to reduce congestion and how those frameworks might be implemented. After countless conferences, articles, books, opinion pieces and government reports, the wider community disagrees as much as ever.

There is a widespread belief, particularly among transportation economists, that some kind of congestion pricing scheme would

be the best way to manage congestion. But this insight is just a springboard for the related wicked problems of firstly what kind of pricing scheme would be most suitable in any given case and secondly how to solve the social and political problems standing in the way of implementation, such as privacy, fairness and access.

The heart of the wicked problem

Most of the current studies and papers describe why we should move toward road pricing as a way to manage demand, to fund crumbling infrastructure, as a replacement for the fuel tax, or to reduce dependency on oil. A smaller but significant number describe toll payment technologies and case studies and their benefits. Here, we have been thorough to the point of extreme redundancy.

Critically missing is a comprehensive focus on socially oriented policy guidelines. From a congestion perspective, how will price setting be both effective and fair? Should fair and effective parking pricing be included? How should we treat those who have no reasonable alternative, except a private vehicle at peak times? Should there be progressive pricing or a tax treatment in consideration of those made worse off?

What level of enforcement is sufficiently effective but not invasive? Is non-payment a traffic violation or tax evasion? Which externalities should we internalize and to what

A wicked class of problems



According to Jeff Conklin, a thought leader who devises

facilitation techniques for Wicked Problems, this class of problems has six critical characteristics:

1. You don't understand the problem until you have developed a solution;
2. There is no stopping rule; you won't be sure if you are done;
3. Solutions are not right or wrong, rather only better or worse;
4. Every problem is essentially unique and novel, so you cannot copy another city's or country's solution;
5. Every solution is a 'one-shot operation', so you will not be able to reuse your own solution;
6. Wicked problems have no given alternative solutions – i.e. there was no 'right answer' in the first place.

One of Boris Johnson's advisors, Kulveer Ranger, has told the London Mayor that many of the capital's 6,000 traffic signals are harmful to traffic

“The road traffic community seems unable to reach rational consensus on the best frameworks to reduce congestion and how those frameworks might be implemented

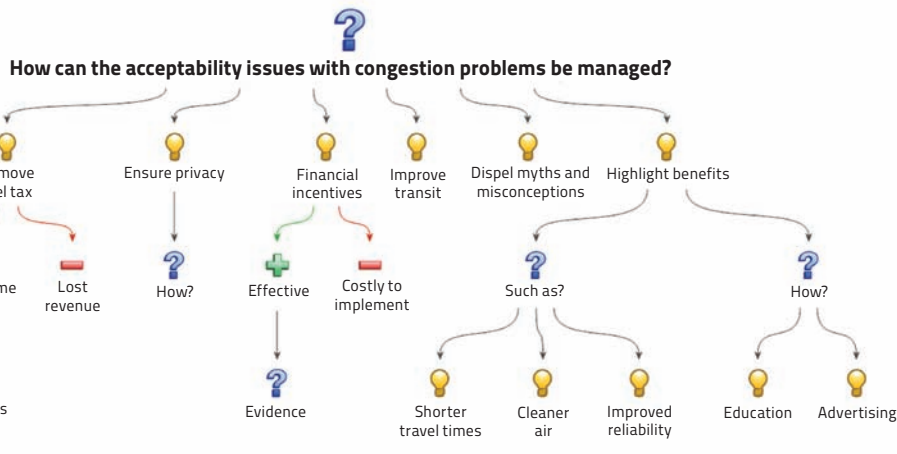
A failure of method

Why the gridlock? Fundamentally the problem is that our standard processes for rational deliberation are simply not up to the challenge. We often believe that when there is a lot of earnest talk and a great accumulation of printed stuff, some comprehensive thinking must be going on. In an important sense, this is often an illusion. The standard processes we use to run conferences or conduct other forms of deliberation do not achieve the intended goals of shared clarity and consensus. Why? Because we stumble around in a fog of verbiage, missing much of what is said, asking a scattering of uncoordinated questions, making misinferences and misassociations, and grabbing biased bits and pieces of arguments and clinging to our own for all we are worth, if only as flotsam that will keep us afloat in the swirling currents of the problem's complexity and our concern for getting it solved. We lack agreed and effective processes for doing better than this. We just continue to do what is customary, continue to be frustrated and continue to make insignificant progress. If we cannot find a better way, our cities are headed for ever-increasing congestion and the resulting impacts – economic stagnation, environmental harm, and social grief.

The UK government's Technology Strategy Board is spending £40 million over five years to develop technologies to reduce traffic congestion



A very good arrangement in a meeting room at the Knowledge Media Institute, Open University, UK



extent? Should prices be set to maximize or minimize road use? (The answer may surprise many!) Should road use fund other modalities and to what extent? (This in itself is a 'wicked problem'.) How much should we charge undesirable vehicles and reward desirable vehicles? Should we reward desirable vehicles? If so, how much and for how long? Should we optimize for sustainable funding or for sustainable congestion levels? (These are two very different problems!)

How will we resolve all the current acceptability problems? How private should we ensure road use metering to be? What should the penalty be for not safeguarding privacy? Should we make all in-vehicle equipment voluntary or mandatory? Should we design enforcement to be operationally self-sustaining? Should beneficiaries such as employers and retailers pay charges, or be permitted (encouraged) to assist employees with more flexible schedules or payment assistance?

Dialogue mapping

An emerging alternative to standard processes for tackling wicked problems is Dialogue Mapping. Using a distinctive methodology, skilled facilitation and specialized software, this approach assists a group to construct a diagram or 'map' representing their collective understanding of the problem – the issues, the options, the arguments and evidence. The approach exploits the visual processing power of our brains to help build a level of clarity, rigor and consensus for group deliberations that cannot be achieved by any other means. Using Dialogue Mapping techniques with non-homogeneous groups of 15-20 stakeholders, we can govern deliberation, constrain it from straying off course, target our use of evidence, specify our disagreements, and capture the whole process with an ease and rigor much greater than available using standard deliberative processes.

The wicked problem of congestion is calling out for something such as Dialogue Mapping

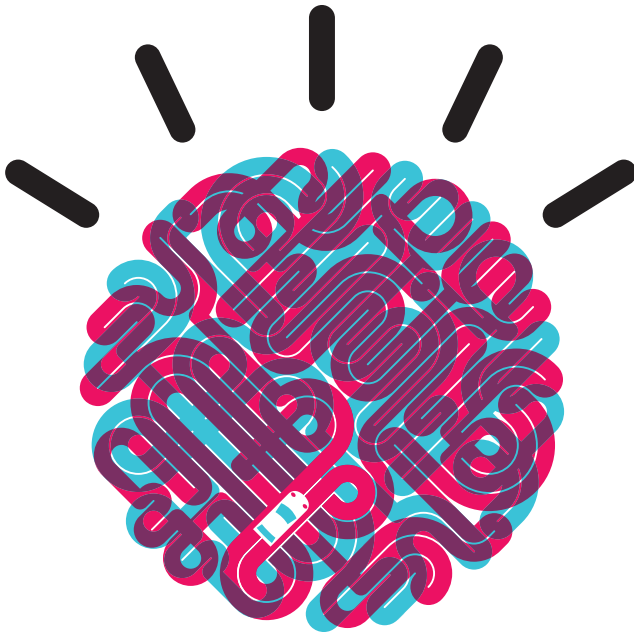
to help it move beyond intellectual gridlock. The multi-dimensional complexity of the problem means that no one person has all the knowledge and insight required to resolve the problem, and no single perspective can hope to adequately capture all the issues. Appropriately selected groups might collectively have the knowledge and insight but have trouble synthesizing it into a solution and securing broad agreement. Dialogue Mapping can address this by creating a shared representation of the problem(s), possible resolutions, and the pros and cons.

Workshops and participants

The most effective Dialogue Mapping workshops engage a wide constituency. Beyond economists, urban planners and traffic engineers, there should be involvement from stakeholders as diverse as developers, politicians, journalists, hauliers, transit riders, drivers, cyclists, transportation system integrators, logistics managers, retailers, tax specialists, public health officials, property owners, and any other stakeholder with a vested interest in the health of a city or region.

Such workshops are aimed at breaking down the intellectual impasse at the head of the wicked problem of traffic congestion. The facilitators guide the structure of the workshop and offer solution approaches, but no specific solution. One-day workshops are introductory versions of longer workshops aimed at making serious headway toward traffic congestion solutions for specific regions or cities. Full workshops may take several days and could stretch over a couple of weeks. It is important for consistency and completeness of dialogue that the participant population remain constant, because it is in the dialogue activity more than in the final map that breakthroughs occur.

The authors feel there will be a noticeable similarity among these workshops from one city or region to another and that the aggregation of these maps would guide a state, province or nation toward a workable understanding and even a roadmap to a solution of congestion through sustainable and acceptable pricing programs. ○



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Growth spurt

Several technology authorities in the weigh-in-motion industry tell **Saul Wordsworth** that the 'acorns to oak trees' approach of the sector over the years is on the verge of paying big dividends

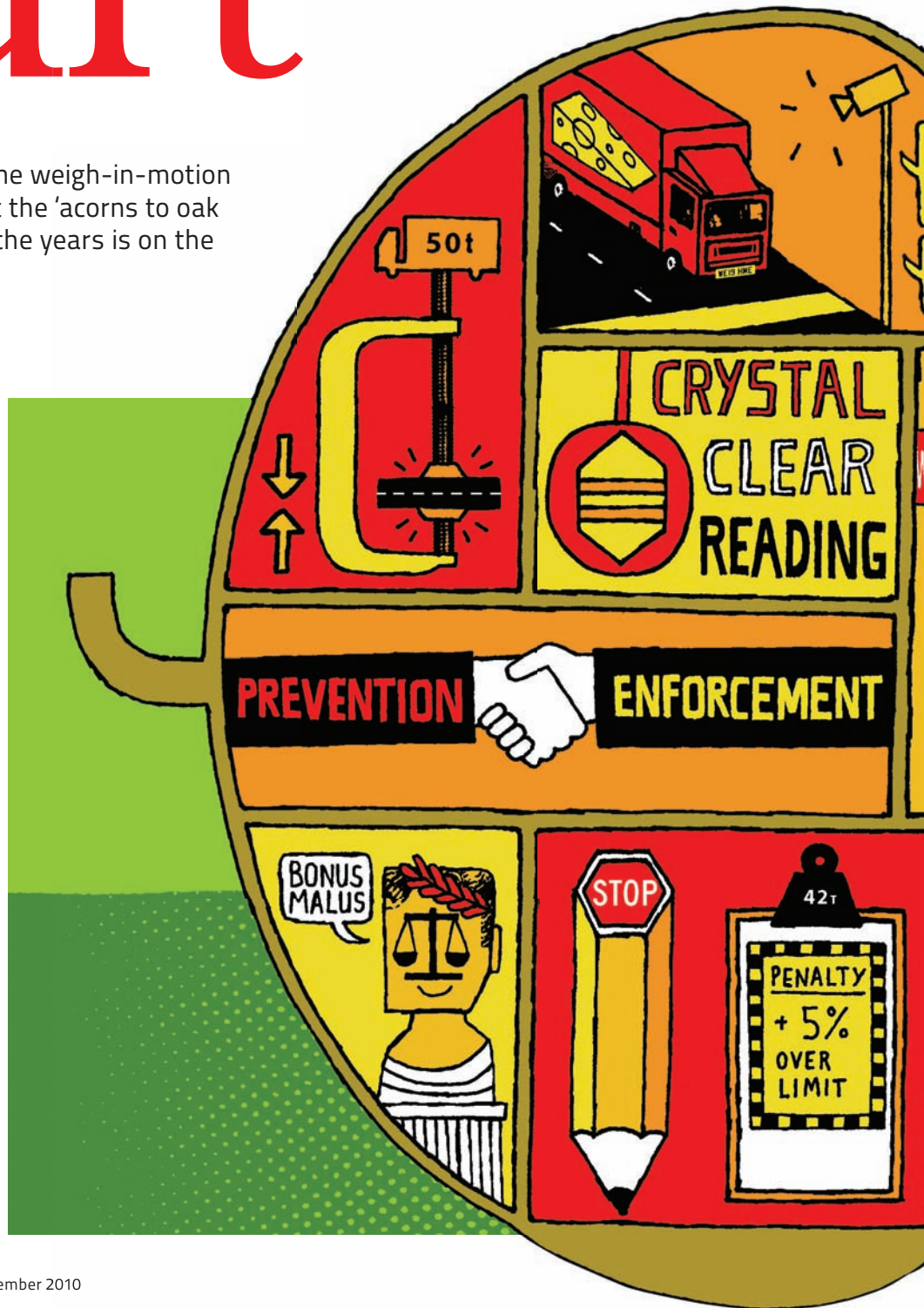
Illustration courtesy of Tim Ellis

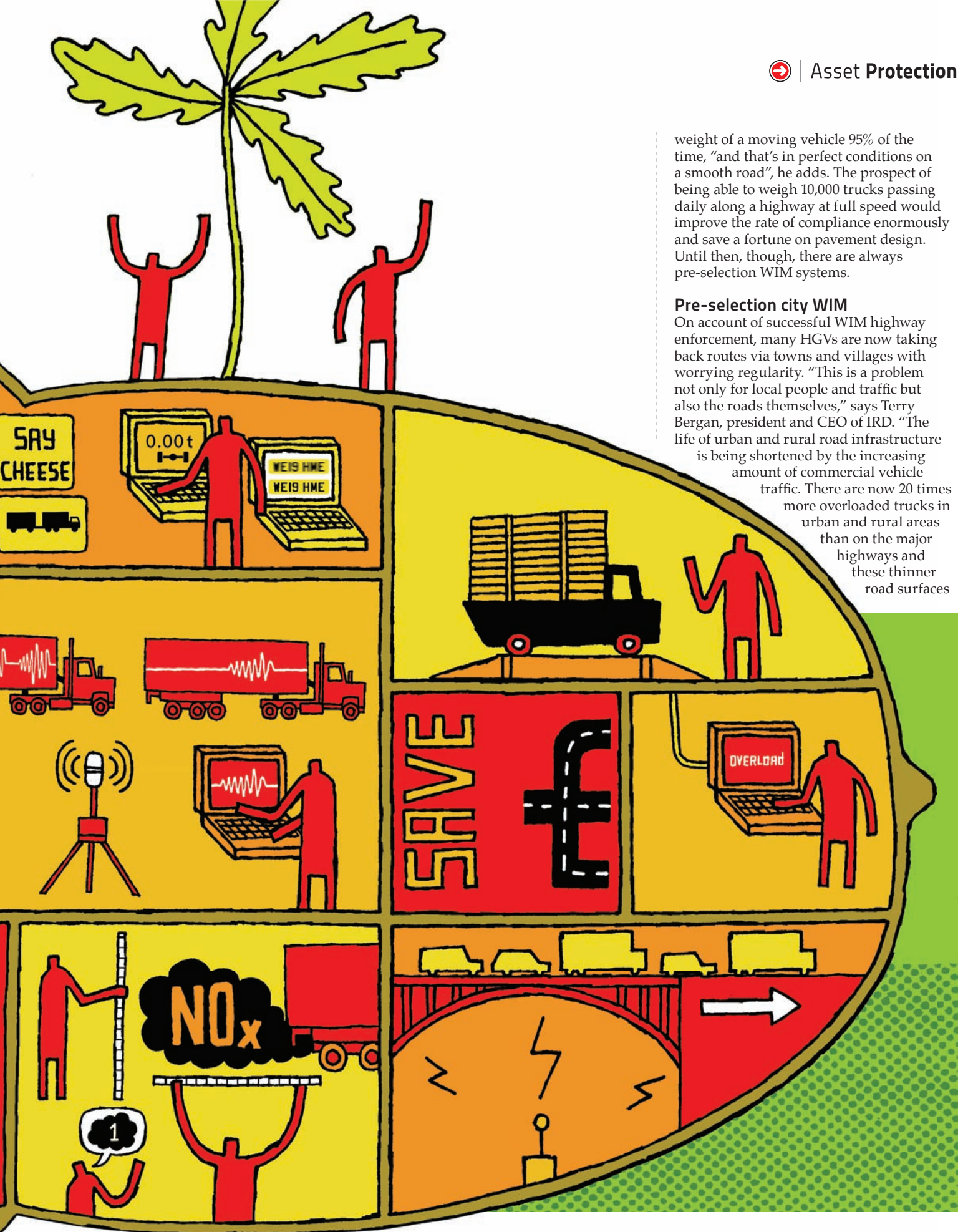
With the goal of stimulating the sharing of worldwide weigh-in-motion knowledge, the International Society of Weigh-in-Motion (ISWIM) was created back in 2007. Its president is Eugene O'Brien, Professor of Engineering at University College Dublin and a man with 20 years' experience in the field. "The technology can be quite varied," he begins. "Some countries have extensive networks while others don't do it at all. There can be problems with the technology and it is sensitive to harsh climates but ISWIM is one way we can learn from each other through regular conferences, newsletters and the sharing of information."

Principles of WIM

There are four principal application areas for WIM: pavement design and assessment; bridge design and assessment; the general study of freight movement; and lastly the enforcement of overloaded trucks. "If that fourth area takes off, the industry will enter a growth phase," predicts O'Brien. "Currently, no country apart from Taiwan is successfully using WIM to directly enforce overloaded trucks. It's like speed cameras; they were challenged in the courts and it took years for them to be accepted as sufficiently accurate and reliable to be used for enforcement. WIM enforcement has been challenged in many countries and failed because it is not accurate enough."

According to O'Brien, even the best systems only get within 5% of the gross





weight of a moving vehicle 95% of the time, “and that’s in perfect conditions on a smooth road”, he adds. The prospect of being able to weigh 10,000 trucks passing daily along a highway at full speed would improve the rate of compliance enormously and save a fortune on pavement design. Until then, though, there are always pre-selection WIM systems.

Pre-selection city WIM

On account of successful WIM highway enforcement, many HGVs are now taking back routes via towns and villages with worrying regularity. “This is a problem not only for local people and traffic but also the roads themselves,” says Terry Bergan, president and CEO of IRD. “The life of urban and rural road infrastructure is being shortened by the increasing amount of commercial vehicle traffic. There are now 20 times more overloaded trucks in urban and rural areas than on the major highways and these thinner road surfaces



were not built for such vehicles. One in five is overloaded and low enforcement can result in violation rates in excess of 25%.”

To combat this development, there is a growing trend toward instrumenting local roads. On the subject, IRD has deployed its virtual weighstations as far afield as New York, Alaska and Qatar, enabling highways agencies to monitor and screen for overweight vehicles on both major and minor roads. The stations incorporate advanced video image capture technology and wireless communications, assisting officers to identify suspected violating vehicles for further inspection.



“The cameras capture an image of each vehicle as it passes over the WIM scales,” Bergan says. “This is achieved with ALPR, which captures a high-resolution image of the front of the vehicle. Each image is associated with the appropriate vehicle record. The system then sends vehicle record information downstream to the operating authority or enforcement officer who can pull the vehicle over for further inspection at, for instance, a static weighstation.” As O’Brien says, “It may be less efficient than an automatic enforcement system but it’s a lot better than just having a policeman at the side of the road.”

Taking its toll

“If every vehicle weighing 50 tonnes is allowed to drive through every village, we won’t have any local roads left before long,” suggests David Cornu, who is responsible for the Road & Traffic unit at Kistler, one of the world’s leading manufacturers of sensors and measuring systems, which recently established a WIM system on a local road in Italy in order to protect a historic village in the north of the country.



Damage-limitation exercise

“Bridges are less sensitive to the weight of individual axles and more vulnerable to overall vehicle weight,” says ISWIM president, Professor Eugene O’Brien. “It is not that bridges get damaged so much as the risk of the bridge collapsing increases. The likelihood is similar to the probability of being struck by lightning but it can happen, and when engineers are designing bridges and assessing current ones they look at such probabilities. If it increases beyond the level of one in a million they start to worry about the bridge and think about strengthening it.”

O’Brien and his colleagues recently collected data from five countries around Europe. The study included 20 weeks at the Dutch port of Rotterdam during which several hundred trucks of 100 tonnes or more were found at a site where the limit was 50 tonnes.

“It’s not that they’re necessarily illegal,” he comments. “They may have special permits, but as countries become increasingly



In 2007, 12% (72,524) of US bridges in the National Bridge Inventory were deemed structurally deficient

industrialized these permit trucks are becoming commonplace. The probability of two or even three trucks meeting on the same bridge at the same time becomes significant. We need to monitor the situation more closely and if it starts to get beyond a certain level we need to start issuing fewer permits and controlling them better.”



(Above) Close-up of IRD technologies for the enforcement of overloaded trucks
(Above left) The use of a virtual weighstation system benefits a transportation agency, the trucking industry, and the general public in many ways

Kistler has long been providing its quartz-based sensors, which allow for very accurate vehicle measurements. Recently, though, the company introduced its Lineas quartz sensors for tolling. “I believe toll-by-weight is a major application for WIM,” Cornu continues. “This weight-based classification is based on the cost-by-cause principle, which is fairer for road users and toll operators as road damage is proportional to the fourth power of the axle load. Many countries are switching to this and major toll plazas have been instrumented with our sensors in countries around the world. Vehicles approaching the plaza are weighed very precisely just before stopping at the booth and based on this slow-speed measurement, a weight- and distance-based fee is calculated.

The big challenge, though, is to provide good accuracy at different speeds and for any driving behavior or condition. “According to the customers that have deployed the technology so far, what’s been decisive for them ahead of other technologies has been the full stability over time, the fast installation, and the absence of maintenance, which reduces the costs of ownership,” Cornu says. “Furthermore, as a result of the benefits of such technology being accurate and speed-independent, plazas can be upgraded from manual toll to ETC with the same weighing equipment, so there’s no need for modifications. This is actually a key feature as sooner or later all manual plazas will be upgraded to ETC in order to improve traffic fluidity and reduce traffic jams.”

Kistler’s tolling technology boasts a better than 5% accuracy class, a wide measuring range – from small cars to trucks – speed-independence and no temperature influence. The same accuracy is available from -40 to +80°C, which is just as well as there are Kistler installations in Asia, Europe as well as the Middle East.



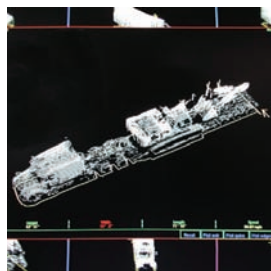
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Mark Phillips, managing director, TDC Systems, UK



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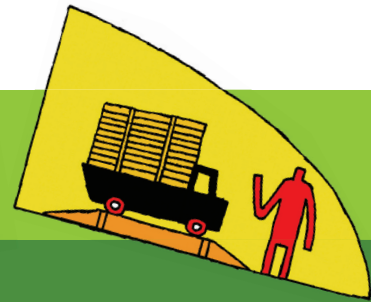
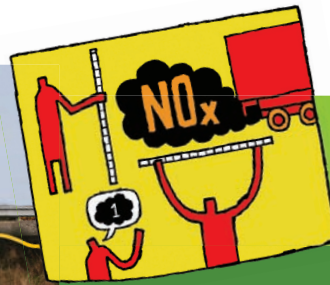
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The wear and tear on transportation infrastructure caused by an individual vehicle is directly proportional to the weight of that vehicle or axle

manufacturer, Cestel, within the Netherlands. Late last year, the Centre for Transport and Navigation (DVS) of the Dutch Ministry of Transport, the Rijkswaterstaat, began a project to test the performance of Cestel's B-WIM under Dutch highway conditions.

"As a result of the wet weather here in the Netherlands and the high traffic volumes, the installation and maintenance of pavement WIM is not easy," suggests Hans van Loo, WIM project manager for Kalibra-Cofley in the Netherlands and Secretary of the Board for ISWIM. "This is the reason DVS has been looking for an alternative. B-WIM might just be this alternative, especially with its flexible deployment."

The B-WIM was installed under a bridge on the A-12 route from The Hague to Utrecht. The intention was to compare it with a standard pavement WIM featuring two rows of Kistler piezo quartz sensors, and a static weighstation. Unfortunately, though – perhaps not untypically in this underfunded and occasionally delicate world – the B-WIM did not produce the expected results, the nearby pavement WIM broke down and the National Traffic Police Agency stopped managing the weighstation due to a political row. "We restarted the project three months ago on a different bridge at a different location but on the same highway," van Loo says. Both WIMs are now working perfectly and the police have been managing the static weighstation. Very soon, all measurements will be finished and an independent consultant will complete the comparative evaluations.

"I anticipate the B-WIM accuracy to be similar to the pavement WIM," van Loo predicts. "I also expect the gross vehicle weight will be similar but for individual axles a little less accurate. Personally I don't see the B-WIM as a replacement for pavement WIM but as a complementary technology. Pavement WIM is excellent if you want detailed data for one location but it doesn't tell you anything about the next road, or 500 yards ahead."

Pay it forward

The steady increase in traffic throughout Europe is creating a huge impact on



(Above) TDC's new development combines air monitoring equipment with vehicle classification technologies for improved and more detailed emissions monitoring (Above left) B-WIM from TDC in operation in the village of Swarkestone to understand traffic movements and vehicles weights

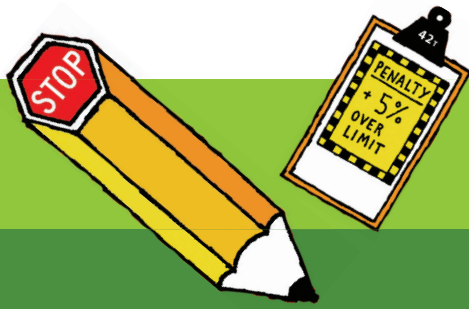
Air today

"There has been a growing demand within the EU to conduct regular reviews of air quality," explains Mark Phillips, managing director of TDC Systems in the UK. Limits have been set for all manner of emissions. Yet although this data is vital for transport and environmental planning, most authorities haven't been able to gather it from feeder road systems. "This is where we come in," Phillips says. "We have found a way to intersect our WIM systems with air quality monitoring equipment – and we're the first to do it."

TDC is interfacing its HI-TRAC High Speed WIM system with air quality monitoring equipment to facilitate a comparison between air quality and traffic data. Vehicle classification data can now be used to directly compare numbers of heavy vehicles on a given route with emission concentrations. The system monitors levels of NOx and particulate matter alongside local meteorological conditions such as windspeed and direction, creating an individual record for each vehicle that passes over the in-road loop. "In the past six months we've installed a number of these systems," Phillips reports. "The UK Department for Transport has two trials running and Transport for Scotland has one on the M8 just outside Glasgow. Further trials are planned in Manchester and Scotland. Being able to study the effect of traffic numbers on air quality and pollution levels makes a big difference to planning processes."

Bridging the gap

Bridge WIM (B-WIM) measures the bending response of a bridge when a vehicle passes over it. It is both an excellent way of recording traffic data and a means of gauging the state of bridges, many of which are now ageing after decades (if not centuries) of use. In the USA, it has been estimated that one in four interstate and local bridges are in distress – that's 150,000 in total! Aside from being a certified calibrator, Kalibra-Cofley represents Slovenian B-WIM



infrastructure, the environment and resources. To understand to what degree, the EU devised the Eureka Logchain Footprint Project to study load, noise, vibrations and gaseous emissions by road (and rail-borne) vehicles. One of the objectives was to quantify this environmental footprint and convert it into economic costs and therefore user charging. "For road measurements, WIM sites using an array of sensors, including Kistler, TDS and HBM, were established – three in the UK and one in Switzerland," reveals Rayner Mayer, project coordinator. Microphones were also used to capture noise and ground-borne vibrations.

Data collected in the UK showed that the maximum vehicle weight of 44 tonnes was exceeded regularly and by a considerable margin, while in both the UK and Switzerland more than 10% of weekday vehicles were found to be overloaded compared with the legal limit. The next stage is a follow-up project, Footprint+. "What we plan to do is to install more Footprint measuring systems in more countries to analyze more data," Rayner says. "Then we want to find a method of transmitting this data back to the operator, to alert them of any infringements. On top of that, we want to try and relate this as an additional element for user charging."

The idea behind this is the so-called *bonus-malus* (Latin for good-bad) system cited in the EU transport package published in July 2008. The idea is to encourage more environmentally friendly vehicles by rewarding the 'good' guys and penalizing the 'bad'. "The penalization comes from measuring their weight, vibration, emissions and noise or anything that exceed either regulatory or safety limits," Rayner says. "The third strand of the work is to arrive at some sort of common calibration system across Europe." So where do you set the limit? "Suppose the accuracy and reproducibility of your system is $\pm 5\%$. If your limit is 40 tonnes, you would penalize anyone whose overall weight was 42 tonnes – two tonnes being 5% of 40 tonnes."

Trends and the future of WIM

Quirky and not always robust, it can take a long time for new WIM systems to come



Global standards

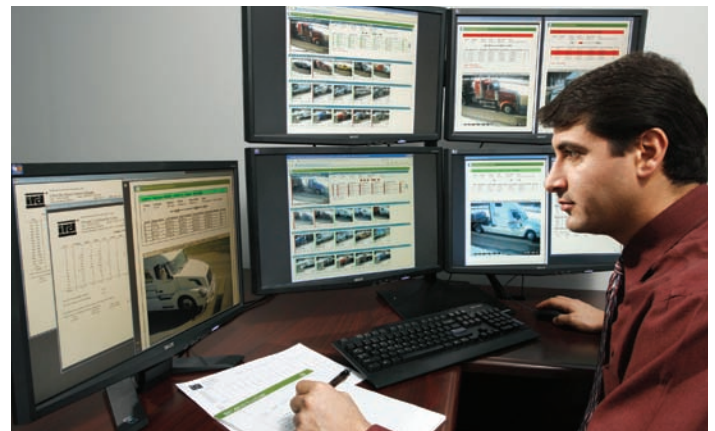
The Federal Highway Administration (FHWA) in the USA has launched an initiative to incorporate WIM technology into the National Institute of Standards and Technology's handbook, Specifications, Tolerances and Other Technical Requirements for Weighing and Measuring Devices. NIST's Weights and Measures Division is partnered alongside FHWA on this venture.

Meanwhile Europe is preparing to draft a European standard for WIM systems known as FiWi. The process is intended to create a CEN standard, the European committee for standardization. FiWi will be loosely based on



COST 323, a de facto 10-year-old project upon which much of European WIM standards have been based. The final version of FiWi will be published by October of this year.

According to IRD, as active enforcement of overloaded trucks increases, non-compliance with truck loading regulations decreases



If we could enforce a legal WIM limit and keep vehicles within it, the lives of pavements would be trebled and we could save a fortune

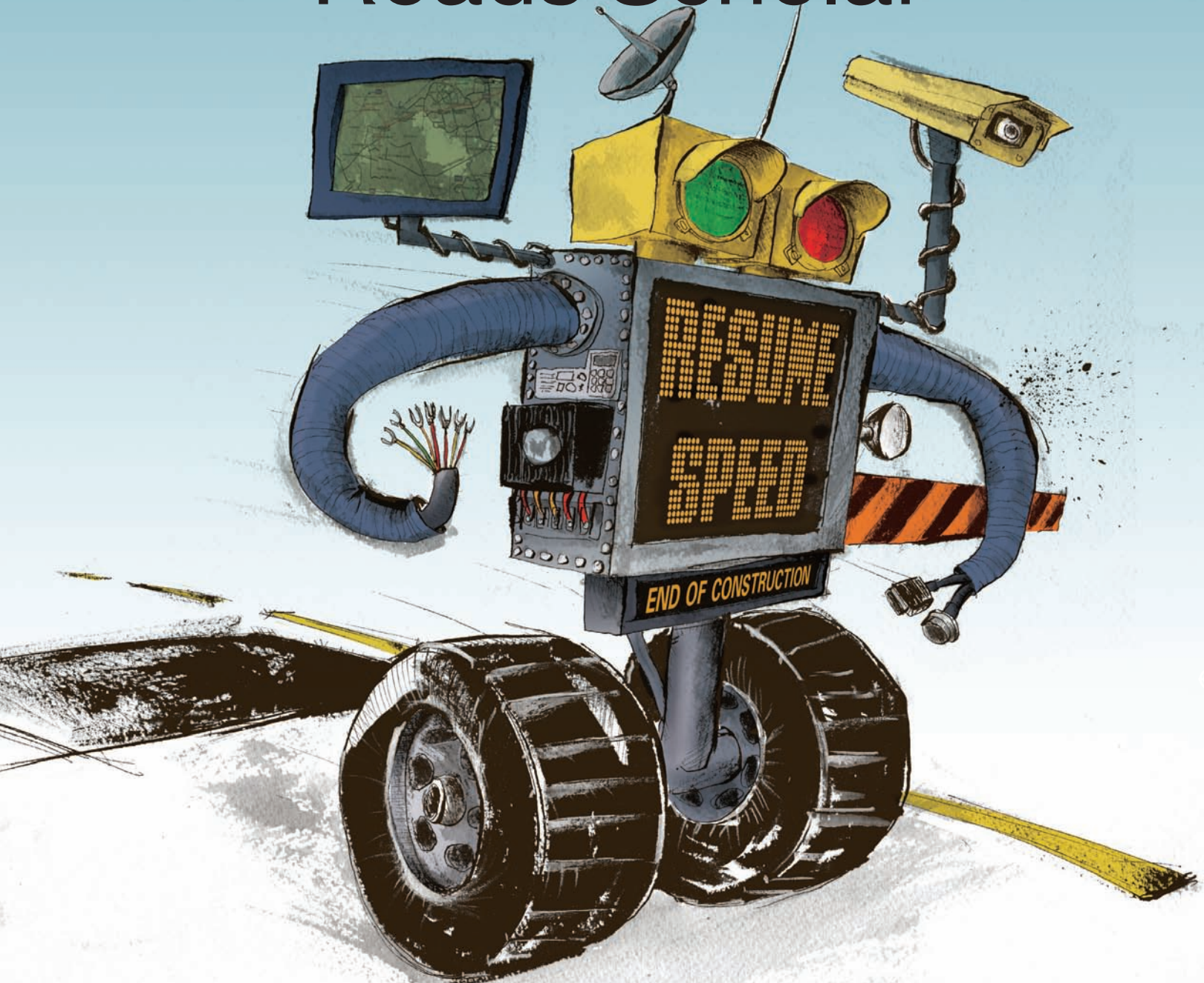
Professor Eugene O'Brien, president, International Society for Weigh-in-Motion

online, often because the decision-making process is tied up in local government. But those who use it appreciate its worth and see an upward trend. "In simple terms, the 'Fourth Power Law' states that pavement damage goes up exponentially with the weight of the axle," says Eugene O'Brien. "If we could enforce a legal WIM limit and keep vehicles within it, the lives of pavements could be trebled and we could save a fortune. Let us hope this is the future."

"My impression is that WIM is getting used more and more – and for more applications," concludes Hans van Loo. "WIM tolling for HGVs is on the rise in countries such as China, India and Japan. I think it's really coming out of the development and research stage and into a period of practical applications which, in turn, are determining the direction of its development." Terry Bergan concurs with new uses. "We are seeing an increased use of unmanned WIM at plants, ports and border crossing where you cannot hide weight," he says. "Where raw materials are being delivered on trucks, you want to make sure you receive what was promised."

If nothing else, what this collection of case studies underlines is that the potential of weigh-in-motion is both broad and growing. ○

Roads Scholar



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As the UK's enforcement market undergoes a period of turmoil (with many heralding the end of spot-speed enforcement), it is interesting to contrast this scenario with the inexorable rise of the machines that's occurring in the USA. As a growing number of UK Local Authorities switch off their existing cameras, the opposite is happening across towns and cities in North America.

"It's amazing. We now have operations in 22 states plus the District of Columbia and two Canadian provinces. We have nearly 300 customers and it just keeps growing," says a delighted Jim Tuton, president and CEO of American Traffic Solutions (ATS).

He's right to be happy with this state of play. Over the past few years, ATS has undergone such a rapid growth spurt (including the acquisition of outfits such as LaserCraft, Traffipax and Nestor) that it's overtaken its main rival, Redflex, to become the USA's largest player in this sector. Of the circa 5,000 cameras currently in operation in the USA, ATS has more than 2,200 active, with another 800 currently being installed.

It's not just buying up the smaller fish in the market that has raised the company's corporate profile, however. A shrewd and long-term vision (to the point of stubbornness) has also paid dividends. Tuton believes 100% in his products and their value in terms of safety; he's just had to wait a while for certain others to agree.

State by state

One recent coup involved the state of Florida. "We took a major stake there when others were unwilling to take the risk," he states. "Florida is by far the largest business opportunity in North America in terms of cities and towns that are adopting and want to adopt intersection safety cameras – we have around 75 current and pending contracts in the state." Until recently, though, ATS was trying to build this market against a background of legal wrangling on red-light cameras that had caused other vendors to pretty much give up on the Sunshine State becoming a viable market.

The abridged version of these legal issues hinged around how a law on enforcement was interpreted, with the anti-camera brigade attempting to argue that for a red-light camera to be properly legal, a police officer would have to be at the roadside to observe the violation. It became evident that further, more transparent legislation was needed. But until that happened, FDOT decreed that no cameras could be installed on the land that it owned. Needless to say, that didn't put ATS off. A smart workaround involving non-invasive technology installed off the FDOT-owned rights-of-way was devised for some of its keenest customers.

Enforcement camera technology is now well established; according to Jim Tuton, the next task is to spread the word about its benefits

Interviewed by Louise Smyth

The tenacity finally paid off. In July 2010, a new uniform standards intersection safety law was passed. "This was a significant victory for our industry," Tuton says. "ATS took a major leadership position and drove the legislation. While it was frustrating for a time – we had 70 customers that we had to work with carefully and slowly as there weren't many opportunities to put the cameras in the places where they were most effective – we've got a huge roll-out in Florida right now. We took a big risk but we now have 90% of the market."

Not every such anecdote ends in victory for ATS, though. The company recently lost a court case against Redflex – a story that has been widely reported in the media, with varying levels of spin. Tuton is refreshingly honest, on and off the record, when asked about the case. "Typically we're not a litigious company. We just feel that from a competitive perspective, you have to play by the rules. We took this case on because we thought that one of Redflex's business practices equated to unfair competition."

As with the Florida scenario, interpretation was paramount. The case revolved around the word 'advertising' and

what constituted advertising. Ultimately, ATS lost the case, although Tuton is not overly disheartened by the result. And indeed the result is almost by the by – the fact that one camera vendor even tried to tackle another on grounds of 'fair play' paints ATS in a very positive light, making the company appear as some kind of moral guardian of the industry. Tuton is not cynical enough to accept this view, however; his is a genuine belief that honesty and transparency are crucial for the industry as a whole to survive. "All we want is for people to play by the rules. The biggest risk we have right now is that someone could come in with something unlawful that could undermine trust and confidence."

This answer touches on an issue that the enforcement industry faces on a daily basis – the ongoing argument surrounding the effectiveness of the cameras. Tuton is relatively happy with the current status quo in this area and cites numerous studies, focus groups and academic research that all show how the majority of US citizens are now firmly in favor of enforcement. Even the language describing these systems has evolved to reflect their status. After 20 years



“The biggest risk we have in the industry is that someone could come in with something unlawful that could undermine trust and confidence

of the does-what-it-says-on-the-tin names of ‘speed cameras’, ‘red-light cameras’ or ‘photo radar’, even Tuton lapses from the newer ‘safety camera’ moniker occasionally.

With regard to those red-light/intersection safety cameras, part of the reason why they’re now widely accepted is that red-light running is so frowned upon. Many people believe that because it’s such a dangerous, reckless thing for a driver to do, there is just no credible argument to suggest that the cameras are a bad idea. These people, of course, are not the same ones whose research shows that red-light cameras result in an increase in rear-end crashes. “This argument comes up all the time and is the drumbeat of the ‘vocal minority,’” says Tuton. “There is much research to counter it. We’re working with Professor Simon Washington at Queensland

University of Technology to develop a standard methodology for measuring the performance of enforcement programs.”

Performance standards

The point about a need for standards is valid. As Tuton observes, in the USA, all is not quite what it seems when it comes to intersection accident statistics: “If a crash occurs here, it is assigned to the nearest intersection. So it is inherently complicated to assess the performance of an intersection safety camera in terms of crashes. You have to consider the approach, the direction of travel, where the camera is installed, if the crash has even occurred within 50ft of the stop line and so on. If there is a crash on the north, south or east side of an intersection equipped with a westbound safety camera, the camera clearly didn’t cause the crash!”

Much as the 48-year-old is used to addressing the anti-camera viewpoints, he is savvy enough to realize that any counter-arguments coming from a camera vendor will always be accused of bias. This is part of the reason that ATS is heavily involved with PARS, the Partnership for Advancing Road Safety. Tuton describes PARS as ‘a coalition of natural allies’ – meaning that among various national and local entities (including the National Safety Council), ATS is also working in harmony with some of its competitors. “The goal is to promote and support the use of advanced technologies to improve road safety,” the keen cyclist explains. “Part of that means conducting primary research that’s not biased by ATS, Redflex, ACS or anyone else.

“Collectively as an industry, we’ve gotten really good at understanding the problem and solving it technically and operationally. Where we’ve been remiss is that we were focused on growing the industry and not on really understanding the messaging and communications. And that’s what PARS is about. We want to change the conversation and ensure that the once silent majority is recognized as exactly that – the majority.” ○



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Cash and questions

With many agencies considering all-electronic tolling, **Glenn Deitiker** looks at some of the technological, process, financial and institutional challenges of cashless tolling in a cash world

Main image courtesy of the Central Texas Regional Mobility Authority

All-electronic tolling (AET), aka cashless tolling, is viewed by many as the future of the toll industry. Although that may be true, it is not a road without risk. Even as AET is being planned and deployed by many operators, it is clear that challenges still exist – and some of those challenges lack proven solutions.

First, AET magnifies flaws or limitations in the toll collection system. For example, in a mixed ORT system, the violation rate might be in $\pm 3\%$ yet on an AET system the rate of non-electronic image transactions could be as high as 20-30%. Any failure of the system to accurately image vehicles and process transactions is now magnified by a factor of seven to 10 times.

One of the challenges for many transport agencies is that a large percentage of toll road users are either unbanked or underbanked

It is simply not possible to convert ‘all’ users to ‘electronic’ users. A significant percentage of users on many toll roads are unbanked or underbanked. In Texas, for instance, 11% of the population is unbanked while 24% is underbanked.^[1] In addition, many users don’t use the system frequently enough to justify signing up for electronic accounts. In the analysis of several agencies by Telvent, it was found that 10-15% of the user base of most systems use the systems less than once a year.

We also need to look at the financial impact of the add-on, ‘non-electronic’ fees that are part of most current AET systems. Are the additional fees being paid disproportionately by lower-income or other disadvantaged users? If so, does that represent direct risk from environmental and finance, as well as indirect risk from public perception?

Where are the solutions?

The challenge of verifying system accuracy is not a technical problem; the techniques for testing and verification of the ORT technology that is the foundation of most AET systems is well understood. Rather, the problem can be described as an issue of process. Toll systems are financial systems but unlike other financial systems, the toll industry lacks a mechanism for certification of performance of our systems. Even if that mechanism existed, the processes that the industry uses for system development, change management and procurement



Switching to AET can offer many operational benefits to toll authorities, but new systems have to be well thought out and smartly deployed



make it difficult for certification to be applied. In an ideal world, toll systems, especially at the lane/point-of-sale (POS), would come precertified to levels of performance, so the buyer would be able to make value decisions prior to purchasing the system and the buyer could choose whether the incremental cost of buying greater accuracy on their system is justified.

Although it sounds simple, performance certification requires the most difficult type of change – institutional change. As an industry, we would need to change our system development practices to ‘productize’ our offerings. We would need to be willing to have our systems tested in the ‘light of day’ by independent third parties. We would need to be willing to limit changes and customization of our systems because those changes could have a negative impact on the performance of the system. And we would need to be willing to let the outside world be aware of any limitations in our systems.

This degree of institutional change is not on the horizon, and may not be possible for many years down the road. In the meantime, we can avail ourselves of the incremental opportunities – have an industry dialog on what certification standards should look like, encourage less customization of systems, and push vendors to publish independently verified performance numbers for their systems.

The non-electronic user challenge is even more difficult – dealing with the cash customer on a cashless system. As more agencies move toward cashless operations, solving this problem has been compared to working on the brakes of a moving car that is bearing down on a wall. The problem is pressing with real risk to the business operation.

Cashless operation does not eliminate the use of cash in a transaction. Rather, what cashless does is move the cash portion of the transactions off of the road. For most operators, the ideal would be that all ‘cash’ users sign up for accounts and fund those accounts with cash. For users who don’t use the road often enough to sign up, the only

remaining option on most systems is that the ‘cash’ is collected by the back-office operation. Although the net financial impact of the decision to move the labor and cost of cash collection from the road to the back-office is debatable, the net impact to the user is clear. In order to cover the cost of invoicing, the operator is charging an additional fee to the user.

Invoicing the ‘cash’ customer is problematic for other reasons also. To improve operating efficiency, most invoice processes will attempt to aggregate multiple transactions on a single invoice. To do so, they must age transactions while not knowing when/if another transaction will appear. To make matters worse, many cash users generate very few transactions.

The Holy Grail

The Holy Grail of cashless transaction processing is an approach that is as convenient to the user as paying cash, and doesn’t add cost to the operator or the user. There are several approaches that have potential, including phone/SMS tolling, and accumulating charges against vehicle registration. None of these approaches are currently implemented in the USA, and none should be considered proven. But it is likely that all will be tried in some form in the near future.

‘Kiosk’ approaches are also being implemented by some agencies. By using a kiosk off the road, the user would be able to establish an electronic account using a dispensed tag or video tolling. This may represent a good solution for unbanked customers, but may not help with the infrequent user.

Most of the approaches listed here depend on video image processing of the user’s license plate to work correctly. License plate OCR has been in use in the industry for quite a while and can be effective in helping to automate processing of license plate images but is by no means perfect. Some vendors have added capability of ‘fingerprinting’, which allows vehicle images to be compared against known good images for identification – an approach that can greatly improve accuracy but is only useful against frequent known users. Reverse fingerprinting, meanwhile, is an approach that shows promise against both known and unknown users. Using vehicle registration information, a virtual image of the vehicle is built, including vehicle make/color, plate type/customization, and



The belt-tightening brought about by both the economic climate and transportation funding problems have given play to ideas and operating techniques that would have been difficult to imagine a few years ago

plate ID. Once built, the virtual database can serve as a known reference against a user that has never been seen before.

Finally, the issue of user payment equity goes well beyond the scope of this article. However, it is worth noting that the belt-tightening brought about by both the economic climate and transportation funding problems have given play to ideas and operating techniques that would have been difficult to imagine a few years ago. This is a challenge that should be confronted and resolved to prevent it from becoming a roadblock in the future. ○

Glenn Deitiker is the president and CTO of Telvent Toll Division. For more information, please email glenn.deitiker@telvent.com, or log on to www.telvent.com/tolling

References

^[1] <http://www.economicinclusion.gov/>

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 **Reversing the trend**

In 1995, when Steve Snider took his road trip into the world of ETC, the aim wasn't just to look for potential technologies but new ideas. "I would say the addition of that third (reversible) lane to the Macdonald Bridge and the introduction of MACPASS are among my proudest achievements," he says. Of that reversible lane, Snider admits it was controversial at the time, but says "we pushed ahead and completed it".

"I remember the day we opened that third lane, effectively increasing capacity by 33%. It was like, 'Where did all the congestion go?' These two changes really saved the day for transportation in the region. It would be horrendous trying to get from one side of the harbor to the other without them."

Since MACPASS was introduced in 1998, there has been a steady decline in the number of users depositing coins, which is just as well, as Snider explains further. "We had 33 million crossings last year so I'd hate to think what things would be like with 33 million people stopping to throw coins into the bins." When he joined in 1994, there were 28 million crossings a year yet more congestion than today with five million more trips. The credit for this lies firmly at the door of the decision to add the extra capacity and introduce ETC.

Other than technology and strategy, Snider reserves praise for the people around him. "Without people who are dedicated to their work, none of this happens," he adds. "One of my most important jobs is to hire well and I'm happy to say I've done that."

The bridge guy

Steve Snider looks ahead to the upcoming IBTTA Annual Meeting in San Diego – and reveals to **Nick Bradley** why his first membership fee 16 years ago is still delivering payback to this very day

Portrait photography courtesy of Halifax Harbour Bridges

When Steve Snider became general manager and CEO of what is now known as Halifax Harbour Bridges (HHB), one of his immediate tasks was to help usher in a new era of tolling technology on the Angus L. Macdonald and A. Murray MacKay Bridges – the two arteries connecting the Halifax Peninsula with Dartmouth in the Halifax Regional Municipality, Nova Scotia. “I remember asking a colleague, ‘Electronic toll collection? Where in the hell do you go to find out about electronic toll collection?’ ‘Easy’, they said. ‘The IBTTA’.

“So I flew down to Florida for the Annual Meeting in Orlando, started making some contacts and learned a bit about emerging technologies and strategies. The year after, in March 1995, a group of us hopped into two cars and went on a road trip, visiting several toll authorities as far south as Richmond, Virginia, to establish whether or not they planned to use ETC, and if they were what their experiences had been.”

Knowing no better, rather than engage with a consultant, Snider and his colleagues sat down to write their own RFP. “We found out a lot about tolling that way,” recalls the 54-year-old, who prior to joining HHB worked in the fishing industry before running a regional transit company, Cape Breton Transit. “I don’t know how much that

A technical tour

According to Snider, Halifax Harbour Bridges is one of the most prominent users of ITS in Atlantic Canada. Obviously, as a toll bridge, a variety of ETC technologies are utilized anyway, with tags and readers courtesy of TransCore. And, of course, with a reversible lane, the Macdonald Bridge is fitted with all the requisite technology to ensure such operations run smoothly and safely.

“One of the bigger challenges we’re facing these days relates to the climate,” says Snider, who in 2003 had to contend with a hurricane sweeping into the harbor – which he would have done

had he not been 3,000 miles away in Paris at the IBTTA Annual Meeting. “My kids didn’t even tell me about it when I phoned in – I guess they didn’t want me to panic. That’s the only time that we have had to close both bridges,” he recalls. “High winds are a challenge for such elevated bridges anyway, but being where we are geographically we have our own fair share of winter storms. Ice and fog can both be very problematic. We have five Vaisala weather stations on both bridges. We also recently installed some large VMS at the approaches, which can direct or redirect traffic and provide

precautionary messages in case of any incidents.

“We also use GPS technology to measure what we refer to as the air gap. We combine this with tidal gauge information from the harbor to calculate what the clearance will be for ships traveling underneath, which stipulated by policy can be as little as 1.3m. You really feel the heat from the exhaust when one of these container ships passes under; it’s like being in the tropics for a moment. Most other bridges would use microwave sensors for this, so I think we’re pretty unique in combining land- and bridge-based GPS data in this fashion.”



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Bridge management

"The difficulty with bridges is that they're a much greater risk," Snider says. "Not only are the maintenance costs per mile much, much greater, the unknowns are as well. I always say that us 'bridge guys and gals' have it easier when it comes to our operations being more compact, but we have greater challenges when it comes to things such as security."

The Macdonald and MacKay Bridges are under constant scrutiny in terms of maintenance and receive a rigorous inspection every year to pinpoint any issues at the earliest possible stage. It's vital that any work that has to be carried out is done so with minimal disruption. "For a CA\$7.4 million maintenance project we carried out this year



on the MacKay Bridge, we paid a 5% premium to conduct operations at night and weekends so as to stay out of the way of commuters. That in itself is a major contribution to keeping traffic flowing in this city."

This seems like an obvious thing to do, but Snider believes it's an area that a lot of others lack – "some don't give a rat's patootie" he says. "I'm not motivated by increasing my shareholders' equity; I'm motivated by providing the most effective and efficient cross-harbor transportation that I can."

This doesn't, however, mean that Snider spends without a thought for balancing the books; he has delivered profit in 15 of the 16 years in which he has been in charge.

road trip cost back then, but boy did we get our payback from the IBTTA membership – it was great value for money and we continue to get payback from our membership today. I believe my organization's investment in IBTTA has been a resounding success and that's why organizations such as ours keep attending."

Mr President

Not even Snider would have thought that 16 years after discovering IBTTA, he would end up as president of the association, a role in which he has immersed himself with the same zest and commitment that's seen him transform mobility in Halifax. "We started discussing what we would like to achieve from my year in charge in about May 2009," he says. "A year is an awfully short time and I stressed to the rest of the executive team that we really need to make sure we were all in alignment in terms of mission and goals; we needed to make sure that we're not going hard left one year and then when somebody else takes over turn hard right. That also means respecting my predecessors as well."

"Being president of the IBTTA doesn't mean you get to run the show," Snider continues. "You get to serve the board and the membership. It's important that I serve them well because the

Technology plays a big part in ensuring smooth operations on both of Halifax's harbor bridges

board, through governance, represents the membership. We've had some challenges in our industry, not least the global economic crisis, so a number of authorities have seen a drop in traffic, which means a reduction in revenue. Some have had to seriously re-evaluate their budgets, which can even boil down to how many people they send to an event such as the IBTTA Annual Meeting & Exhibition. But when times are tough, the



When times are tough, the last thing I would give up is the professional development of my staff, because you rely on them more and more to deliver

last thing I would give up is the professional development of my staff, because you rely on them more and more (perhaps now more than ever) to deliver."

Sustainability

Driving Sustainability is the theme of this year's Annual Meeting and is an issue that isn't ignored in the operations of Halifax Harbour Bridges. "I'm not a geologist so I can't tell you about the world's oil reserves. I'm not an automotive engineer so I don't know much about all of the great improvements that are going to come. And I'm not a sociologist so I don't know all of the dynamics of creating a huge change in a community. But somewhere along the way, our cities and countries have been built around the automobile, with a focus on moving cars and trucks. We need to focus on moving people and goods – the well-being of our economies are built on the ability to effectively and efficiently do that. We need to consider change now and have a choice

A question of financing

"If the government ever decided to divest itself of Halifax Harbour Bridges, I'd be the first in line!" Snider says, when asked if a third harbor cross-over could be built and operated on a concession basis. "But you couldn't just privatize one bridge – you would have to privatize all three, as a concessionaire might implement higher tolls, so in effect you'd be pushing more and more traffic back over the cheaper MacKay and Macdonald Bridges."

"Of course, at the end of the day, I would prefer to see two or three people in every car and if that means my volumes drop, maybe we would need to make an adjustment at some point. I have an easier time adjusting for lower revenue. That's the difference between the boards, commissions, agencies and DOTs versus concessions. The

concessions can have a positive impact and that's around the pricing element; I can go a little bit beyond that element."

There are very few concessionized bridges in North America. Off the top of his head, Snider cites the Confederation Bridge, which links New Brunswick with Prince Edward Island. "This was a concession from the outset," he explains. Opening in 1997, the eight-mile (12.9km) bridge was constructed at a cost of more than CA\$1 billion. "With bridge operations, the trend is more toward making use of the revenue stream to fund other transportation modes. There are a great number of us in the area of bridges that subsidize transit. We don't do that yet in Halifax, but in San Francisco, New York and Boston, there's definitely subsidization of other modes of transport."

rather than being forced somewhere down the road. As most of us in transportation are well aware, the strongest tool we have tends to be road pricing.

“At our IBTTA Annual Meeting in San Diego (September 13-15, 2010), we’re going to get the chance to listen to what’s been going on in California, a state that’s largely been without toll roads. They have some, of course, but California is looking at a number of options to generate more revenue and effect a greater change. We need to do that. Most often, our actions are driven by crisis and I just hope that we don’t reach a state of crisis before we make some wise decisions.”

So what exactly does sustainable transportation mean in regard to Halifax Harbour Bridges’ two crossings? “It’s meeting the mobility needs of the present without compromising the needs of future generations, and it means making use of technologies that help people make the changes to the way they travel that are better for the environment.”

Cross Harbour Needs Assessment

A keen gardener, someone who makes his own wine and enjoys nothing more than a glass or two with friends and family, Snider is proud of the fact that he can do his bit for the environment, especially at a local level. “The environmental impact of how people and traffic move around the region has to be uppermost in our minds,” he insists, especially as rising traffic congestion in the years to come will only make matters worse. “In 2006, we commissioned the *Cross Harbour Traffic Needs Assessment Study*, which was completed in 2008. The upshot of the report was that between 2016 and 2026, capacity across the Macdonald and MacKay Bridges will be such that we’ll need a third crossing over the harbor, either a bridge or a tunnel.” Tough decisions are going to have to be made. “Some people in our community are very skeptical about the ability to alter travel patterns, but what other choices do



Dedication’s what you need...

Snider has traveled most of North America and the world over the past 16 years, attending ITS conferences such as the IBTTA Annual Meetings. What in particular has impressed him about operations elsewhere? “This might be in part out of respect for my very good friend, Ed DeLozier at E-470 in Colorado (who passed away earlier in the year), but I admire their very positive and tenacious approach to going cashless,” he says. “They made the decision to do it, got it under way, and I think the folks

in Denver run a great operation.” Anyone else? “It’s a small thing but I remember seeing a toll lane in Paris set up just for motorcycles; that was nice. I’m also impressed with what Brazil’s CCR has done with its Road to Citizenship program. And although this might be blowing our own horn a bit, last year in Halifax we had a fundraiser for breast cancer with people (mainly women!) donating 11,000 bras, which we strung across the bridge. I had no idea they came in so many shapes and colors!”

Generally, though, what impresses Snider is the dedication of the industry to efficient transportation. “If you look at our educational program for San Diego and you think about some of the programs we’ve offered over the past three or four years, the tolling side of the transportation industry has really stepped up and is dealing with the sustainability and environmental questions and they’re focusing on being part of the solution – not part of the problem.”

we have? It’s either build a new bridge or a tunnel, look at creating a modal shift, or just put up with the congestion. Some people cheer on the idea of congestion; they think the more jams there are, the quicker people will be forced to switch to other modes. It doesn’t work like that. For me, the thought of going back to a 30-minute wait to get onto the bridge structure itself isn’t very appealing!”

According to the report, additional cross-over capacity in the form of a bridge or a tunnel would cost somewhere in the region



Some people cheer on the idea of congestion; they think the more jams there are, the quicker people will be forced to switch to other modes. It doesn’t work like that

The Macdonald Bridge benefits from a third (reversible) lane to assist with traffic flow in peak periods

of CA\$1.1 billion and CA\$1.4 billion, which would necessitate a toll increase, perhaps as much as three to four dollars each way. Currently, ETC users are charged 60¢ while cash users must pay 75¢. “We have not had a toll increase for automobiles since 1992,” Snider reveals, “although if we receive authorization from the Nova Scotia Utility and Review Board, we will be increasing those tolls to CA\$1.00 for cash users and 80¢ for ETC soon. But even going from that to three or four dollars is a huge leap, so my hope is that we can convince people to change the way they travel. I’ve made my position on the various options quite clear in the past. I keep pitching road pricing to the politicians and to the public whenever I get the chance; I’ve talked about it time and time again at our Annual Stakeholders Meeting!

“I had a taxi ride a few weeks back and the driver got talking to me about what I do, so I told him. I could have saved a whole lot of money on studies if I’d have brought this guy in,” Snider laughs. ‘The big problem,’ he said to me, ‘is that we’ve got too much congestion and we need to get people out of their cars, so I think we should consider something like charging people to drive into the city’. I wouldn’t say that’s an indication that public perception of road pricing is changing, but that’s the first time I’ve ever had that conversation in reverse!” ○



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Dutch courage, English lessons

Following the suspension of the Kilometerprijs project – by far Europe’s most ambitious road pricing scheme – is there anything we can learn as other countries press ahead with their own projects? **Trevor Ellis** pores over the political situation, the myths, and what happens next

Images courtesy of Andrew Jalali & M.E. Amrani

At the time of writing, Dutch politicians are trying to agree a coalition to form the next government – a process that may take many more months. In the meantime, activities on the Dutch national road user charging system, the *Kilometerprijs*, are suspended and the future for this project remains uncertain. It is however worth reflecting on the factors that have led the previous government to advance this scheme, to outline the options open to the new coalition, as well as see if there are any lessons in the experience for the UK and other countries.

The Netherlands is one of the most crowded countries in Europe, and even the world. As a Brit, it comes as a surprise that mainland European countries can be more crowded than our small island, but the statistics point to the fact that although it is a smaller country than the UK, it is more densely populated – both in terms of people and vehicles. In fact, the Netherlands has more people and vehicles per square kilometer than any other major European country and even more than Japan, which is widely regarded as one of the most crowded countries in the world.^[1]

What is also apparent is that the Dutch take their transport infrastructure seriously, and have built a denser network of roads than in the UK, particularly motorways. Set against this, the Dutch also pay some of the highest vehicle taxes in Europe, both when they purchase new vehicles, and an ongoing annual tax.

Anyone who has driven in the Netherlands in recent years will recognize that despite this comprehensive road network, there is still major congestion on both urban and inter-urban roads. Indeed,



two Dutch cities, Amsterdam and Rotterdam, feature in the top 20 most congested cities of Europe^[2].

Given these statistics, it is not surprising that the Netherlands has looked at many ways of reducing the congestion on their roads, and indeed they have been at the forefront of many ITS initiatives and technologies. Examples include the use of variable speed limits and average speed enforcement. However, there is also a long history of looking into road user charging.

Serious investigation into road pricing in the Netherlands began initially with the *Rekeningrijden* project, which started in 1988 under the then Transport Minister Neelie Kroes, who is now a vice president with the European Commissioner responsible for the Digital Agenda. This project investigated charging vehicles for passing toll cordons around the four major cities during the morning peak hours, with a fixed charge levied through tag-and-beacon DSRC technology. Various pricing projects have been started and stopped since then, including peak hour vignet for motorways, *Rekeningrijden II*, Express Lanes and Kilometre Charge I.

In 2005, the *Anders Betalen voor Mobiliteit (ABvM)*, the literal translation of which is 'Different Paying for Mobility', program was started, and the road pricing mechanism was changed to a charge based on the distance driven on any Dutch road, using data from a

GNSS-based onboard unit (OBU). This system was termed the '*Kilometerprijs*'.

The *Kilometerprijs* system is possibly the most advanced and ambitious road user charging scheme proposed worldwide. The Netherlands has around 8.5 million registered vehicles, and it is proposed that every one would be equipped with a professionally installed OBU. Provided by the government, they would be one of the most advanced 'smart client' types, where the tariff distances are calculated in the OBU to protect privacy. In addition, they would incorporate a 'trusted element' for maximum security and also have a DSRC capability, so that roadside enforcement equipment could 'interrogate' the OBU to check that it is operating correctly.

In the Netherlands, there is widespread agreement that something needs to be done to ease the country's overloaded road network



Do the alternatives to road pricing work to reduce congestion?

In the UK, we are used to the anti-tolling arguments that the answer to road congestion is to improve public transport, build more roads and increase the usage of the bicycle. By comparison, the Netherlands does have more roads per vehicle (especially motorways). It has train and tram systems that have far more extensive networks, and are more frequent, less

crowded and cheaper than the UK equivalents. Also, Dutch usage of bicycles as a serious form of transport is at levels that would be undreamt of in the UK. Yet, despite all of this, the congestion problems still remain. On this basis, the evidence has to be that these alternatives alone are not enough to significantly reduce congestion, and reduce our addiction to car journeys.



Non-Dutch trucks would also be charged through a secondary system if they do not have an OBU. This would either be through a flat charge per day, or an odometer reading could be declared on entering and leaving the country, and if the distance covered is below a certain amount, then a discount on the flat fee can be claimed.

Overall the charges are designed to be revenue-neutral for the average Dutch road user traveling an average distance in a year. The other vehicle taxes would gradually be phased out as the *Kilometerprijs* is phased in, instead of everyone paying a flat vehicle tax, those who use the roads the most would pay the most, and vice versa. It has been estimated that the scheme would reduce overall vehicle kilometers driven on Dutch roads by 15%, and reduce driver hours wasted in congestion by 60%.

Progress report

So just how far had the scheme gone before the present halt? The original timetable for implementation had a first stage go-live in 2011, with gradually more and more vehicles coming into the scheme until all vehicles were equipped by 2016. In the course of the project this timetable was put back one year. The Dutch cabinet and lower house had approved the scheme in principle in November 2009.

The procurement process was split into two 'tracks'. The first of these was the *Garantiespoor* (guarantee track), which provides the first tranche of OBUs, the charging and enforcement back-office and front-office systems, and some other services. The supply was split into 'lots', and following an open competition, a shortlist of tenderers for each lot had been selected. Initial specifications had been sent to each tenderer, and there had been an extensive dialog phase to refine the requirements and offerings.

It was envisaged that many of the OBUs in the roll-out would be supplied by commercial service providers under what was known as the *'Hoofdspoor'* (main track). Again, potential suppliers had been shortlisted, and a dialog phase had taken place.

Why was the project suspended?

In February 2010, the Dutch coalition government discussed a request from NATO regarding the +2,000 troops that the Netherlands has provided to the conflict in Afghanistan, who were scheduled to be withdrawn in August 2010, although NATO had requested that they be kept on longer. Despite continuing discussions through the night, the two partners in the coalition (the Christian-Democrats Party (CDA) and the Socialist Party (PvdA) could not agree

Public support for road pricing

For the previous UK Labour government, public support was one of the most vexing issues for them. There have been a number of referenda on road user charging. There were votes on the introduction of congestion charging in Edinburgh and Manchester, with both votes going heavily against the charge. In London, the Mayor has already gone out to formal consultation on the continuation of the Western Extension to the London Congestion Charge, although the informal consultation some months ago tends to indicate this vote will also reject continuation of the scheme.

There have, of course, been examples of votes in favor of road user charging schemes elsewhere. Possibly the most notable example is the Stockholm Congestion Charge, where

local residents voted narrowly to retain the system. Opinion polls in London also show that Londoners are mainly in favor of the London Congestion Charge.

The Netherlands also seems to have a public that is more open to the idea of road user charging. A survey was conducted just before the fall of the Dutch government by the Dutch Motoring organization, ANWB, which is the equivalent to the UK's AA or RAC. Nearly 70% of respondents to this survey said that they would prefer some sort of pay-per-kilometer charge over the present fixed taxation.^[3] Having said this, respondents were less enthusiastic about paying a higher charge for peak road usage, possibly indicating that fairness – rather than congestion reduction – was their most pressing concern.

Government terms and major projects

Major projects such as the *Kilometerprijs* have a long lead time. Most successful road user charging schemes have usually been implemented in the lifetime of one government. The *Kilometerprijs* is suspended because the government was dissolved before the term ended. Therefore one prerequisite for implementing a major

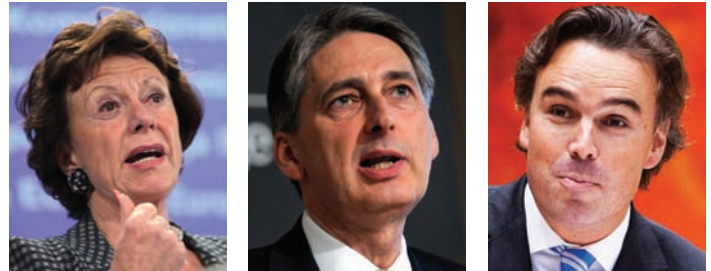
scheme may well be a stable government that is likely to last until the project is implemented. The implication of this for the UK is that any national project should be implemented within five years. This may make highly complex schemes less viable, and also indicates that projects need to be started as soon as possible after elections.

Previous attempts to reduce traffic – from offering incentives to people who carpool to giving away free croissants and newspapers on public transport – have had little effect in the Netherlands



It has been estimated that the scheme would reduce overall vehicle kilometers driven on Dutch roads by 15%, and reduce driver hours wasted in congestion by 60%

(From left to right) Neelie Kroes, Philip Hammond and Camiel Eurlings, all past and present figures in the politics of road pricing



🔄 | Privacy and GNSS-based systems

Again this is a vexing issue, and may be one of the major factors in gaining public support. People do not like the idea of their every movement being tracked by the government.

The design for the Kilometerprijns addressed this by offering a 'smart client' OBU so that actual positional data never went outside the vehicle. Despite this, there still seems to be some privacy concerns amongst the Dutch public^[3], indicating that either this 'technical fix' was not seen as adequate protection, or the message was not put across adequately.

In a way this public concern is curious, as we seem perfectly happy that mobile phone companies can track not just who we call, but also our location at

the time. We are likewise unconcerned that banks not only know all of our financial details, but also can track our movements through the use of credit and debit cards.

It is thus not clear what particular privacy aspect of road user charging spurs the public fear. Is the fear that the information may be with the government, rather than a commercial company? Or is it just that the information exists at all? Or could it be that some objectors do not like paying, and see the privacy argument as more powerful, and with higher moral standing than simply admitting that they don't want to pay. The best way to deal with this vital issue will depend on which of the above is the real underlying fear.

🔄 | The future

Looking to the future of UK road user charging, the new Secretary of State for Transport, Philip Hammond, has stated there will be no national tolling scheme for cars, but that they may re-examine the case for a truck-tolling scheme. He also indicated that using tolls to pay for new roads (such as the Midlands Expressway), may

also be considered. Prior to the election, however, the Liberal party, part of the coalition government, were in favor of a more universal scheme.

One thing the Dutch experience does tell us clearly is that as long as congestion problems remain, the issue of road user charging is unlikely to just go away.

and decided that in view of this they could no longer work together as a coalition. This caused the government to be dissolved and a new election was called for June 9, 2010. One of the less publicized side-effects of this situation was that around 320 programs – including 44 legislation proposals – were declared as 'controversial' on the basis that it was not certain that the next government would support them. The *Kilometerprijns* was one of these. The designation means that no new expenditure is authorized, and so effectively the project is "put on ice" until the new government is formed.

So what happens now?

The general election took place in the Netherlands on June 9 and negotiations to form the next coalition are still ongoing. In England, we're used to knowing who is forming the next government the day after an election. Recently in the UK, for instance, there was panic when it took a week for the ruling coalition to be formed. It's much different in the Netherlands and is likely to take a few months more for the complex negotiations and horse-trading between parties to be completed. Once the new government has appointed a transport minister, he or she will essentially have three options: the project could be restarted in its original form, cancelled altogether, or restarted in a changed form. Of course, it is well beyond the scope of this article to speculate about which of these courses will be followed, although there are lessons and conclusions that can be drawn from the story so far, particularly from a UK perspective. ○

Trevor Ellis advises on road user charging, enforcement, traffic data, ALPR and highway systems. He is also chairman of the ITS UK Enforcement Interest Group. Please email any comments to trevor@trevorellis.co.uk. The author would like to thank Stefan Eisses of Rapp Trans for his help in the preparation of this article

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Collected development

The race is on to apply a new technology to an old problem – the instrumentation of arterial roads with traffic detection equipment. **Nick Bradley** speaks with the experts who feel Bluetooth is the optimal route to a new era in real-time traffic information and more

Illustration courtesy of Magictorch

Ever since the late 1960s – for as long as Phil Tarnoff has been involved in the field of traffic engineering – DOTs have been searching for the industry's Holy Grail: a viable way of instrumenting arterial roads. "But even today, 40 years on, only 6% of the USA's arterials have any detection on them at all," confirms *Traffic Technology International's* longstanding contributor. All of that could be about to change, though, thanks to some smart thinking from what is currently just a handful of experts who have been researching Bluetooth as a potential source of traffic data.

Tarnoff and his colleagues at the University of Maryland can trace their initial forays into Bluetooth back to early 2007, although industry-wide momentum has picked up over the past 12 months in particular, with commercialized products materializing from at least four vendors. "As far as we know, we were the first developers of a Bluetooth tool for monitoring traffic flow," Tarnoff reveals. "We initially began development to support the validation of Inrix's travel-time data in relation to our work for the I-95 Corridor

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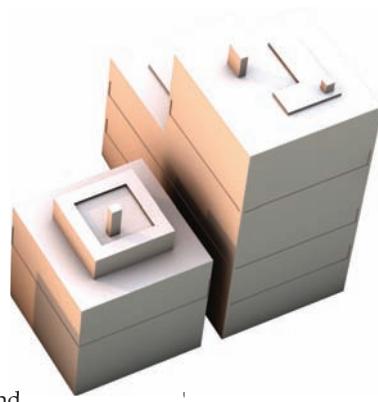
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"It provides additional functionality that up until now may have been the preserve of the DOTs and agencies with more funding behind them," Voigt continues. "For me, this is where Bluetooth changes the game. It brings down the cost and the infrastructure requirements hugely, so smaller counties, cities and municipalities can now enter the game should they choose to."

"We've estimated it brings down the cost in comparison to AVI by a magnitude of two," Puckett states. "An AVI station here in Houston has run between US\$100,000-US\$150,000, covering two directions of a freeway. Our equivalent solution, AWAM (Anonymous Wireless Address Matching), can cost less than US\$10,000. In our field demonstrations at the ITS America Annual Meeting in May, we replicated the data-gathering capability at one location on a freeway with only one of our AWAM devices, whereas the AVI system took a minimum of eight antennae plus two readers to do the same thing. The cost of installing that – not to mention the lane closures, construction, the hard infrastructure needed such as overhead sign bridges for the AVI antennae – all disappears with Bluetooth."

Coalition." Ultimately, though, the Bluetooth data proved more accurate than Inrix's GPS probe data and was generated at a much lower cost than through floating cars. "We estimated the cost per travel-time data point of the Bluetooth data was just 1/300th of the cost of comparable floating car data," Tarnoff adds. As development continued at the University of Maryland, horizons expanded with potential in applications beyond travel information and incident detection. The decision was therefore taken to establish Traffax Inc to market what subsequently became known as 'BluFAX'.

At roughly the same time, academics at the Texas Transportation Institute (TTI) began conducting their own research. "We've been working on probe-based data for 15-20 years; it's just the methods have changed as technology has evolved," says Darryl Puckett, research scientist. Bluetooth, he feels, is the next stage in that evolution. "Texas DOT and Harris County have over 800 directional miles of travel-time monitoring coverage using toll tags and AVI," adds Puckett's colleague, Tony Voigt, a TTI research engineer. "Several of the agencies with which we're closely linked, such as the City of Houston and Harris County, have been looking at bringing travel-time monitoring capability down to arterials but until now installation and maintenance costs have precluded all systems."

"If there is a downside to Bluetooth, it's that it's not a silver bullet," says a refreshingly honest Puckett. "You cannot get the same information that you can with loops or radar. Ultimately, I see it developing as a complementary technology. But in cases where travel time is the main requirement and other factors are not so important, I think Bluetooth's a slam-dunk!"

Privacy protection and filtration

Of course, Bluetooth devices within vehicles might not be the only ones to pass a reader – pedestrians, transit riders, etc, could all be in possession of their own Bluetooth-enabled technologies. Will these not influence readings? "Our host software uses various statistically based algorithms to filter matches that appear to be outliers," explains TTI's Tony Voigt. "These algorithms can be configured based on the characteristics of

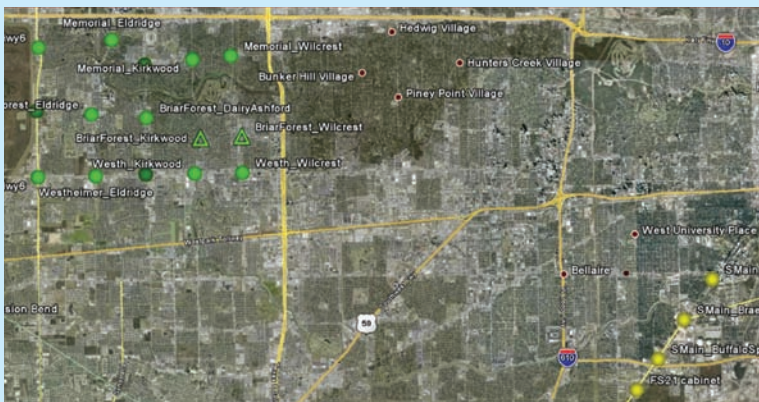
each individual segment being monitored."

The research engineer admits the distinction of transit vehicles versus other vehicles and pedestrians is difficult in practice, but possible using TTI's in-house-developed field software processes. "Much of our intellectual property is based on this. We have seen gains in matches of 50% over other processes with our patent-pending methods, which allow

for a more robust analysis capability, including potentially differentiating transit vehicles.

A further critical aspect of the TTI process is privacy protection. "We have the capability to make the MAC address data collected anonymous before transmitting from the field, which we can do without any reduction in the fidelity of the data." But isn't anonymity a major benefit of Bluetooth? If MAC addresses are not linked to a user, why the extra process? "If there is even a very small chance that a hacker could sniff the communications pathway from field to host, there should be procedures and protocols in place to minimize the threat."

Voigt says anonymizing the data may be more of a benefit if the raw data is archived for later analysis. A partial MAC address when anonymized then archived is less subject to scrutiny, although there are methods to use to enable further use of the data for operational and planning purposes, such as higher-level origin/destination studies.



TTI's AWAM can distinguish 'groups' of Bluetooth devices on a particular route

Proved in the field

Arguably the highest-profile deployment to date is on the Eisenhower Expressway in Chicago, Illinois, which features BlueTOAD, as developed by the Wisconsin-based company TrafficCast. Neal Campbell, a product of the Motorola production line, is TrafficCast's CEO. "Last year, I got together with a few guys and we just started penciling some ideas down about producing a real-time, connected Bluetooth device," he says of BlueTOAD's origins. "We built it on standard cell phone platform technologies, processors and modules. We wanted it to be completely live and autonomous, so at first we just focused on individual technologies."

BlueTOAD has enabled Illinois DOT to maintain the communication of vital driver information throughout the I-290 project, when extensive congestion and delays are likely



The team worked up some magic as far as detection ranges were concerned as well as the speed with which Bluetooth devices could be detected. "Academics sometimes get caught up in the bits and bytes, whereas the management team I've assembled know about industry," Campbell says. "There's nothing simple about wireless real-time communications and very rapid Bluetooth detection. That real-time aspect was really our focus. The people I've hired have years of experience; they've built real mobile phone systems before, which I think has had a tremendous impact on our progress."

He is not spinning the story here either. In just over a year, TrafficCast has taken BlueTOAD from sketches on paper to units being deployed – either commercially or at trial stage – in 12 US states. Campbell won't reveal how much has been invested into BlueTOAD, but will admit he has backing from a venture fund. Regardless, he insists the achievements over the past year are down to the people around him and the product offering – not a blank check. "We're getting match rates in the 3-6% range," he says. "Most traffic science will tell you that if you're getting 5% or 6% sample rate, you've got very, very accurate real-time traffic information. And that's what we've found. We do a lot of benchmarking, taking cars with GPS receivers on the road, driving them down the expressways, and with BlueTOAD we're literally within tenths of a mile per hour in respect of our travel times."

Alongside its flagship deployment on the Eisenhower Expressway, TrafficCast has also recently worked with Wisconsin DOT on a trial in which BlueTOAD units were deployed to analyze the proportion of vehicles leaving a particular freeway exit serving a local tourist attraction. "We strategically placed our BlueTOAD units at specific locations to ascertain the percentage of flow based on Bluetooth densities, while at the same time conducting origination and destination studies, obtaining real-time travel data, and even valuable information for metropolitan and planning organizations. What's nice about this technology is that it can show you what's happening before, during and after construction, and in the long term what impact those changes had on the infrastructure."

In this respect, Campbell thinks that performance measurement of other ITS deployments could be a key area for technologies such as BlueTOAD, which can be installed and collecting data within 15 minutes. "What we're seeing with the Reauthorization Bill is that performance metrics have to be supplied," he says. "US taxpayers have spent all of this money on new infrastructure, so they want to know what the real, measurable benefits of all that investment have been. As a result of its relatively low cost, I fully expect Bluetooth to become the de facto performance measurement tool."

The perfect complement?

A further deployment of Bluetooth in Minnesota has also been announced by Iteris, as part of Mn/DOT's 2009/2010 ITS Innovative Idea Program. Developed using software and hardware licensed from Savari Networks in Santa Clara, the technology is being analyzed at six intersections. For Iteris to switch on to Bluetooth so quickly is a shrewd move, as it could technically be integrated with



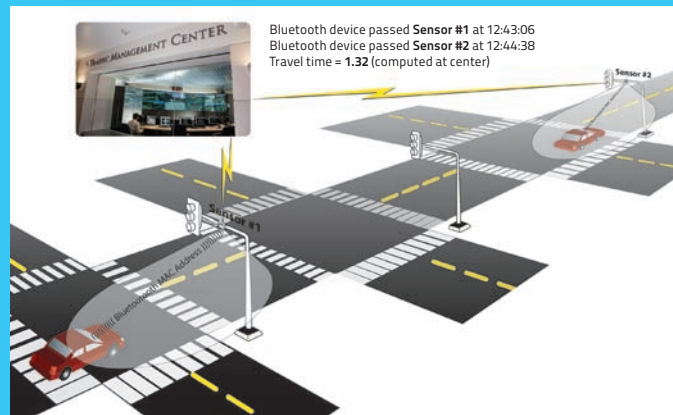
Bluetooth: how does it work?

Every Bluetooth device has a unique Media Access Control identifier, known as a MAC address. If the device passes a Bluetooth reader on the roadside, the sensor picks it up, timestamps it, and when passing another reader further down the road, the exercise is repeated. The data can then be transmitted to a central server, at which simple travel time calculations are performed.

"MAC addresses are unique 48-bit addresses assigned by manufacturers of consumer electronic wireless devices such as cell phones, laptops, hands-free headsets, MP3 players and GPS devices that have either WiFi or Bluetooth capability," explains Abbas

Mohaddes, president and CEO of Iteris. An 'inquiry' mode will establish a link between a pair of devices, and these inquiries are made whenever a device is 'paired' with another device, in doing so allowing a Bluetooth receiver to pick up a MAC address when the device passes by within the respective range.

According to Mohaddes, the actual range of a Bluetooth receiver is dependent on the strength of the device itself. "We tend to focus on a power class that operates in a range of approximately 100m, so we set our device at key locations and collect data as vehicles pass each device, then we calculate their travel time from one point to another."



The Iteris system works by timestamping a MAC address at two different points and then calculating a travel time at a central server



The only game in town for arterials

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



"We differentiate between the market for permanent installations for producing real-time data and the market for temporary installations as an alternative to floating car studies," says Phil Tarnoff, CEO of Traffax Inc. He suggests that as consultants and other data-collection companies become aware of the trade-offs between automated (Bluetooth) and manual (floating car) data collection techniques, the demand from the market will increase rapidly, to the extent that he forecasts the floating car will become extinct in the next five years.

"Penetration of the real-time (permanent) market is also rapidly increasing," he adds. "But the competition for real-time travel data is fierce due to the availability of competing technologies such as probe data, cellular geolocation

technology, toll tag technology, and the use of conventional detectors such as loops, radar, and so on.

In terms of both cost and accuracy over the use of floating cars for traffic studies, Tarnoff says Bluetooth has a significant edge. "For real-time applications, it measures travel times much more accurately than point detection devices (conventional detectors) as the Bluetooth units are measuring space mean speed, not point mean speed."

Also, when measuring travel times on freeways, it has a significant cost advantage over toll tag devices that operate in a similar fashion, as a single Bluetooth unit can measure flows in all lanes and in some cases both directions from a roadside installation, whereas the toll tag units must be mounted over the lanes.

"When measuring travel times in real time on arterials, Bluetooth technology is currently the only game in town," Tarnoff states. "Vehicle



Many applications exist for Bluetooth technology that can leverage O-D capabilities

probe technologies such as those offered by Inrix have demonstrated that they provide adequate accuracy for most traveler information systems, and offer the benefit that the data can be purchased from the vendor without requiring the installation of roadside infrastructure. But the cost of installing and maintaining Bluetooth equipment is comparable to that of the purchased data, while providing larger sample sizes that are essential for arterial and ramp data collection."

several of its existing ITS products, in doing so offering customers added functionality.

Such a strategy is confirmed by Ravi Puvvala, CEO of Savari Networks, which developed the hardware and software. "We offer a future-proof solution by incorporating technologies such as DSRC, Wi-Fi, 3G and Bluetooth into a single device. DOTs can not only use our platform for accurate travel-time measurements but also for other applications such as emergency vehicle priority, congestion pricing, etc. Furthermore, when combined with existing ITS equipment such as video detection or even ALPR, we believe that DOTs will find a huge value proposition in our ability to use and bridge today's infrastructure with tomorrow's needs. When considering the multi-faceted nature of our solution, the cost of installation and maintenance of our device is negligible."

"We have been looking at various technologies for travel-time calculations," confirms Abbas Mohaddes, president and CEO of Iteris. "We've looked at GSM for over 10 years, but there are technical challenges, although it's certainly progressed with the advent of new smart phones." Mohaddes also feels that ALPR currently has a cost disadvantage, suggesting agencies might be less than enthusiastic about deploying a network of license plate readers. He adds, "Loops are just starting to be utilized for travel-time calculations, but in general we don't favor

invasive technologies for environmental, installation and maintenance cost reasons. And although cell phone tracking, or Wireless Location Technology, has proved its worth along freeways, it may be of less value in an urban arterial setting due to the reduced distances being traveled, as well as interference from buildings." Arterials, he goes on to explain, also introduce added complexity as more paths are potentially feasible and systems must be able to correctly distinguish between wireless devices that aren't located within a vehicle and those that are. Bluetooth, Mohaddes is sure, ticks many boxes so Iteris will continue to investigate its use in other projects and products in the future.



US taxpayers have spent all of this money on new infrastructure, so they want to know the real, measurable benefits of all that investment

Big business?

Alongside products from TrafficCast, Traffax, Iteris/Savari, and TTI's soon-to-be-available AWAM, suppliers elsewhere have made advances, notably Trinité Automatisering in the Netherlands with BlueTracking. So how big could the market be? "Outsiders to ITS might assume the market could be deduced by dividing the number of miles of urban roadway by sensor installations at two-mile intervals," suggests Phil Tarnoff. "It's actually more likely 5-10% of that, so the Bluetooth 'pie' might only be large enough for several small suppliers." Historically, he concludes, agencies have been slow to make use of real-time travel-time data on arterials, so for this reason he predicts sales expanding gradually. "But as Bluetooth is one of the few techniques capable of measuring arterial travel times, it could dominate this segment of the market for years to come." ○



Korea path

As well as adding a splash of color to the 17th World Congress on ITS, Busan is set to provide the perfect platform for practitioners to exchange knowledge and experiences of ITS research and deployments. A key figure from the organizing committee tells **Saul Wordsworth** why he can't wait for the doors to open

Main image courtesy of Scott Abraham

The 17th ITS World Congress is almost upon us and anticipation is in the air. This year's host is Busan, Korea's second largest city after Seoul. Korea is a historical backer of the ITS industry. The first time it held the World Congress on ITS, back in 1998, the country hoped to accelerate the growth of intelligent transport systems in Korea by raising national awareness and government support. This time around, its priorities are rather different. Dr Young-Jun Moon is the chairman of the International Program Committee for this 17th installment: "We now have plenty of support for ITS here in Korea," he reveals. "What we as a nation and even as an international community need to think about is the future. Transport contributes 28% of total global emissions. Priority has to be developing an environmentally friendly and sustainable transport system."

The theme for this year's Congress is 'Ubiquitous Society with ITS'. "This is like ITS 2.0," Moon continues. "It means that transport intelligence should be accessible wherever you are. The three main strategies of ubiquity, transparency and trustability will be threads running throughout the event. I for one cannot wait for it to begin!" ○



The chairman

Dr Young-Jun Moon is a Research Fellow and director of the Department of Advanced Transportation Research at KOTI, the Korea Transport Institute. After schooling in his home country, he moved to the USA and received a degree in Civil and Environmental Engineering from the University of Illinois at Urbana-Champaign. During the early 1990s, Moon worked for Korea's Agency for Defence Development (ADD) as an engineer developing systems for surface-to-air missiles. After returning to the USA in the mid-1990s to complete his doctorate

in transportation engineering he finally came home for good in 1999 and started working for KOTI.

Moon's areas of particular interest at KOTI include traffic safety and control, traffic flow theory, cooperative vehicle and highway infrastructure systems and telematics and transportation information systems.

"For more than 20 years, KOTI has played a key role as a national leader for research and development in transportation," Moon explains. "Long may it remain that way!"

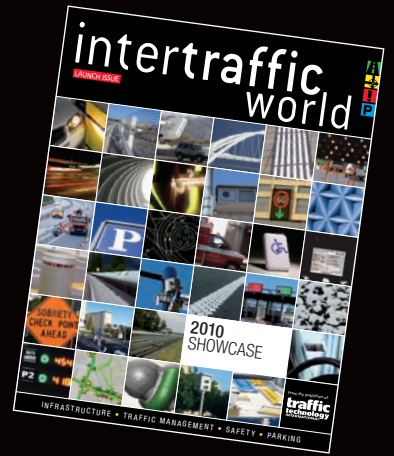
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➤ | Road safety in Korea

"Our road safety record is slightly inferior to other OECD (Organisation for Economic Cooperation and Development) countries but we are definitely on an upward trend," Moon insists. "In my opinion, the driving style in Korea is more aggressive than the West, especially in the cities. At intersections everyone thinks it is their right-of-way."

Around 10 years ago, there were 10,000 fatalities a year – quite a high number for a country with just 50 million inhabitants. By 2005, this figure had fallen to 6,000 and remains below it. "That we've reduced this number is almost entirely due to ITS," Moon feels. "A decade ago, we upgraded and modified our signalized intersection systems. We have also updated all driver information systems and VMS, which means in places where there are hazards or sharp bends in the road, ITS flags this up and alerts you to the danger."

➤ | ITS on the roads of Korea

"Here in Korea we are able to deploy technology in the field very quickly because there is a close collaboration between the government, industry and private research," Moon reveals. "Korea is a good example of a public-private partnership whereby private business is funded in part by the government. Often there is a Memorandum of Understanding that stipulates technical developments go to the government first on account of their investment."

Today in Korea, 17 million vehicles are registered out of a population of nearly 50 million; 10 million of these vehicles are fitted with satellite navigation systems and five million with the Hi-Pass electronic toll

collection system, which according to Moon is "a great example of Korea using technology to integrate transportation infrastructure management and information systems". More than 40% of commuters receive real-time traffic information while driving and more than 70% of urban buses now have information for public transit users.

"Around one in five people now owns a wireless smartphone," he adds. "We are working hard on making the most of this new development by making the smartphone into the ultimate nomadic device. This is what we mean by 'the ubiquitous society with ITS' – the opportunity for all to receive real-time transportation data and information wherever they are."

“ For the mobile demonstration we will focus on real-time traffic information, the transfer of information, direction guiding services, and multimedia services based on mobile technology



➤ | World Congress highlights

"We will showcase both network- and mobile-based systems at the Congress," reveals Moon. "The network system will connect traffic information systems using DSRC, IPTV and Intelligent Vehicle System with WAVE communication around the conference center. It will also provide relay systems using mobile-based ITS service demonstrations, connecting the demonstration vehicle for passengers outside the center. For the mobile demonstration, we will focus on real-time traffic information, the transfer of information, direction-guiding services, and multimedia services based on mobile technology." The mobile demonstration will feature

a Smart-Planner that will provide all the required information for Congress attendees, including registration services, main event information, location services and shuttle bus reservations. "We have many big questions to address at the conference," Moon says. "Do we do just enough to satisfy our quest for technological innovation or do we improve it for future generations? Are our goals for the future of ITS safety, security and convenience or green sustainability? More than 1,000 scientific and technical papers have been submitted [some of which are detailed here] for the event and we hope to address them all during the five days. I am just looking forward to listening."

➤ | How Korea solves congestion

During peak hours, the capital city Seoul along with the busy metropolitan areas of Busan suffer from very heavy congestion. For the most part, these problems are quickly resolved by ITS.

"After coming to ITS later than the West, we have truly embraced its presence here over the past 20 years," insists Moon. "Many of our vehicles are equipped with Transport Protocol Expert Group (TPEG) combined with the broadcast system, Digital Multimedia Broadcasting (DMB). This means each driver has a live congestion map fed into their car. As a result, although we do have pockets of congestion here in Korea, more often than not they are quickly resolved as a result of drivers being given the information they require to navigate around incidents and construction zones."



17th ITS World Congress, Busan 2010



"Ubiquitous Society with ITS"

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i | FCD and intersection delays

Tuesday, October 26 (16.00-17.30hrs)

Harry Lahrman, Aalborg University, Denmark

Traditionally, the mapping of flow rate in a road network has been based on spot and intersection counting. Using these counting techniques, detailed information about traffic at a few spots in the road network is obtained. However, these techniques give no exact information about traffic only a few meters away from the measuring spots.

The situation is the opposite when it comes to logging data from GPS receivers. Here, detailed information about individual cars in the entire road network is obtained. However, the GPS data is only available from a small subset of the cars. Where the challenge of traditional spot measuring has been the estimation of traffic behavior outside the spots on the basis of single point measurements, the

challenge of using Floating Car Data (FCD) is to estimate general traffic behavior based on very detailed information from a small subset of cars.

Researchers from Aalborg University have developed a method to determine travel time, congestion levels and delays in signal-controlled intersections using FCD. Four entry points and four exit points are defined for a four-leg intersection. The times at which an individual vehicle passes are established, first an entry point then next at an exit point and obviously the time elapsing between the vehicle passing the entry point and then the exit point is the travel time of a single trip. This calculation is made for all the trips passing through the same



intersection after which data is aggregated to find average travel time for all trips through the intersection. In grouping travel-time data by time of day, congestion level and delays can be obtained. Assuming that trips made between 09.00 and 06.00hrs are not delayed by other traffic, a so-called 'free-flow time' can be calculated. Finally, by relating the 'free-flow time' to the actual travel time of, for instance, the morning peak hour, the average delay and the congestion

level can be calculated. On the basis of the traffic volume of the intersection in question, the total delay can be calculated.

The method has been tested in two signal-controlled intersections. The conclusion is the data gathered is that the method yields valid travel times for the individual trip. In addition, good estimates of mean travel time variation over a 24-hour period are made possible if a sufficient number of trips are available.

i | Toward 3D LIDAR processing

Tuesday, October 26 (14.00-15.30hrs)

Philipp Lindner, Chemnitz University of Technology, Germany

Laser sensors (LiDAR) are common in today's vehicle environment-recognition tasks for ADAS applications. The benefits of active scanning laser sensors include a high range of measurements for distance and horizontal field-of-view as well as high spatial resolution – which are attractive for an automotive environment detection sensor. To

fully exploit the potential of these kinds of sensors, custom signal-processing algorithms have to be developed. Recent and future approaches for laser-based vehicle environment recognition have to address and solve challenges such as multipath propagation, multi-echo signals

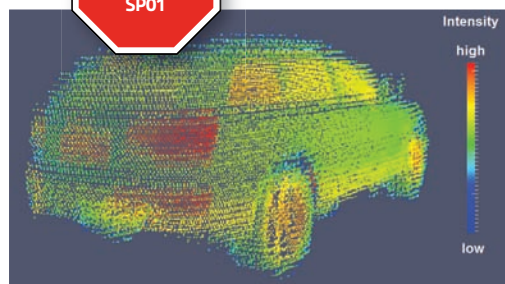
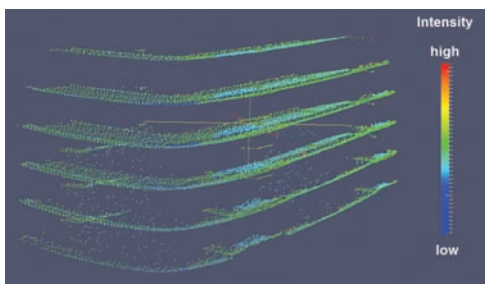
and backscatter from the road surface and the roadside.

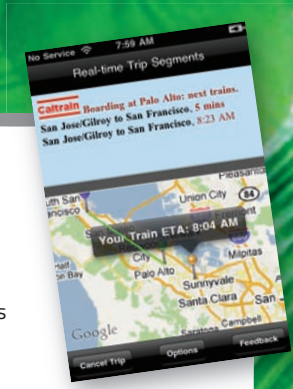
One of the most promising yet challenging features in scanning laser sensors is multi-layer technology, which uses multiple layers of laser light stacked upon each other to obtain sensor readings in three dimensions, in doing so measuring the height of potential obstacles. Estimating the height of objects is of particular importance to be able to decide whether to activate a safety system (obstacle) or not (i.e. for a pothole or curb).

A practical problem facing researchers and engineers

today is the negative influence of the vehicle's dynamics on the laser measurements. Vehicle pitching, for example, is caused by accelerations and decelerations or from hitting a pothole. An issue introduced in such a situation would appear as a false laser measurement, generated by the road surface or as a wrong estimated obstacle height within the vehicle environment.

The presentation will detail a practical approach using the LiDAR itself as a sensor for the vehicle's pitch angle and to recalculate a correcting factor for the laser measurements. Examples for LiDAR-based 3D obstacle detection will be shown as well as a system evaluation based on simulated groundtruth laser data. In addition, it will be shown that obstacle feature estimation can be significantly improved by using the LiDAR based self-compensation of the vehicle's dynamics.





The connected traveler

Tuesday, October 26 (14.00-15.30hrs)

Jim Misener/Liping Zhang, University of California, USA

Researchers from California PATH will describe an integrated multimodal travel information (IMTI) application, PATH2Go, which integrates real-time transit, traffic and parking information.

PATH2Go was developed for a field test on the main corridor connecting Silicon Valley and San Francisco Bay to establish whether travelers will benefit from real-time IMTI and therefore be more likely to consider using transit. It is,

at least in North America, one of the first applications where virtually all of the data from all the potential modes is real-time, allowing for accurate and timely information delivered pre-trip and en route, so allowing high utility and, it is hoped, user satisfaction and adoption.

PATH2Go integrates a web-based multimodal trip-planning tool that uses real-time information of available transit, traffic and parking availability, a web-based search

tool that finds real-time transit arrival and schedule information and a mobile app that provides personalized en route transit trip information. PATH2Go integrates these major components of traveler information into one platform to make it easier for travelers to access and really use real-time information. Based on integrated data sources, PATH2Go has included some experimental features to improve the state-of-the-art IMTI systems, including a comparison of multimodal trips at a glance and integration of mobile- and web-based apps.

A field test lasting several months involving commuters

Traveler Information Services SPO2

along this corridor began in August 2010. In that field test, data will be collected for performance analysis, including accuracy and performance of algorithms (GPS matching, scenario parsing, etc). Participants will also be asked to evaluate the usefulness, timeliness and accuracy of the information, the results of which will be reviewed to verify how the integrated service would affect travelers' choices.

Analyzing driver fuel economy

Tuesday, October 26 (16.00-17.30hrs)

Adrian Zlocki, RWTH Aachen University, Germany

Driving strategies in terms of vehicle acceleration or deceleration determine fuel consumption and energy recuperation, especially for hybrid vehicles.

Next to the driver, who does not always adapt the optimal driving strategy, technical systems can recommend an optimal strategy or provide an optimized longitudinal vehicle control – e.g. for ACC systems. The extra degree of freedom within the powertrain of hybrid vehicles can be used in intelligent driving strategies.

During this presentation, a methodology on how to quantify the fuel-reduction potential for different driving strategies in different driving scenarios is described. In a first-step reference, measurements of different drivers are recorded to determine the baseline for the quantification of the possible fuel-reduction potential against a realistic reference. Afterward, the representative average driver for each scenario



Green Mobility SPO6

is derived from these measurements. Together with the reference profiles of the slowest and the 'sportiest' driver out of these velocity profiles, input values for the simulation of different driving strategies are generated. Therefore a simulation model of the hybrid vehicle and a model of the scenarios are available in MATLAB/SIMULINK. The vehicle model represents the powertrain of the hybrid vehicle and allows a calculation of fuel consumption and the state of charge of the hybrid battery.

The fuel-reduction potential for different driving scenarios and strategies has been calculated and the results will be compared and shown. The method is applied for designing fuel consumption-optimized ACC in conventional and hybrid cars.

Combining modeling levels

Tuesday, October 26 (14.00-15.30hrs)

Alexandre Torday, TSS-Transport Simulation Systems, Spain

Rather than promoting any one modeling approach as a one-size-fits-all solution, TSS feels that setting one model against another creates something of a pseudo dilemma. Few transport engineering projects can be neatly categorized as 'static assignment' or 'microscopic' and indeed such categorization is no longer realistic or even desirable.

The choice of dynamic traffic assignment technique creates yet another pseudo dilemma – equilibrium assignment versus stochastic route choice. Although the former excels in computing habitual routes, the latter is superior for dealing with non-recurring congestion. The need for both of these assignment methods

in an online traffic management scenario dictates two more decisions that influence the architecture of Aimsun – both methods must be available and combined with either mesoscopic or microscopic modeling.

Although these design decisions seem to rid Aimsun users of methodological pseudo dilemmas, they cannot overcome the fact that meso and micro models are often needed concurrently; the meso offering the scale and the scope and the micro offering the detail.

TSS-Transport Simulation Systems will demonstrate a hybrid simulation – a concurrent mesoscopic and microscopic approach that promises to combine the benefits of both at minimal performance cost. The proposition is for a single multi-level framework and software architecture, which is not only convenient for the user or developer but also necessitates a coherence of the two models – the ultimate reason why fusion is the way forward.

Modeling and Simulation (I) TP005



i | Update on the Australian IAP

Tuesday, October 26 (14.00-15.30hrs)

Charles Karl, Transport Certification Australia, Australia

The Australian Intelligent Access Program (IAP) is now fully operational, providing a nationwide framework for vehicle GPS telematics solutions that permits both regulatory and commercial uses.

The program has five private sector telematics companies certified as IAP Service Providers, giving transport operators a genuinely competitive market from which to choose their preferred IAP Service Provider.

Currently, four Australian states – New South Wales, Queensland, South Australia and Victoria – have operational IAP Applications. The IAP can deliver significant benefits for the transport and logistics sectors and the broader community, including increasing road transport industry efficiency and

productivity, providing for safer, more productive and compliant heavy vehicle operation, and reducing compliance costs through more efficient administration procedures. It can also promote sustainable road infrastructure, increase the range of concessions that road authorities can offer transport operators, and optimize road freight policy, including on-road enforcement activities. Finally, road safety could be improved, as well as the public perception of heavy vehicle movement management, all while reducing the environmental effects.

Transport Certification Australia (TCA) – the government-owned organization administering the IAP – is also managing a number of key projects related to



Regional and National Initiatives TP006

the use of regulatory and commercial telematics.

In December 2009, for instance, TCA delivered draft specifications for electronic heavy vehicle speed and driver fatigue monitoring (also known as the Electronic Work Diary (EWD) project) to government, specifications for which will be released for public consultation in the near future.

An operational pilot with onboard mass monitoring (OBM) of heavy vehicles in the major

eastern states of Australia is expected to commence in early 2011 based on draft onboard mass-monitoring specifications developed by TCA.

Meanwhile, a new work item, ISO 15638 Framework for collaborative telematics applications for heavy vehicles, has been developed as a first draft and will be discussed at the International Standards Organisation Technical Committee 204 meeting in South Korea in November 2010.

i | A way to increase ISA adoption

Tuesday, October 26 (14.00-15.30hrs)

Jonathan Guard, Avego Limited, Ireland

Over the past 10 years, there have been extensive trials and demonstrations of the use of Intelligent Speed Adaptation (ISA) technology but there are no signs that adoption at commercial scales has occurred anywhere yet to date.

The goal of the Galileo Speed Warning (GSW) project was to develop an innovative product that could be used to reward good driving behavior. The result of this is the CARAT (Continuous Assessment of Road ATtributes) Counter, which accumulates

points when a driver maintains speed under the speed limit for a given road. If the driver breaks the limit, they stop generating CARATs. In terms of the rewards aspect, CARATs can be traded for rewards, analogous to airmiles or retail loyalty cards. In time, it is envisaged that the scheme could be extended to cover other aspects of a driver's behavior, including harsh braking, dangerous overtaking, etc.

The image is of the ISA unit, which shows a face (smiling when the driver is below the speed limit, and frowning when the driver is above the speed limit). The points score to the left of the face shows the CARATs achieved by the driver and the points score below the potential CARATs that could have achieved had speed limits been observed. Once the driver has completed a journey, the CARATs can be transferred using a

Experiences TP007

memory stick to a computer and uploaded to a dedicated website.

A number of demonstrations of the prototype CARAT Counter were carried out in Dublin, London, Gouda and Brussels. For the London demonstrations, the CARAT Counter was used by TfL as part of its ongoing ISA trials.

The purpose was to assess how the system would be used by actual drivers. Using a bespoke map and four TfL drivers, a four-week study was carried out, which concluded that the drivers found the system safe, clear, consistent, understandable and intuitive. Being a prototype system there were some issues raised about the form factor of the device and GPS accuracy.

The target market may eventually be mass-market, but feedback from stakeholders has shown that specific markets such as young drivers on their parent's insurance cover, may be the early adopters for ISA.



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i Safer rural workzones

Wednesday, October 27 (11.00-12.30hrs)

Theodore Smith, Noblis, USA

To address some of the issues associated with rural workzone fatalities, the US Department of Transportation selected the California Department of Transportation and the Western Transportation Institute to demonstrate and validate the Augmented Speed Enforcement System (aSE). Augmented Speed Enforcement differs from traditional automated speed enforcement in that it notifies a linked CHP officer to manually track and stop the offender. ASE

communicates relevant speed, violation, and hazard information to CHP officers and workers in the construction zone.

Portable radar stations (sensors) track the speed of vehicles exceeding the advanced workzone speed limit sign. Violators identified by their license plate will receive a speed warning on a changeable message sign (CMS) at the entrance to the workzone. Once the vehicle



enters the workzone, a series of 'smart cones' track individual vehicle speed and synchronize the cone light display to 'highlight' and follow any violating vehicle. A local pager network is configured to automatically alert (vibration mode) only those workers in direct proximity to the detected hazard.

The system will also incorporate a 'panic mode' that any worker can trigger in the case of an injury to automatically contact the site supervisor who can request public safety assistance to the workzone. Those vehicles that do not adhere or adjust to the posted speed limit for the workzone will be notified that they may be subject to a speed



citation with an additional CMS at the exit of the workzone. Relevant information about the violating vehicle (e.g. duration of violation, maximum speed, average speed, license plate, vehicle photograph etc) will be communicated and displayed to downstream CHP officers who can then use their judgment to locate the vehicle and cite the driver.

i Building value in ITS services

Wednesday, October 27 (09.00-10.30hrs)

Pekka Leviäkangas, VTT, Finland

ITS services need to be developed and there is potential for new business opportunities and investors, but the value of information must be properly assessed. The first task is to identify which value definition is in fact on the table. The value of information is built out of value attributes. The value attributes of information are not independent, but associated with each other and there are conceptual and semantic challenges in treating them separately. But the dependences do not diminish their usability, as applications and use cases are so numerous. It goes without saying that attribute dependencies are very contingent and may vary significantly between contexts. For example, such attributes include cost of information, effectiveness, timeliness and relevance. The challenge is that the weight and importance of these attributes change along the value chain, hence creating

a value asymmetry in the service supply chain. The management of different functions of the service supply chain must work together to achieve the total value at the end that meets the end-users' needs. Horizontal integration strategy is one of the solutions and strong quality management of the whole service process is the first obvious answer – integrating the service supply chain under the same strategic management will undoubtedly mitigate at least partly the value asymmetry problem.

Stakeholders in the service supply chain will look into all attributes, but the emphasis for example could be on cost, uniqueness, availability and accessibility. If these are required and yet they fail the test, it is hard to see stakeholders putting effort into building up the service. All other attributes must also pass, but some might be improved more easily – e.g. by technical means.

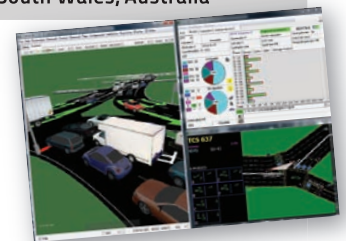


i Operating SCATS in simulation

Wednesday, October 27 (14.00-15.30hrs)

Christian Chong-White, RTA of New South Wales, Australia

Traffic simulation studies can be used to evaluate and optimize policy choices that affect adaptive traffic control (ATC) systems. Appropriate modeling accuracy of an ATC system is required to ensure that study outcomes are defensible. Many simulators offer the capability to model traffic signal logic by providing internal capability to model traffic signals and associated logic. These often require modelers to recreate the logic of the real control system of interest. The Sydney Coordinated Adaptive Traffic System (SCATS) provides an alternative facility, known as SCATSIM, which builds on the SCATS traffic management platform developed by the RTA of New South Wales. Where a modeling problem concerns sophisticated and proprietary ATC systems, internal simulator facilities can require estimating and/or simplifying the real ATC logic; the risk is increased modeling error and diminished



derived modeling value. SCATSIM enables operation of a real installed SCATS system within an accommodating traffic simulation model. SCATS interfaces to the simulator to primarily facilitate the communication of simulated traffic signal states and detector actuations. By using the real ATC system, the need to simulate the control system behavior in SCATSIM is removed – only simulation of the road network and road users is required, which ensures accuracy of control decision-making within the simulated world. But when using SCATSIM, there remains the big challenge of ensuring the modeling experimental design considers the intricacies of the relevant SCATS installation.



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i | Network management

Tuesday, October 26 (14.00-15.30hrs)

Frank Ottenhof, Trinité Automation, the Netherlands

Today, most management systems used for network management cannot communicate with each other. A standard interface between the different management systems is missing. Traffic management would be more effective if all systems could cooperate, so systems could exchange information with other systems in other regions. In this way, it would be possible to coordinate traffic management between different management areas.

The standardization of the systems will ultimately lead to higher purchase intentions for road authorities, which can be best explained by using the idea of 'network effects'. When a 'network effect' is present, the value of a product increases when more people use the same product. A fax machine is a proper example in this case. If only one person has a fax, then the fax is worth little as there is nobody to send a fax to. The fax becomes more valuable when

a second person buys a fax. Eventually, when many people use a fax, the fax becomes really valuable. As indeed with that single fax machine, millions of people can be reached. In network management things are no different. As more road authorities plead for standardized Network Management Systems, the systems become more valuable. This will ultimately lead to a rise in purchase intent.

Suppliers should become more aware of this. Most suppliers of management systems currently have a monopoly. As the systems of different vendors cannot communicate with each other, road authorities are forced to purchase and maintain their equipment at one and the same supplier. Standardization provides a solution to these 'vendor lock-ins'. At the World Congress, Ottenhof will emphasize that suppliers need to consider standardization as an opportunity to significantly increase their market rather than as a threat to their monopoly.



i | Distance-based HGV tolling

Wednesday, October 27 (14.00-15.30hrs)

Brian Michie, EROAD, New Zealand

EROAD has implemented the world's first autonomous GNSS/CN tolling system for HGVs in New Zealand. The EROAD system does not rely on specialist enforcement equipment nor gantries, and could be applied to any road network to implement distance-, mass-, time-, location- and emission-based charging.

The EROAD technology platform was designed to modernize New Zealand's existing weight-, distance- and location-based Road User Charge (RUC) regime. Engineered to deliver an integrated end-to-end solution, the EROAD eRUC Management System encompasses a secure electronic distance recorder (OBU) and a bank-grade web-based payment gateway to purchase and manage RUC and monitor vehicle activity.

The eHubo OBU utilizes a combination of GNSS and GPRS, providing for maximum flexibility and the ability to support network-wide tolling. Security and integrity has been built



into the eHubo design and web application to protect and secure interfaces and information. The system operates across all New Zealand roads, consisting of 92,000km of public roads and an extensive network of private roads.

This presentation will provide an overview of EROAD and the institutional arrangements underpinning the move to eRUC in New Zealand. The innovative model means that the government has not incurred any costs to develop or operate an electronic HGV tolling service. In addition, the institutional model encourages the electronic toll provider to be innovative and service orientated because they rely on voluntary take-up within the HGV industry.

i | The SafeTRIP project

Tuesday, October 26 (14.00-15.30hrs)

Guy Frémont, SANEF, France

SafeTRIP started in October 2009 and will go on for three years with the objective to improve the use of road transport infrastructure and to optimize the alert chain in case of incidents. This will be achieved through



an integrated system from data collection to safety service provision. SafeTRIP builds on a new satellite technology, S-band communication via the WZA satellite, which was launched by Eutelsat in April 2009. The S-band transmitter is optimized for multimedia content delivery and two-way communications for onboard vehicle units, and is interoperable with 3G. The new technology provides an opportunity to progress beyond the state-of-the-art, allowing

two-way communications via small omnidirectional antennas on the mobile units.

In SafeTRIP, the consortium chose to develop the full potential of this platform through extensive user requirements and technical research, experimentation and evaluation in field trials. To produce the best system – and to ensure that end-users will benefit of this integrated system once deployed – SafeTRIP will develop and trial different applications in various contexts, evaluate benefits and opportunities for a range of stakeholders: individual travelers, transport businesses, emergency services, local and

national government. The main target users are the drivers and passengers of cars and coaches.

The approach of this project is to demonstrate the technical feasibility, the business cases and to experiment with a subset of applications using road-based scenarios supported by onfield experimentations. Then, according to the outcomes, other obstacles will be identified – technical, legal, organizational, economic – for large-scale deployments. The proposed business model is to allow third-party developers to implement their services using this open system. The auto and telecoms industry in general will be able to benefit from vehicles that are always connected.



Roundabout metering

Thursday, October 28 (14.00-15.30hrs)

Glenn Geers, NICTA, Australia

To help traffic engineers and traffic control systems to deliver more efficient traffic flows, NICTA is developing new ways to measure incremental changes in traffic flows, even where daily variations in traffic flows might otherwise disguise them. NICTA has deployed new queue-measurement techniques to improve traffic flows at a metered roundabout at the end of a freeway south of Sydney, at which traffic is impacted at certain times of the day by flow

imbalances that would otherwise result in excessive queuing.

Traditionally, the road authority has used the presence of vehicles stopped on in-road detectors to determine when queues are too long and traffic signals need to be activated. NICTA's innovation allows the finer adjustment of the traffic signaling by identifying the onset of queuing even before vehicles come to a stop on the detectors, without the need for additional devices.

Extensive simulation undertaken by NICTA showed that traffic flows could indeed be improved and the trial system was subsequently deployed in late 2009. To measure the performance improvement in the real world, the old and new control regimes were run week on, week off, over an eight-week period. Differences in performance under each of the control systems were expected to reflect the gains experienced in simulation. Indeed, comparisons on corresponding days of the week during the morning peak period indicated that the enhanced controller performed significantly better



Modeling and Simulation (V) TP087

than the standard one for very similar flows. But performance variation between days with very similar flow patterns that appeared much greater than was evident under simulation has meant traditional methods used for quantifying performance gains lack the precision where changes are small, even though such changes do appear to deliver observable improvements.

Adapting traffic signal control

Thursday, October 28 (09.00-10.30hrs)

Thomas Otto, University of Kassel, Germany

This presentation focuses on the advantages of using floating car data (FCD) for the possibility to capture signalization quality parameters directly, and to integrate them into the signal controller. Within the framework of the German research project 'AKTIV VM' – funded by the German Federal Ministry of Economics and Technology (BMWi) – the intention is to develop a cooperative signal-control application using nomadic devices such as an FCD gathering and processing unit including an HMI.



Cooperative systems with the goal of improving adaptive signal control via mobile-collected traffic data have seldom been the subject of transport research. A reason for this could be the costs involved in the collection, processing and storing of FCD and its transmission to traffic signal controllers. For this reason, the focus of this research has been the analysis of the correlations between the different mobile-collected data and the derived information respectively. The principle tasks will be the definition of mobile-captured traffic flow parameters, their mathematical correlations among each other and their suitability for the level of service determination of an approach road to an intersection. Beside the adaptation of signal programs, drivers are able to adapt their behavior to the current traffic situation using infrastructure-sided information. The optimum between the consistency of the driver information and the flexibility of the signal control information is different in each individual case.

Vehicle-Infrastructure Cooperation (II) SP19

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Tolling and the environment

Thursday, October 28 (11.00-12.30hrs)

Thomas Reiter, Graz University of Technology, Austria

This presentation deals with dynamic tolling for roads. The main aim is to control path choice by introducing road user charges. Depending on predefined parameters, dynamic tolling changes toll tariffs temporarily. This change in fees – directed by levels of road capacity or emissions – makes road users rethink their route choice, departure time or preferred mode of transportation.

A generalized cost function is used to manage traffic assignment. In this model, the route choice reflects the user's response to various dynamic pricing schemes. In one example, load balancing of alternative routes between Salzburg and Graz features

different tariffs. The two routes were similar in respect to travel time. In the simulation, the traffic assignment was run with varying toll rates for one section, which meant you could predict at which toll rate the traffic shifts from route A to B.

According to calculations, a classified system was selected that indicated different toll rates. Due to the parameters, level of congestion and pollution, one out of four colors will be assigned to the appropriate road sections. The idea of color-coding simplifies dynamic tolling for operators and users likewise. Simulation indicates that dynamic tolling will help reduce congestion by load balancing, it will control bottlenecks, and reduce traffic in environmentally sensitive zones.

More details on the mathematical background of the generalized cost function and the classification on four levels of congestion and pollution will be provided.

Payment Systems SP24



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ITS



It's extraordinarily hard to write about 'green ITS' without it reading like a call to arms. A little research, however, makes the whole issue feel like blindingly obvious common sense. Whether intentionally – or as an added bonus to its central tenets of aiding mobility and safety – ITS can help reduce the harmful emissions that transport produces. Even if you feel *The Day After Tomorrow*-type scenarios are vaguely plausible at most, who can argue against improved mobility, fewer KSIs and cleaner air?

Integrated approach to emissions

Keith McCabe is at the forefront of the UK's green ITS movement, both in his regular day job at Atkins and as the chair of ITS UK's Carbon Working Group, which has sprung out of the association's Smart Environment Interest Group. Currently busy promoting the carbon strategy paper that ITS UK has published, he is also paying close attention to the work being conducted by the UK's Committee for Climate Change, whose second report to parliament (June 2010) suggests the UK has already hit its targets for 2014 and achieved a nearly 9% reduction in overall emissions from 2008 to 2009.

As great as this appears, though, there is a catch: "It's a decrease in economic activity, i.e. the recession, that has enabled these results rather than an implementation of all of the measures proposed by that very committee," McCabe suggests. "Taking this to its logical conclusion, if we enter a period of economic recovery, emissions will start to go up again and coming out of recession could be perceived as problematic! The committee's most recent report really reiterates the point that economic recovery and climate change need to be looked at together."

A more integrated approach in general is something that McCabe is keen to see as we move forward. One of the drums he is banging here relates to eco driving. Having worked on projects involving probe vehicles and measuring emissions, McCabe sides with other research in the area that suggests driver behavior has more bearing

on emissions than vehicle speed. But when it comes to behavior, there are two elements to be tackled: "Of course we need to work on harsh accelerating/braking, on lane-changing maneuvers, and on educating the individual, but where ITS can really help is to encourage the network itself to promote eco driving – from access-control strategies and variable speed limits to average speed enforcement."

It's notable that all of these examples use technologies already in existence, which makes you wonder why progress in this area seems so frustratingly slow: "Change is happening; it's happening in different countries at different paces," McCabe insists. "The principles surrounding what ITS can do for reducing emissions are pretty well defined, but there are issues associated with the likes of variable speed limits that mean broader policy discussion is needed."

"As part of my role with ITS UK's Carbon Working Group, I sit as an international member on ITS America's equivalent. What has struck me is that the two organizations

Transportation's impact on the planet is well documented – and even contested by some.

Louise Smyth speaks with the industry's practitioners hoping today's intelligent technologies will contribute to a cleaner environment tomorrow

Illustration courtesy of Magictorch

Green day

are following a similar path in terms of specific issues and how to address them. That's interesting considering how people tend to view the UK and USA's outlook on climate change. I think at a practical level there are more similarities than differences."

"I hate to sound like a skeptic," says Louis Neudorff, McCabe's American counterpart, "but I don't think the USA is quite as far ahead as the UK in areas such as legislation, ITS-based active traffic management, or eco-driving. At the same time, it is very encouraging that the US DOT has identified sustainability as a high priority."

An Iteris man by trade, Neudorff's sideline of co-chairing ITS's Sustainable Transport Working Group (alongside Larry Yermack) means he's got a good handle on the current state of play. "It is disconcerting that we still don't have any national climate change legislation and despite many politicians and groups acknowledging the problem, there is also a vocal group that doesn't believe in global warming, thinks it's a hoax or just a cyclical issue of nature."

Not to be defeated by the naysayers, Neudorff and the working group are becoming increasingly vocal in spreading the word of ITS to a wider audience. One of his more high-profile efforts of late has been his published response to the Cambridge Systematics 2009 report entitled *Moving Cooler*. Although Neudorff is quick to praise the report, upon reading it he was dismayed that ITS operations did not come out looking as effective when compared to other strategies. His response tackles a number of issues geared around getting others to see the true potential of ITS and to hammer home the point that adding capacity and improving the operations of existing capacity (as ITS does) are not the same thing.

What is ITS in this context?

As an ITS practitioner, alarm bells were instantly ringing when Neudorff caught sight of a table of results that listed things such as lower/enforced speed limits and regional congestion pricing in a completely separate category to 'ITS operations'. These are ITS operations!

How can you introduce congestion pricing or speed enforcement without ITS? Defining what ITS is and does is a huge part of the communications issue within the transport/climate change debate.

As well as looking to other countries (he cites the UK's managed motorways efforts as something the USA could learn from), Neudorff looks to other facets of ITS as the way forward. "There's a subset of IntelliDrive called AERIS that's looking at what environmental data we need and how we can get this information from the vehicle," he says. "One of the problems we have is that it's hard to measure greenhouse gas emissions. Carbon dioxide has this tendency of floating up to the atmosphere and hanging around for a couple of hundred years! If we could start measuring CO₂ emissions either directly or through knowing how much fuel is being used in each vehicle and its carbon content, we can have some decent performance measures and start adjusting some of our parameters. Imagine a variable speed limit system where we adjust speed to reduce greenhouse gases. That's the future; not only deploying ITS but operating these systems to minimize emissions."



The committee's most recent report really reiterates the point that economic recovery and climate change need to be looked at together

Keith McCabe, principal ITS consultant, Atkins, UK

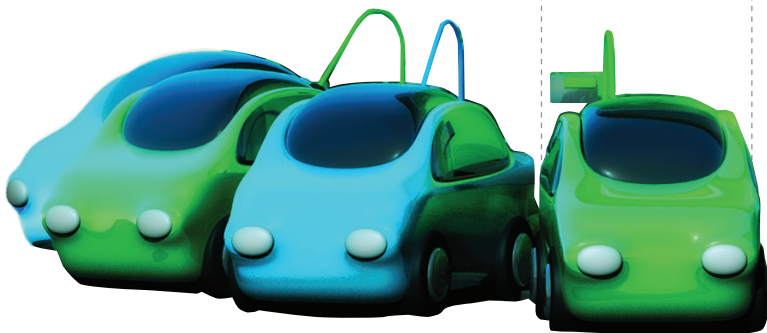
The wider picture

Somebody well aware of the need for better measurements of emissions is Professor Margaret Bell from Newcastle University and chairperson of the Smart Environment Interest Group (SEIG). "We're doing a lot in this field and it is complicated," she admits. "The biggest project we have funded is the EPSRC and DfT project, 4M: Measurement, Modelling, Mapping and Management: An Evidence-Based Methodology for Understanding and Shrinking the Urban Carbon Footprint, in Leicester."

This is an ambitious scheme involving five universities, the local council and several schools and workplaces. It is very much looking at the wider picture, so transport is assessed alongside use of energy in buildings/household emissions, carbon sequestration and much more. It's a refreshingly unique project that raises all sorts of 'what ifs?' associated with creating green travel plans. 'Typically academic' is how Bell refers to questions such as, 'If a company's workers were all driving in from one side of town, how can we incentivize that company to move its location – or even to offer company mortgages for those who walk to work?' "It's trying to look holistically at real novel solutions that may cost very little but could in return give us high reductions in CO₂," Bell says.

In keeping with this theme, she explains how a key part of the measurement side of things involves ITS: "The benefits of ITS are to smooth flows, calm speeds and do everything possible to prevent transients. Most air quality software models don't take those into account. So we are saying, let's use the raw data from ITS (SCOOT, in this instance) as a by-product of their primary function to better predict tailpipe emissions based on congestion levels. Theoretically you could add up emissions in the SCOOT areas each day and monitor how they are changing, so measure the effect of new ITS deployments."

Stupid question time: why isn't every authority using SCOOT doing this? Bell displays no surprise at the delay in getting such ideas out of academia and into the market. "Research we did in the mid-1990s is only now being implemented in practice. It's through the SEIG and the carbon working group that Keith McCabe is leading that we are gradually getting the messages from research into the ITS community." ○



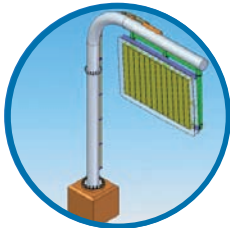


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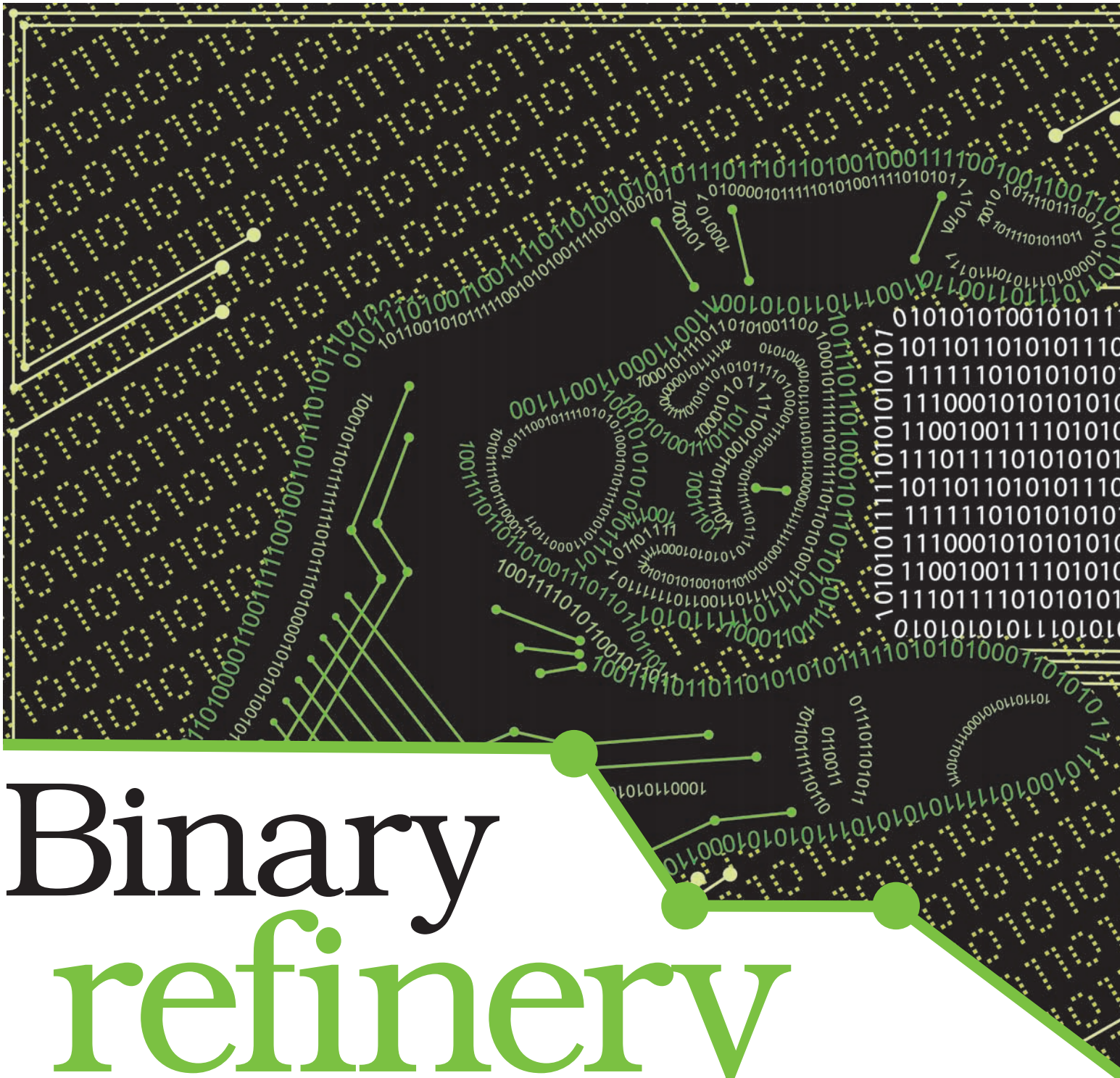
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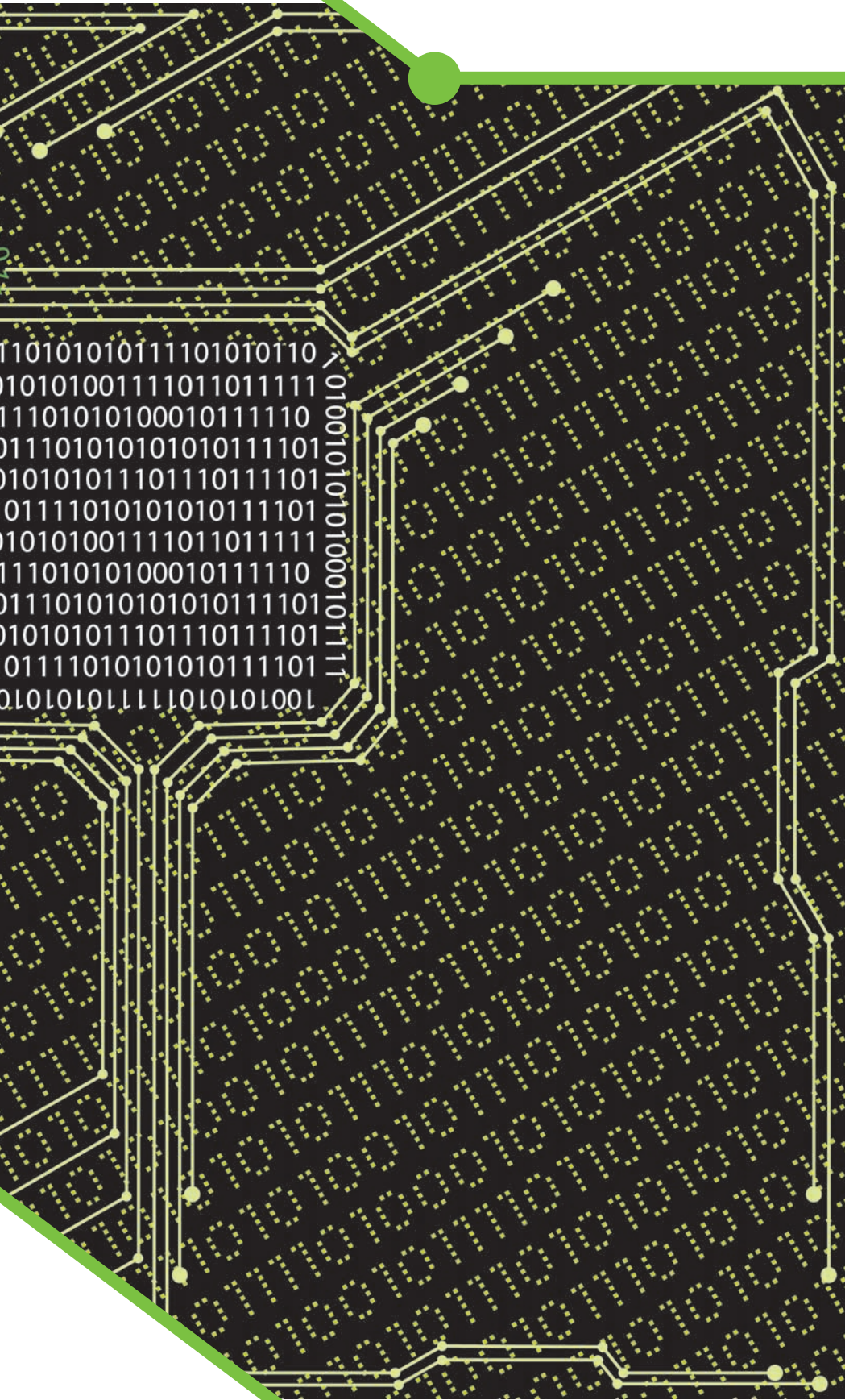
Informing; Innovating



Binary refinery

Bunches of 0s and 1s have never been an übersexy topic for the masses so have never been subject to any type of dizzying flurry of innovation – until now... PBS&J's **Jon Sorensen** looks at the changing face of transportation data

Images courtesy of Onder Yildirim



If you're the type of geek who feels an inherent desire to stay current on all things technology, you would've had your hands full over the past 10 years, twirling the proverbial plates from all appendages. The relentless stream of new gizmos and gadgetry can leave even the most dedicated propellerhead reaching for the Dramamine. But what about data – the bloodline of technology?

Paradigm shifts are occurring in most areas related to the use, formatting, storage, accessibility, availability and management of all things data, due in part to the slew of new technologies reaching the masses as well as new philosophical shifts related to data management. The new face of data is moving toward a ubiquitous, connected, enriched structure built on technology that provides greater access and availability. As a result, 'next-gen' data shows great promise for realizing new and enhanced applications to support the planning, design, integration and operations of transportation systems.

Transportation data has never been more accessible to the entrepreneurial and application developer communities than it is today. Recent trends have shown a significant movement toward liberating both static and real-time data, so facilitating application development through crowd-sourced intelligence. Simply put, when it comes to data, access equals innovation.

Cloud-based data

Recent improvements to networking speeds and the emergence of new network management technologies have supported a sizeable shift in data management processes, including one to a centralized or 'cloud-based' architecture. By centralizing data 'in the cloud', it is always accessible

Ahead in the cloud

Doug Couto from Citrix explains how cloud computing can provide ITS managers with a cost-cutting, scalable and effective way to make giant leaps forward in the interoperability of many transportation technologies

If we are to leverage the full potential of cloud computing in advancing our ITS goals, we must first understand what it has to offer. Cloud computing is a game of definitions. Once upon a time, the pervasive cloud on a computing diagram represented any network connecting two computers. Today, at its most basic level, cloud computing provides applications or IT resources as a service to users over the internet, negating the need to own any infrastructure, application or technology other than a web browser. The technologies involved in cloud computing – from virtualization to encryption – are proven, mature technologies that the marketplace has already accepted.

All cloud services offer meaningful benefits to ITS managers: no stovepipes to hinder the sharing of information, technology or solutions. Technology- and vendor-agnostic solutions create an interoperable, standards- and services-based environment that support the data infrastructures we've already worked so hard to build – as well as the infrastructures we're stuck with until funding changes. Cost reductions enable ITS managers to accomplish more with flat technology budgets.

Within the cloud itself, we find a hierarchy of delivery models and services, typically billed by the cloud provider on a subscription basis.

The cost benefit is perhaps the most powerful motivator behind cloud computing in ITS development. The cloud allows the ITS manager to leverage economies of scale as services, equipment and even software licenses are managed for an entire group. Measured payment, or pay-per-use, further cuts costs associated with the massive computing power needed to support ITS applications such as electronic toll collection or variable speed limits. Best of all, the cost reductions



Severe weather in 2008 led to a spike in web traffic that made accessing the WSDOT site nearly impossible

associated with cloud computing enable ITS teams to focus on – and reinvest in – core mission objectives.

The public sector is looking to the National Institute of Standards (NIST) to define cloud computing and develop standards and deployment models. The most current definition recognizes that it is “still an evolving paradigm” and that “the cloud computing industry represents a large ecosystem of many models, vendors, and market niches.”^[1]

“Cloud computing offers benefits – cost reductions, flexibility, scalability and more – that far outweigh the challenges of making the jump to the cloud

The move to the cloud can be easier than we expect; it can also solve the problems we once thought were insurmountable. Existing, robust technologies such as virtualization can provide simple stepping stones, preparing the data infrastructure and the data center for cloud computing. Open-source virtualization solutions and networking technologies already power the world's largest and most demanding cloud and internet sites every day. In fact, if you've

used the internet today, you've probably used these sites and virtualization solutions.

In the cloud, we share capacity; via virtualization, our applications go idle when not in use, and we pay only for actual 'run time' instead of 24/7 access. Additionally, the cloud provides an instantaneous response to surges in use.

But what can virtualization technologies and cloud computing accomplish in the real world? Just ask the State of Washington. In 2008, severe weather in Seattle, Washington, triggered a dramatic spike in web traffic as travelers looked to the Washington State Department of Transportation (WSDOT) for information on the status of public transportation, snow emergency routes and other critical information. With traditional data infrastructures in place, the WSDOT website was quickly overwhelmed, with a record 5.8 million page views in a single day. This led to internal network issues and made the site nearly impossible to access when demand was at an all-time high. WSDOT was forced to post messages letting the public know what was happening.

After that disastrous winter, WSDOT leveraged virtualization technologies to move traveler-critical information to the cloud and ultimately 'weather-proof' its website. Even the severe weather of the 2009-2010 season did not shut down access to information as more and more travelers accessed the site for information and guidance – achieving a primary goal of ITS managers around the world.

Cloud computing offers benefits – cost reductions, flexibility, scalability and more –



that far outweigh the challenges of making the jump to the cloud. As with any process advancement, there are a few key elements to keep in mind now that we understand what cloud computing really is: *Recognize mature technologies:* The evolving cloud computing model is founded on mature technologies used in different ways to gain new benefits. Government and industry standards are already in place to ensure the secure and efficient processes needed to make any cloud – private, community, public or hybrid – more effective for ITS teams.

Get to know your cloud provider: Understand the risk and benefits of using a cloud provider by working through aspects such as contract provisions to define issue resolution, service levels, data ownership, penalties and exit strategies.

Make a site visit: When selecting a cloud provider, follow good assessment practices. Make a site visit to review security assessments, certifications and processes. Particularly in terms of security concerns, many cloud centers meet the highest government and industry standards. But due diligence is required; visit the cloud provider's site, ask questions and kick the proverbial tires in order to make an informed decision about the move to cloud computing. And, don't hesitate to make additional site visits as your needs or the cloud provider's services change.

Listen to the ITS experts: At this year's 17th ITS World Congress in Busan, ITS managers have the opportunity to learn more about how to make the best use of emerging IT technologies. Cloud computing should be front and center in any ITS technology discussion, and information from the 2010 ITS World Congress can help us all make more informed decisions.

Economies of scale enabled by the cloud help to cut costs associated with the huge computing power required to support ITS deployments such as variable speed limits

References

^[1] NIST (Computer Security Resource Center)

C. Douglass (Doug) Couto is the director of transportation for Citrix Government, Education & Health, and he recently completed his six-year term as chairman of the TRB's Information Systems and Technology Committee



The new face of data is moving toward a ubiquitous, connected, enriched structure built on technology that provides greater access and availability

from anywhere in the world, on almost any device (given proper access credentials).

Such a system is less prone to network failures or mismanagement of data, and is typically fortified within an ISP's secured, resilient and redundant data centers. Cloud-based networks also offer transportation agencies the capability of real-time network scaling, or 'redundancy on the fly', generally require less time to configure and cost much less to deploy and operate. In these times of budget cuts and staff reductions, the architecture provides an attractive

alternative. The transportation industry has even started to migrate software applications to the cloud, led by the transit industry with CAD/AVL applications residing entirely in the cloud.

The availability of transportation data is also on the rise. The new face of transportation data includes the emergence of new data sources, as well as the erosion of concerns related to privacy. This new availability, coupled with enhanced access to existing and new data catalogs, has exponentially increased the amount of data

Mobile applications are being provided for free to users in exchange for their private location data





available to transportation professionals and the application developer community.

Probe vehicle to people

The growing abundance of data sources continues to expand as well, enriching the the real-time conditions reporting capabilities of transportation networks. The past few years have seen a move from ‘probe vehicle’ to ‘probe people’ data-generation resources, with the emergence of GPS-based personal devices. In addition to supplementing existing GPS data sources, this new paradigm will institute an enriched, cross-platform, multimodel data model. The value and accuracies of transportation datasets are also improving, enabling hyper-local conditions reporting with higher degrees of accuracies, in doing so refining the granularity of data and information available to travelers and transportation professionals. As a result, the combination of new available, connected data sources and the improved accessibility to existing data catalogs have enabled the development of many new tools, with improved functionality and greater accuracies.

Data (and information) privacy has always been at the forefront of discussions in transportation. But recent trends have shown a gradual decay of some of these concerns related to data privacy. Like it or not, data privacy fears have been gradually diminishing over the past decade. This is easily illustrated by the tremendous increase in the use of social networking tools such as Foursquare, Facebook and

Traffic and transportation apps are available that provide free traffic information to end-users in exchange for their location data

Twitter, or the widespread adoption of smart phones, which continuously emit real-time location data of each user. Developers have been able to establish ‘value propositions’ that are beneficial to all partners in a data-user relationship. ITS has already capitalized on mutually beneficial value propositions with the development of traffic and transportation tools such as mobile apps that provide free traffic information to the end-user in exchange for their location data. Improved encryption technologies and network security strategies have also assisted in the gradual erosion of data privacy concerns.

The future semantics of data

The Semantic Web – considered by many to represent the next generation of the internet (also known as Web 3.0) – aims to transition the internet from a ‘web of pages’ to a ‘web of data’. It is implementing the use of structured metadata (tagging) to enrich datasets with added information specified for each data element in a dataset. This new metadata scheme will enable machine-readable and machine-comprehensible web-based data. The Semantic Web will

‘understand’ data and information on the web and automate logical connections and relationships with other semantic data on the web. By implementing this new nomenclature, data achieves meaning, or ‘semantics’, which will ultimately facilitate automated identification, access and exchange of data between transportation systems without the need for human intervention. Signal timing data, vehicle detector count data, RFID data, transit CAD/AVL data and

emergency responder data could be automatically identified, exchanged, ingested and processed by other applications, within an agency or externally with partner applications, with no human intervention or the need for a single, dedicated software application running on all partner systems. Semantic technologies can also be seen as a key building block for peer-to-peer, or vehicle-to-vehicle communications – a key component of the USA’s IntelliDrive program.



Data is also undergoing transformation with regards to structure and format. New architectures are framing a new data ecosystem, enabling hyper-connectivity between datasets as well as between applications and datasets. This is diminishing barriers between humans, applications and data by applying 'meaningful' metadata to datasets (semantics rather than syntax). These structure and formatting changes coupled with the 'open data' philosophies are implementing the framework for the automation of data exchange and automated data processing, on a scale previously unattainable. ITS data has also experienced a shift in the processes and



➔ | Open data initiatives

The recent push behind 'open data initiatives' was originally initiated by Oregon's TriMet Agency, later expanded by Washington, DC's 'Apps for Democracy' project, and further reinforced by President Obama's transparency directives in 2009. 'Open Data' has led to the liberation (release) of mountains of public agency data, including transportation and transit data. This new data management ideal has enabled the software developer community to create valuable

tools and mobile applications for use by the general public, at little or no cost to the public agency. Open Data has already led to the development of hundreds of transportation applications, addressing a myriad of transportation needs around the world. Also, the recent push to democratize data has provided a side-benefit by re-energizing industry efforts to improve formatting of general data structures and improve completeness to facilitate use by the general public.

procedures for which data standards are being developed, formalized and implemented, seen in the General Transit Feed Standard (GTFS), developed by Google. Although not formally adopted by a national standards organization, it's



The recent paradigm shifts and evolutionary trends in data management are sure to keep the propellers spinning on the beanies for the foreseeable future

As data sources expand, for instance with advances in probe data, the amount of data available to the transportation community will be enriched also

essentially become the de facto transit data feed standard, simply through the quasi-adoption by transit agencies and the underlying tools development and industry support by Google.

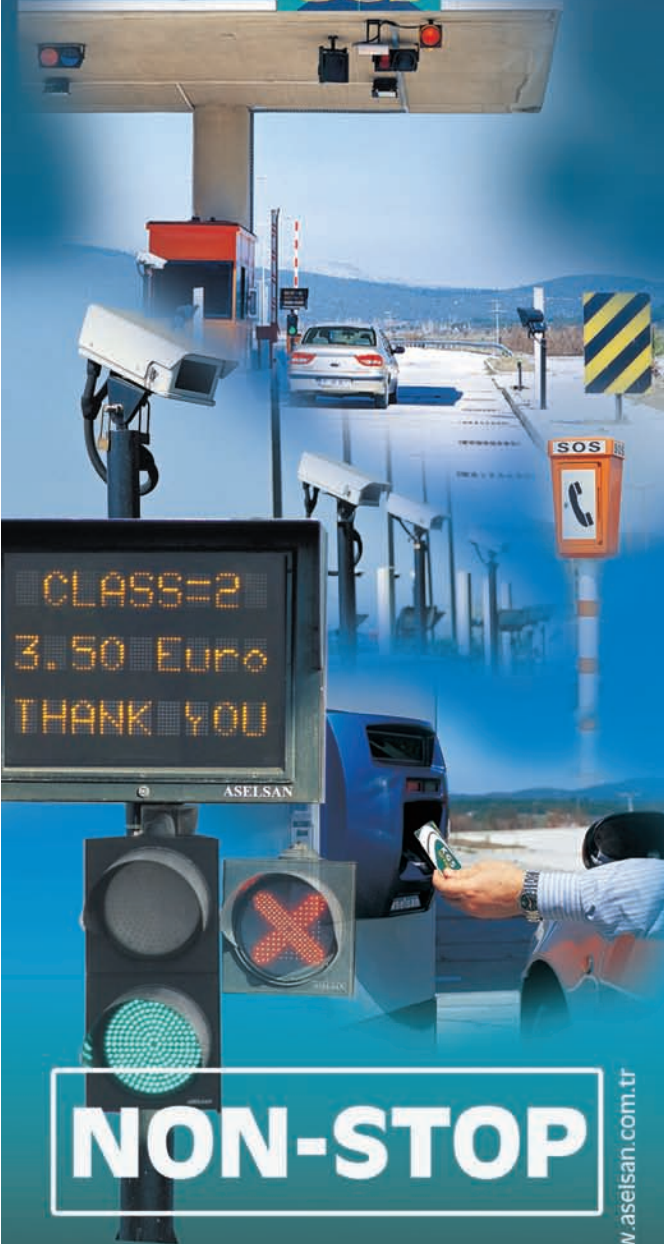
Down the road

Data management will possibly never truly excite the masses. But the recent shifts and trends are sure to keep the propellers spinning on the beanies for the foreseeable future. How we individually deal with these new data management technologies and philosophies, and manage and utilize new data structures and formats will ultimately define our own personal, and agency valuation of this new face of data. ○

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(Left and below) CS equipped the Golden Ears Bridge with a free-flow system that uses either a vehicle's Quickpass tag or video tolling in order to charge for payment



Tolling in an urban scenario

Many authorities responsible for urban mobility are having to address the question of whether or not to introduce road user charging. Urban tolling has already been deployed around the world in various forms, from Singapore in 1975 to Melbourne and Santiago, and more recently Oslo, Stockholm and London.

There are a number of different objectives that characterize various urban tolling schemes, such as easing congestion, reducing pollution in certain areas, as well as the impact of the road traffic network on the environment in general. Improving public transport and funding the construction of infrastructure or transport services are also goals for a number of authorities.

All of these objectives are worth considering when it comes to selecting the type of urban tolling to be deployed (network, zone, or ring) and also how the charges are actually created. For instance, should the price be variable according to demand on the network? Or is the pricing variable dependent on pollution levels? Authorities must consider whether HOV/HOT lanes are suitable for their environment and even if charging should be based on the emissions of specific vehicles – e.g. older, more polluting vehicles pay more.



Need to know?

The questions that need to be answered to ensure successful urban tolling

- > Why getting it right by design is a priority for all new urban charging schemes
- > Lessons learned from countries around the world
- > The need to be transparent: smart solutions are all well and good but they need to be promoted among the community they will be affecting

Of course, another key consideration is how any revenue generated by the proposed scheme is to be used – to improve public transport and get drivers off the roads, or is it to go toward more general development of the community?

From concept to reality

The implementation of a scheme raises a number of new questions to be addressed. First of all, local and national laws need to be considered. Is invoicing a driver for entering a certain zone of the city or for the use of a public road allowed by law or not? In France, urban tolling is only allowed when used to fund the construction of a new road, tunnel or bridge, as with the Prado-Carenage tunnel in Marseille.

Once the legalities are established, the next step is to decide what sort of tolling scheme is most appropriate for the urban area being considered. With network tolling, users are charged to access a city (as in Santiago and Melbourne), while zone tolling sees users charged for driving within a defined area (as in London). Ring tolling, on the other hand, is where a charge is levied on the ring surrounding the city, such as in Dublin.

The next aspect to consider is which technology is best suited.

Urban tolling must be free-flow and could be based on microwave, GPS or video technology, depending on the type of tolling required.

The infrastructure needed depends on what type of tolling is chosen. For LPR or microwave tag recognition, gantries over the road are needed. Tag technology also requires the development of points of sale or other distribution channels, as well as user registration, tag assignment and tag distribution/activation. It is also vital to establish how the scheme will be enforced.

All new schemes will require some form of customer services for any public contact and registration that's necessary. It goes without saying that an effective data collection and invoicing system is a priority.

An end-to-end solution is needed to automate processes and reduce operation costs. Finding the right integrator to make the system work to its best potential is key. CS Group is an experienced integrator able to provide solutions and engineering services to help authorities reach their objectives and can boast some significant contracts in Dublin (M50), Vancouver (Golden Ears Bridge), San Diego and Santiago.

A final issue is that of the financial ROI of the tolling and the ratio of operational costs versus revenue, which must be carefully calculated and acceptable to the local community. To be a success, it's essential that the local community understands (and accepts) the objectives for implementing a scheme. A communications and marketing campaign that informs the public of the benefits of urban tolling and how the revenue collected will improve their quality of life is invaluable. ○

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Less pollution, better traffic flow and improved mobility

Mobility models in the 21st century reveal a clear need for new concepts if we are to decrease traffic jams and increase mobility, stimulate the use of greener cars that generate less pollution, especially in larger cities, and charge taxes more fairly based on car usage instead of car ownership.

Over the past several years, many experts and universities have come to the conclusion that the introduction of GPS-based road user charging schemes for all cars on all roads are the optimal solution to meet these needs. When car drivers pay a certain amount per kilometer, this leads to a change in driver behavior, which can be further influenced by specific financial incentives – for instance when the price per kilometer depends on time of day (with more expensive rush hours and lower tariffs outside of rush-hour), the type of road (if highways are cheaper than city roads, the use of cars in city centers will decrease), and also emissions ('greener' cars pay less).

Such a scheme may also increase revenue streams for governments, which is highly attractive (especially with the current economic situation) and might also be used to finance infrastructure investments.

Standardization and proven technology

Although the approach mentioned above targets all vehicles (trucks and passenger cars), the system can be introduced gradually – for example, starting with large trucks (> 7.5 tons) followed by small trucks (3.5-7 tons), and finally passenger cars.

A key aspect that should be considered is the European Electronic Toll Service (EETS) standardization that

| Need to know?

An automotive telematics platform to form the basis for a road pricing system

- > Meets requirements for use in automobiles
- > Tried and tested technologies, combined in a safe and efficient manner
- > Built to comply with interoperability requirements such as the European Electronic Tolling System (EETS)
- > Enables single OBUs to be used for stolen vehicle tracking, eCall and road pricing as well as other services including PAYD, e-Horizon, eco-navigation and location-based mobility services

will stimulate road user charging to be deployed with GPS-/Galileo-based positioning and DSRC technology-based enforcement. The ambition is to design all European OBUs in such a way that they can support road user charging schemes in all EU countries.

Several field trials and implementations (in Germany, Belgium, the Netherlands and Slovakia, for instance) show the technology is ready for deployment. A key reason for this is that proved components are being used for GPS positioning (as demonstrated in all sorts of sat-navs), GPRS wireless connection (as used billions of times daily on mobile networks), and security (proved in financial transactions).

Basic requirements

Areas such as security, fraud prevention and privacy still require special attention. In terms of security

and fraud prevention, few companies have enough experience to actually build secure systems, which should be financial-grade (same security as used for financial transactions) to ensure that all tax will be paid correctly without car owners being able to easily manipulate or commit fraud. Current state-of-the-art security technology provides the required guarantees, even to the extent that electronic payment could be handled by OBUs.

Regards privacy, car drivers would obviously not agree to a system allowing governments to continuously track their steps. Maintaining privacy is therefore essential. An easy solution is an OBU that registers the position of the car, calculates the cost for the driven distance, and only communicates this calculated amount to the relevant authorities. More advanced models communicate car usage in such a way that government computer systems know what bill to send to each car owner without knowing where each car has been. In these models, the government does however receive a lot of anonymous traffic information that is highly valuable for advanced traffic management. Detailed information on road usage and average speed on the road can be used to inform measures such as speed advice or traffic flow guidance.

Another essential requirement concerns the reliability of the system. All the technology used should be fully operational under all circumstances, which requires automotive-grade quality that is more comparable to your braking system, for example, than to navigation systems and cell phones. The latter will typically not be guaranteed to operate from -40°C up to more than +85°C.

In addition to security and quality, the total cost of the system and the OBU is important. High-quality, low-cost units can only be produced using highly integrated



The OBU used in the Eindhoven trial featured a chipset from NXP based on ATOP



technology. Furthermore, easy installation or even self-installment can bring down the cost of introducing all-car, all-road user charging considerably. In addition, it increases end-user acceptance, which is especially important when involving all passenger cars.

Intelligent applications

Having this technology available in vehicles opens the door to multiple other intelligent use cases. A key application that can use exactly the same OBU is eCall or emergency call, which automatically signals the local emergency services if a car is having an accident. If and when it becomes available in all EU countries, this technology is expected to save at least 2,500 lives a year. (The EU is preparing plans to require every new car to have this on board from 2014 onward.)

Another application that comes almost for free with this technology is stolen vehicle tracking. If every vehicle that is stolen can easily be tracked, the number of car thefts could go down considerably.

To address the wide implementation of road user charging and eCall, NXP has designed its Automotive Onboard Unit Platform solution called ATOP, a turnkey concept for telematics applications combining GSM/GPRS, GPS, an ARM7 vehicle interface microcontroller offering controlled area network (CAN) connections, a security controller SmartMX based on the highest banking standards accepted security levels, and an RFID interface based on the NFC standard. With ATOP, NXP provides the core of an OBU that enables the fast, affordable, low-risk design of next-generation OBUs. ○



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I have a confession to make; I've been reading over somebody's shoulder on the train. It took a while to register after said passenger had removed various sheets from a red leather box-type briefcase that what I was seeing was the Secretary of State for Transport's instructions to officials on the *Autumn Spending Review*, the gist of which seemed to be...

"I'm reasonably confident of settling with the Chancellor for a lower figure than -40% as every other department is making noises about how their scope for reduction is constrained by inadequate or insufficient transport. But I'm not in the 'protected' category – a daft idea if you ask me given the known inefficiencies and waste in Health and Defence – so we'll have to show genuine cuts.

"Top of my 'cuts' list for analysis are: Network Rail's (NR) internal bureaucracy, procurement techniques and project micromanagement which double, at least, the cost of our rail infrastructure; the number of rail franchises; the over-60 free bus pass; a flat rate hit on all Local Authority transport allocations; a two-year pushback for all major road schemes not yet contracted; a two-year pushback for all major rail schemes not yet contracted, excluding scoping and survey work for any electrification and HS2; closing Bus Service Operating Grant but only surrendering 50% of that saving. (We allocate the rest to LAs for genuine cases where uneconomic services need to be supported.)

"On my 'increased income' list are the introduction of a general lorry road

usage charge plus charges for all vehicles at the worst 20 congestion points on the strategic network; Fuel Duty to go up by at least RPI +2% and the VED link to emissions to be emphasized [I know tax policy is technically for the Chancellor but I need a much higher rate for both by 2013 to enable the road user charge to be brought in with an offsetting reduction]. I've been lobbied about the burden on the freight industry, and the readiness and unreadiness of road charging technology and my views are quite clear.

"I don't accept the argument that our hauliers have a huge cost disadvantage compared to mainland Europe – it is much cheaper to run any business here than in France or Spain, say, and we all know that the last lorry charging scheme foundered because of the ridiculous 'refund' element. I want a simple charging scheme and if the extra cost closes the least efficient or effective operations then they will have been treated as equally as the rest of UK business. I also believe the technology is ready – we don't need a massive system that charges for every centimeter a vehicle travels in the Scottish Highlands, just something that complies with EETS and is as accurate as current legislation requires for a truck tachograph or a speedometer. Let's run a test exercise – invite the industry to make proposals against those simple requirements.

"On internal staffing, I'm struck by the large number of technical people in the Rail Directorates who seem to be duplicating what NR does; NR must take a suitable hit and 10% internally seems achievable. I don't see the need for such a huge Press Office now we've stopped 'spinning' news. I'm concerned we don't have much internal effort nurturing new ideas, technologies and transport systems. I'd like the Chief Scientific Adviser's numbers to be not just protected but enhanced so we have a small but heavyweight internal think tank commissioning studies to take us through this parliament and the next so I have a continuous stream of advice on what I might have to react to and what I might be able to do in future."

Remember – you read it here first!

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It took a while to register...that I was seeing the Secretary of State for Transport's instructions to officials on the Autumn Spending Review

Professor Eric Sampson, Newcastle University/ITS-UK, UK



 | Need to know?

The best way to cater to the cash customer when switching to an all-electronic tolling system

- > Increase convenience for cash customers to increase participation
- > Two-pronged approach including introduction of Toll-By-Plate and new cash-based retail locations
- > Qualified financial vendors to operate the kiosks
- > Customers to tap into the safer, faster and more convenient AET experience

The cash customer in an all-electronic era

Florida's Turnpike Enterprise (FTE) has achieved over 70% participation in SunPass, its electronic tolling system, since introducing it a little more than a decade ago, with more than five million transponders sold and an additional 60,000 being sold every month. Ensuring that electronic tolling is easy and convenient for customers is a priority, exemplified by FTE's recent announcement of a program to implement all-electronic tolling within the state, encompassing plans over time to remove all toll booths and discontinue the option to pay cash at booths altogether.

Bridging the gap

We've thought long and hard about how we can improve our

SunPass participation – and make it more convenient for customers who don't use SunPass – while still moving toward our end goal of all-electronic toll collection.

We know, based on a decade of experience, that opting in to the SunPass program needs to be very, very convenient to customers. When we started selling SunPass transponders in supermarkets and pharmacy stores, for instance, we saw a significant increase in sales. We also know that people from all walks of life use the FTE facilities. From the customer's perspective, it's just as important for a working class person to get to a job on time as it is for an executive to catch a flight at the airport.

We started thinking about how people pay for our services. SunPass customers are encouraged to purchase and/or replenish their accounts via a bank account or credit card. Customers may also replenish their accounts with cash, but this is not a convenient method as they must visit one of a limited number of SunPass walk-in centers. We believe this lack of convenience has prevented our regular cash customers from adopting SunPass, preferring instead to pay cash at the toll booths.

Cash simply isn't going to go away, so we need much more convenience for our cash customers if we want to increase SunPass participation; we need to serve those customers better.

So we asked ourselves, surely there must be a better way? That's when the lightbulb switched on.

Cash? Yes!

The Federal Deposit Insurance Corporation estimates that over 25% of the people in the USA conduct most or all of their financial transactions in cash. 'Unbanked' consumers (7.7% of the population) have no checking or savings accounts or credit cards. 'Underbanked' consumers (17.9%) may have an account but still make most of their purchases with cash.

Cash-based customers tend to be working, low-to-moderate-income consumers. They manage tight budgets and perceive many benefits to only using cash. They appreciate the transparency of cash and try to avoid institutions that levy surprise hidden fees or back-end charges. Cash-based customers may also have a cultural aversion to using mainstream banks. Many immigrants come from cash-based cultures and

Convenience is key for cash-based customers of operators such as Florida's Turnpike Enterprise



are reluctant to trust banks with their hard-earned money.

Traditional banking institutions have not necessarily served cash-based customers well. Banks tend to locate their facilities in middle and upper class suburbs. There are far fewer banks in working class and minority neighborhoods. Cash-based customers often lack the liquidity that is required to open and maintain traditional bank accounts.

In today's tough economic climate, even formerly well-off people are living 'close to the edge' of their financial means. Foreclosures, loss of employment, maxed-out credit cards, and a very tight credit market are all acting together to push people toward conducting more cash-based transactions.

In fact, over the past several months, FTE has seen an increase in the number of credit card 'declines', meaning that automatic credit card replenishment of customers' SunPass accounts has not gone through.

The promise of e-cash

We realized that, in order to increase our electronic tolling participation, we had to make it convenient for our cash-based customers as well. We're taking a major two-pronged approach.

First, we've introduced Toll-By-Plate, an electronic tolling program for customers without a valid SunPass transponder. A digital photograph is taken of the license plate number and the registered owner of the vehicle is billed. For customers with a prepaid Toll-By-Plate account, the toll amount is automatically deducted from their account. Customers without a prepaid account are invoiced by mail and they pay a higher toll rate.

Second, FTE has begun to roll out a unique cash replenishment system for tolling operations. At select locations throughout the state, cash-based customers will be able to use cash to purchase and/or replenish their prepaid SunPass transponder account. They will also be able to pay into a prepaid Toll-By-Plate account, pay Toll-by-Plate invoices, and pay for toll violations – all using cash.

The new cash-based retail locations will consist of a combination of computerized kiosks (similar to ATM machines) and staffed facilities (similar to check cashing and money transfer outlets).

How it will work

FTE has selected several qualified financial vendors to set

up and operate the cash-based retail locations. Over the next several months, the top-ranked vendor will set up a minimum of 1,000 retail locations to offer cash replenishment and invoice payment services. Other vendors will be mobilized as part of the continuing roll-out.

As the program gains recognition, FTE and its vendors will open additional retail locations. Having multiple vendors promotes private sector completion in the market and maximizes the number of retail locations – so that FTE's customers have convenient choices.

These vendors will be set up to accept cash for prepaid SunPass and Toll-By-Plate account replenishments; cash payment of post-paid Toll-By-Plate invoices; cash payment of unpaid toll violations (tickets issued for the non-payment of tolls on SunPass facilities); and cash payment of uniform toll citations (unpaid SunPass tickets and associated fines).

The vendors will recognize FTE customers based on one or more ways, including combinations of data such as the license plate number, the SunPass or Toll-By-Plate account number, the transponder number, invoice number, invoice amount, ticket (toll violation) number, and/or the dollar amount. FTE is also requiring that customers be able to check the balance of their prepaid SunPass or Toll-By-Plate account at the retail locations.

The vendors are allowed to charge a maximum of US\$1.50 for each transaction on top of the moneys gathered for FTE, with balance inquiries offered free-of-charge.

Similar to most financial models for e-cash payments at retail locations (for devices such as cell phones, etc), the customer pays

this convenience fee, not the agency. The vendors are required to wire transfer all moneys associated with account replenishments or invoice payments to FTE daily.

Services at the kiosks and staffed facilities will be offered in English and Spanish to include the large Hispanic population in Florida. Each retail location is required to be open at a minimum every day (including weekends) from 09.00hrs to 17.00hrs, excluding holidays. Again, convenience is the key.

Just in time

In FTE's first major all-electronic tolling project, we're planning to convert all 47 miles of the Homestead Extension of Florida's Turnpike (in Miami-Dade County) to a cashless facility by February 2011. Customers using the Homestead Extension will pay their tolls with a SunPass transponder or with Toll-By-Plate.

Customers will be able to pay their tolls without slowing down or stopping. With the elimination of toll booths, customers will experience a safer, faster and more convenient ride to their destination. All-electronic open road tolling is better for the environment because cars are not stopping and idling at the toll plazas, which reduces emissions and improves customers' gas mileage.

And with our new cash-based program, more and more customers will be able to tap into these many benefits, conveniently. ○

Richard Nelson is the director of Toll Operations at Florida's Turnpike Enterprise. Brian Spence is a senior tolls specialist with PBS&J, FTE's toll consultant on the project



Computerized kiosks are further evidence of FTE's ongoing support of all customers using its facilities

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Automating counts with video analytics

Since the 2008 launch of its traffic data collection system, Miovision has enhanced count programs for private and public agencies in 18 countries on four continents. The Ontario-based company has built its business by providing public agencies, private engineering firms and traffic data collectors with the tools to automate turning counts at junctions and major intersections. Its newest solution for counting and classifying large roundabouts complements its existing service offering and solves many of the challenges to counting roundabouts manually.

Traditionally, large roundabout studies have been difficult to conduct: they were hard to staff, expensive, and experienced a high rate of error. However, this latest innovation suffers from none of these challenges. Just one on-site member of staff is required to set-up the portable Video Collection Units (VCUs), costs are kept under control with budget-friendly processing rates, and it has a high accuracy rate.

As large roundabout studies are an extension



The tripod frame allows users to deploy the VCU at any location near the roadside

of Miovision's existing turning counts system, they are simple to collect and existing equipment and software can be used. The real innovation lies in a new algorithm that collates data from multiple VCUs at separate legs of a roundabout to perform a complete study.

As most roundabouts cannot be seen in their entirety from one vantage point, it was necessary to create a way to merge data from multiple VCUs and accurately

perform volume and classification counts. The challenge is in determining a vehicle's path from origin to destination when the vehicle enters at one leg seen by one camera, circulates the roundabout, and exits in the view of another camera. The solution was to observe movements from each leg, including entries and exits, direct left turns and circulating volume. Specially developed software then constructs the full set of turning movement data that best agrees with the movements observed by the visual tracking technology. The new algorithm provides a complete turning movement count with high accuracy using movements from each leg.

Automating large roundabout studies has implications for private and public agencies. They can markedly reduce the labor required to complete a roundabout count and standardize the accuracy. Anyone with experience counting a roundabout using manual staff stationed at the roadside or manually counting from video will know it is labor-intensive and accuracy wanes when compared with a standard junction or link count.

On the street

Recently, the City of Edmonton – Canada's fifth-largest city – selected Miovision to assist with data collection for its Transportation Master Plan, part of a 10-year planning framework to 'Transform Edmonton'. The DOT was to create a multi-modal transportation system to encourage the move away from drive-alone vehicles. The city was presented with three major challenges to complete the data collection. It needed

| Need to know?

Video and web-based technologies to help traffic managers reduce the cost of collecting, analyzing, and reporting accurate traffic data

- > Uses computer vision techniques to intelligently analyze vehicle movements and classifications in video
- > Video analytics has an accuracy rate higher than manual data collectors due to the lack of human error and a video audit trail
- > Uses software and hardware to significantly improve clients' cost structure, the accuracy and reliability of their results, and the safety of their field staff
- > Accurately tracks vehicles from when they enter a scene to when they leave it, recording each vehicle path and each vehicle's classification

to reduce operating costs, collect longer counts without increasing labor, and collect a new study type.

By automating traffic data collection and sending one technician to manage multiple count sites, the city was able to reduce its operating costs by 54% and increase its data collection. "Miovision certainly helped us achieve more with our count program," confirms Brian Murphy, Edmonton's supervisor of traffic monitoring. "Reduced costs and longer count periods with a higher degree of accuracy have contributed to enhancing our data collection programs. Now if it can be seen, it is counted!"

Through the innovation of traffic data collection products and services, Miovision's ultimate goal is to help to reduce congestion, minimize environmental impacts and improve overall road safety.

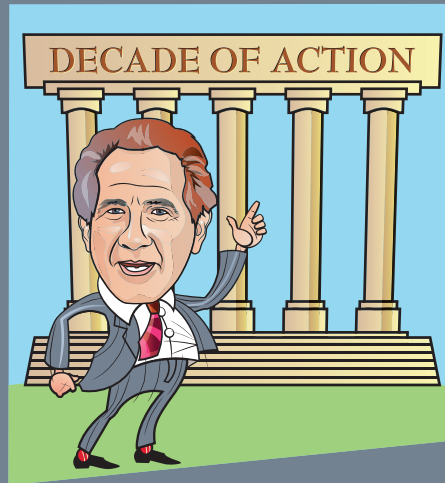


VCUs save on man-power while providing accurate traffic data

Providing traffic engineers with better tools is the first step to achieving these aims. Accurate data is the central element to correctly modeling and optimizing traffic flow. Inaccurate data affects the planned level of service, which could leave junctions or roundabouts ill-equipped to meet the level of service required. It is therefore essential to work from accurate data to ensure that the flow and safety of a junction, roundabout or corridor are correctly planned, built and maintained.

Technology has proven its potential to positively influence these transportation goals. Non-intrusive technology for measuring traffic keeps individuals away from the roadway and reduces the potential for accidents. Products such as those developed by Miovision can be set up within minutes away from the roadway, in doing so reducing the time an individual is at the roadside with their attention directed elsewhere, while there is also no need to have employees sitting at the roadside for up to 12 hours. Video analytics-based technologies mean an engineer can have a bird's-eye view of the intersection without needing to visit the count site. They simply rewind, pause and fast-forward video to occurrences of interest and manually audit their study without risking their safety or incurring travel time.

New technologies and applications are helping traffic data collection become more efficient, safer and more accurate – resulting in better information. This will help reduce congestion, pollution and safety problems. Ultimately, the automation of data collection provides another element that helps traffic engineers to make the best decisions possible. ○



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There is growing awareness that the current global road safety situation constitutes a crisis with devastating health, social and economic impacts that threaten the health and development gains achieved in the past half-century. Many countries are taking measures to improve road safety, but the disparity in performance between the best and worse is widening. Road safety is not a new issue but over the past decade, activity in the OECD countries in particular has reduced casualties often by substantial numbers; (in the UK and the Netherlands reductions of 30% and more have been achieved).

At the international level, initiatives such as the launch of the *WHO World Bank World report on road traffic injury prevention (2004)*, a series of resolutions from the UN General Assembly, the launch of the *OEDC/ITF Towards Zero: Ambitious Road Safety Targets and the Safe System Approach (2008)*, and a target-setting project by UNECE led to an increased international awareness and a UN General Assembly Resolution earlier this year calling for a 'Decade of Action for Road Safety' to launch in May 2011.

Ambitious vision, increased investment, and better collaboration between governments – and above all between governments and the private sector – is needed. A Decade will provide a timeframe for action to encourage political and private resources committed

both globally and nationally. Countries, regional agencies and the private sector are being encouraged to implement the Decade following five pillars of action.

First, capacity should be built through the creation of multi-sectoral partnerships and designation of lead agencies with the capacity to develop national road safety strategies, plans and targets, supported by the data collection and evidential research to assess countermeasure design and monitor implementation and effectiveness.

Second, road infrastructure assessment ratings and improved design should be used to raise the inherent safety and protective quality of road networks for the benefit of all road users, especially the most vulnerable.

Improved vehicle safety technologies should also be deployed for both passive and active safety on a global scale through a combination of harmonization of relevant global standards, consumer information schemes and incentives to accelerate the uptake of new technologies.

Also, through sustained enforcement of road traffic laws and standards and rules combined with public awareness/education activities (in both public and the private sectors), compliance with regulations that reduce the impact of the key risk factors will be raised. (These include speeding, drink-driving, non-use of helmets and seatbelts/child restraints, and commercial vehicle operations.)

Post-crash care should also be improved by increasing responsiveness to emergencies and improving the ability of health systems to provide appropriate emergency treatment and longer-term rehabilitation.

Technology such as the deployment of new active safety systems and new engineering approaches to infrastructure design have made the developed world's roads much safer, now it is the turn to apply these to all the world's roads to achieve massive casualty reductions during the Decade of Action.

Ambitious vision, increased investment, and better collaboration between governments – and above all between governments and the private sector – is needed

Adrian Walsh, director, Roadsafe, UK

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A systems engineering process

Improving system-wide safety and increasing mobility is the goal of transportation networks around the world. Whether it is highway, aviation or rail, agencies must often deploy critical communications solutions while maintaining a fully functional network. Today, Harris Corporation is helping transportation customers achieve their goals by working with them to employ the systems engineering process that will overcome this challenge and use emerging communications technologies, such as those being deployed in the ITS arena.

Successfully used in military installations around the world to deploy critical communications systems, Harris's systems engineering process for transportation partners helps users look at existing regional infrastructure and create long-term strategic ITS plans. One of the best resources for developing such a process for a transportation agency is the *International Council on Systems Engineering (INCOSE) Handbook*. The council presents a number of models that when properly executed make deployment of a critical communications network easier. The systems engineering process can be boiled down to a simple phased approach.

Phases of action

The first element (a prephase, if you like) to be tackled is Interfacing with Planning and the Regional Architecture. Phase zero, or the baseline phase, involves Concept Exploration and Benefits Analysis, which calls for a needs assessment and concept selection.

The first phase of systems engineering for ITS is Project



(Top) TMCs reap the benefits of improved comms
(Left) These benefits are also felt at street level

| Need to know?

How a smart approach can help to evolve ITS communications technology

- > Communications systems and equipment
- > Use in applications from real-time data monitoring of assets to wireless video surveillance
- > Enabling TMCs to wirelessly transmit and receive data, stream video of critical infrastructure and collect data from RWIS and tracked passenger vehicles

Planning and Concept of Operations Development.

Phase two is System Definition and Design, where system requirements, high level and detailed designs of the proposed system are worked out and begin to take shape.

System Development and Implementation is step three and involves much of the software coding, hardware fabrication and unit testing.

Phase four is Validation, Operations and Maintenance, Changes and Upgrades, which includes system validation and acceptance and spans a large portion of the operational lifetime of the ITS system.

The final phase is System Retirement/Replacement.

An example of where a systems engineering approach is most valuable would be through the deployment of a wireless broadband network for a Metropolitan Transit Authority (MTA). The typical MTA has a large geographic footprint, is linked to other agencies, and has buses and trains moving through the region, in doing so making it an ideal anchor tenant/operator for a mobile broadband system. Using the MTA's rolling stock, a DSRC radio can help deliver traffic signal prioritization and real-time traffic updates to the intersections through which it passes. It can also deliver video content from rolling stock to infrastructure and other mobile assets, enabling real-time situational awareness.

To begin the systems engineering process, the MTA would need to completely assess what it wants to achieve with the deployment of a wireless broadband solution. It then needs a full accounting of its current wireless communication assets and the infrastructure used by the regional agencies it services and those it wants to interoperate with. The MTA would then enter into an agreement to implement the broadband solution, construct project goals, and begin working through the technical details.

Today's solutions

In the future, the management of all voice and data applications on a single private network will be made possible by broadband technologies such as Long Term Evolution (LTE). Today, Harris is leveraging LTE and WiMax technologies to enable high-speed wireless broadband capabilities in the 700MHz and 4.9GHz bands for transportation

PTV. Planning Transportation Visions.



Michael is fascinated by numbers – maybe you too?

Traffic data provides the basis for sustainable planning in the fields of transport and environment. Take advantage of PTV TrafficCountManagement:

- ▶ This software solution allows you to easily and consistently access all your traffic count data thanks to central data management.
- ▶ Automatic processes will import and verify data from different sources for you.
- ▶ With the software you can clearly visualise and analyse your data.
- ▶ In addition to pre-defined out-of-the-box reports you can get deep insight into your traffic data by using flexible ad-hoc reports.
- ▶ To update your traffic model processed count data can be imported directly into the transportation planning system VISUM.

For more information, please feel free to contact us!

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agencies currently using functions such as data backhaul, video streaming and push-to-talk (PTT) technology.

The landscape for today's narrowband voice and data systems has been affected by federal requirements that make establishing wireless partnerships especially important. The Federal Communications Commission's (FCC) narrowband mandate is requiring many transportation agencies to make modifications to their Land Mobile Radio (LMR) communications systems. The FCC's goal for LMR narrowband modifications will ultimately improve spectrum efficiencies and create new licensable frequencies.

Funding is available through both federal recovery and broadband stimulus grants designed to help agencies meet narrowband guidelines and build a communications platform on widely accepted, standards-based IP technology. Now is an ideal time to look beyond the voice communications needs of agency narrowband radio networks and look further into regional transportation partners that may want to exchange voice and data information.

Future-focused technology

Harris has made it a core mission to be a leading authority in the deployment of ITS that will help make roads safer, more efficient and environmentally responsible. According to the USDOT, in 2008 approximately 37,000 people died and 2.35 million were injured on US roadways in about 5.8 million crashes. Adoption of wireless standards would allow positional data to be communicated instantaneously between vehicles and greatly

reduce those numbers.

Increased safety isn't the only benefit that wireless ITS is positioned to facilitate. The initiative also looks to reduce the amount of congestion on US roadways, which will ultimately reduce the amount of CO₂ and other pollutants emitted by vehicles. Harris is currently working with customers such as the Pennsylvania Turnpike, Dallas Area Rapid Transit (DART) and others to deploy wireless broadband for applications ranging from electronic signage to wireless video surveillance. It is Harris's belief that ITS technology has far more potential than is currently being realized.

The USDOT is experimenting with ITS technology similar to that currently being deployed by Harris as part of the IntelliDrive initiative and plans to make its decisions on wireless standards after testing is complete in 2013.

Harris has a successful track record of utilizing the systems engineering process for customers on their most critical systems and is positioned to contribute to ITS as standards and technology continue to be developed. The company has also been the prime contractor for the FAA's FTI network and the FICA network for the US Census department. Additionally, Harris companies have deployed a significant number of wireless networks for mass-transit bus and rail systems throughout the USA. ○

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A backbone network for ITS

Resulting from the rapid growth in IP networking, video, voice and data can all now be transmitted over Ethernet or internet. But if all three are simultaneously transmitted over the same network in large amounts, network traffic can experience a major slowdown. A fiber Gigabit IP network is thus needed to ensure that enough bandwidth is available to transmit all information smoothly. Gigabit Ethernet can be used as a backbone that provides a flexible bandwidth for video streaming. Analog CCTV can be integrated into a network video solution, enabling access to real-time video at any time from any computer. Video can also be integrated into a SCADA system. As for voice, audio-over-IP equipment (such as IP phones) is easily integrated into a network for emergency use or for other communication purposes. A single network solution provides improvements in convenience, flexibility and scalability, while also helping to save money.

Sophisticated surveillance

The Italian government and a number of local municipalities in the south of Italy – including the cities of Lecce, Mural and San Pietro – recently decided to increase their traffic safety and security facilities with Italy's largest ever deployment of IP video surveillance solutions. Designed to operate 24/7, the systems offer increased security on all surrounding motorways.

Among the multiple telecommunications technologies in play, the system integrator used existing SDH (Synchronous Digital Hierarchy) networks, newly deployed Gigabit Ethernet networks and wireless technology. For an

Need to know?

Industrial device networking solutions specifically designed to control and manage road traffic data

- > Products are used to help monitor tunnel and highway conditions
- > Compact products to support built-in Ethernet and power redundancy
- > Robust enough to work in harsh environments
- > High-bandwidth Gigabit Ethernet networks that transfer large volumes of traffic data, video, and voice transmission over one IP network allow real-time, continuous traffic monitoring and response

READER ENQUIRY NO. **506**



Moxa's EDS-P510 industrial Ethernet switches (above) form the backbone of applications such as Italy's largest IP video surveillance project (below)



application connecting several hundred distributed IP cameras, Gigabit Ethernet must be used to ensure sufficient bandwidth for video streaming.

An industrial-grade Gigabit network along the motorways needed to be deployed to build the access network for the complete video surveillance system. As the huge number of devices would consume a lot of energy and take a long time to install, the backbone switches had to be equipped with built-in Power-over-Ethernet (PoE) technology to both power IP cameras and save cabling and deployment costs. The communication infrastructure needed to be based on fiber optics to cover the large distances between the installations. As a consequence, flexible fiber interface options to reach the different IP camera

locations with the most cost-effective fiber selection were necessary. The network also had to offer centralized supervision and management capabilities and enough bandwidth for continuous video recording.

The deployment includes multiple Gigabit Ethernet networks carrying traffic from 15 IP cameras in the smallest networks up to more than 150 in the largest ones. Network video recording software triggers alarms in the event of exceptional movements, congestion or other incidents, and sends real-time notifications to the central control station.

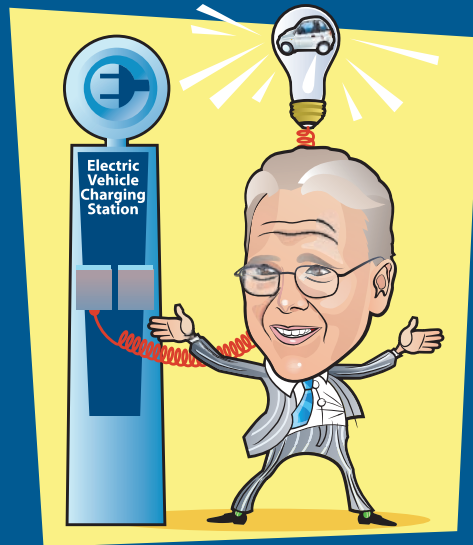
Turbo solution

The network is using Moxa's Turbo Ring and Turbo Chain technologies, which provide recovery against failures within 20m, ensuring that any failure or damage in the network will not interrupt surveillance.

A large number of industrial Ethernet switches are installed in cabinets alongside the motorways. Moxa delivered its EDS-P510A-T industrial Ethernet switches to build the Gigabit access networks for this project.

In the technical evaluation, EDS-P510A-T offered superior PoE management options for remote management, which saves maintenance costs for failed IP cameras, unless on-site repair is absolutely required.

The EDS-P510 series switches come with four 10/100BaseT(X) 802.3af (PoE) compliant Ethernet ports and three combo Gigabit Ethernet ports. They provide up to 15.4W of power per PoE port, and allow power to be supplied to connected devices (e.g. CCTV cameras, wireless access points and IP phones) when AC power is not readily available or is too costly to provide locally. They support advanced management and security features. ○



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In July 2010, UK Transport Secretary, Philip Hammond confirmed that the 'Plug-In-Car Grant' designed to stimulate demand for low carbon vehicles will go ahead from January 2011.

Parsing this sentence, repeated in many news articles, you might suppose this program is about greening the fleet. But if you read the majority of the first 20 Google hits for 'plug-in-car grant' you would see it is more about economic stimulation for the auto industry. The low-carbon part is the perfect excuse for a subsidy.

An article at puregreencars.com was clear despite its name: "Car-makers had been putting pressure on the new government to announce the electric car subsidy and had warned the UK would not be attractive for new technology auto investment without it." No handout, no investment.

If you have read my column before, you know well that fuel tax – as a mechanism to fund roads – is unsustainable, and that all programming to move us into vehicles that directly use

fewer hydrocarbons further endangers that funding source.

Notice that the UK government has in the past been unable to execute its oft-touted national road pricing program, but is now prepared to take tax dollars from somewhere to subsidize the purchase of cars (albeit clean ones), hence reducing the tax base needed to build, repair and operate the roads that these new, greener cars will use. Notice that they are not paying people to take transit, bike, or move closer to work, but they are using tax money to pump up an industry that can only cause congestion levels to increase.

Drivers prefer the autonomy, convenience, privacy and time-saving of a car. It is very hard to transition people out of cars or to move domiciles for the guilt of a few pounds of carbon that they cannot see except in the abstract. If you can subsidize switching costs, a lot of people will elect to drive a cleaner car. But why not do this with differential road pricing rather than cash handouts? You could start voluntarily and immediately, as it turns out.

I am all for government programming to nudge us in the right direction. However, the problem is that if the car user is being encouraged with direct subsidies, he is encouraged to drive more. The resting state of a world of heavily subsidized, 100% green, single-occupant vehicles is 24-hour total gridlock.

Green at all costs needs slightly more thought than this.

Drivers prefer the autonomy, convenience, privacy, and time-saving of a car. It is very hard to transition people out of cars or to move domiciles for the guilt of a few pounds of carbon that they cannot see except in the abstract

Bern Grush, chief scientist, Skymeter Corporation, Canada

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READER ENQUIRY NO. 507

 Need to know?

A comprehensive solution to successfully reduce operational costs, manage maintenance resource allocations, and reduce traffic congestion

- > Technical and product support able to efficiently meet all new challenges, integration, budgetary, and documentation requirements
- > Proven flexibility and scalability
- > Ease of access to a user-friendly, intuitive, graphics-based operating system
- > Scheme is now part of an 11-mile regional ITS demonstration corridor



Benefits realized from citywide ATMS upgrade

For transportation agencies, deepening cuts to citywide services are placing added pressures on their ongoing goal of mitigating increasing traffic congestion while enhancing safety for all road users. Although implementing ITS to optimize existing capacity and mobility by employing signal coordination strategies may seem out of reach for many US regions, one Californian city has actually demonstrated the viability of installing ITS amid tightening budgets.

The city of Mission Viejo recently implemented Phase 1

of a planned 114-intersection, citywide ATMS upgrade, including the addition of nine new CCTV cameras. As part of this first phase, 24 intersections were equipped with Centrac ATMS and ASC/3 controllers from Econolite, enabling immediate traffic signal coordination updates along two major corridors.

Located about 50 miles south of Los Angeles, Mission Viejo is mostly residential and suburban in culture. Named among the safest cities in the USA, it covers approximately 18 square miles (46.6 square km) and has a

population of about 100,000. Resulting from its geography, the city has limited north-south road networks, placing a heavy traffic burden on its few east-west corridors. Combined with an overall Orange County population growth rate of nearly 10% between 2000 and 2008, Mission Viejo faces urban-level congestion, so maintaining mobility is a priority.

Centrac was selected to replace an obsolete central traffic signal master that had been in service since 1993. The city was searching for a turnkey transition from its existing

system to an ATMS solution that provides enhanced systemwide control of signal controllers, operational monitoring, interagency sharing, system scalability and support. A powerful client-server ATMS application providing seamless WAN communications using the city's current workstations and IT tools was a prerequisite, which included the ability to communicate over both Ethernet fiber-optic and existing copper serial systems.

Flexible approach

System and support flexibility was essential to stay within budget. The first challenge in implementing the new ATMS was that it had to be configured in a virtual server environment because the city required server operation integrated with an existing citywide IT system.



Centrac is a robust and cost-effective system for improving intersection efficiency and traffic signal coordination



Econolite explored the feasibility, provided the technical support to establish and test the operation, and completed the installation of Centrac without difficulty. A further milestone was integrating Centrac with a new gigabyte fiber-optic Ethernet communications system. However, no problems arose with integration and hardware compatibility as a result of Centrac's architecture.

Deploying the ATMS and integrating the first 24 intersections successfully established communication, intersection monitoring, and implemented signal coordination strategies as planned. Centrac is thus being deployed to the remaining 90 intersections, in doing so retiring the old traffic management system.

In deploying an ATMS system, the development of a master plan to identify key issues and a long-range goal is vital. This master plan needs to assess the (often overlooked) challenge of understanding the compatibility of hardware/software, especially as it relates to legacy or existing systems. This directly impacts selection of any new hardware and components and, as a result, overall costs. As replacing legacy equipment was not in the budget, in this project it was important to ensure that key traffic operations, CCTV and other related functions were maintained as new equipment was integrated with older systems. For Mission Viejo, the plan is to transition the traffic signals to a fiber-optic Ethernet system, although a portion of the signals will remain on

existing copper serial communications. The Transportation Division also shares traffic signal fiber-optic communications with the fiber-optic system currently providing the city's data and phone connectivity between remote facilities. Although cost-effective, this complicates overall ATMS design and planning. Another challenge is ensuring the IT equipment located in the field and signal cabinets is hardened and able to work in extreme temperatures.

The city uses a specialized-member team to deploy and support the ATMS. This team is composed of traffic engineering staff, as well as IT-trained personnel and consultants. This leverages the skills of IT-trained (non-traffic engineering) staff to support the required IT equipment, such as the Centrac server, security, and Ethernet communications systems. This approach also makes specialized skills available, such as troubleshooting fiber optics. And it recognizes the merging of different technologies in operating new ITS.

The benefits

Mission Viejo promotes and participates in regional traffic coordination programs. Fifteen of its initial 24 intersections operating with Centrac are located along Alicia Parkway, which has been designated an 11-mile (17.7km) regional ITS demonstration corridor. Signal coordination is implemented

in conjunction with six other neighboring cities for a total of 41 signalized intersections. Mission Viejo's participation with the Alicia Parkway corridor required the successful deployment of the ATMS per the required six-agency schedule.

Travel-time studies to measure before-and-after traffic conditions are in progress, the analysis of which will allow quantifiable measurement of traffic-operational improvements and a calculation of corresponding reduced emissions. A similar ITS project on Oso Parkway (eight miles, eight agencies and 34 intersections) resulted in a 30% improvement in travel time and a 50% reduction in stops.

Mission Viejo expects Centrac will exceed expectations in monitoring the 114 signalized intersections and operating signal coordination programs. Its user-friendly workstation interface has minimized the need for training while increasing the potential for sharing interagency data. This will enhance current monitoring (turn movement counts every three years and annual counts), yet anticipate future transportation demands and issues. ○

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The critical need for toll system testing

READER ENQUIRY NO. 508

Testing is how an agency can know and assure its stakeholders that a new system is working properly. This means verifying that the system is functioning as intended, meeting its performance and accuracy requirements, and that it will continue to operate properly. Testing in its various incarnations – including functional, operational, accuracy, performance and regression – provides the assurances that an agency needs to grant system approval. Often, however, this testing is inadequate and the required assurance is not achieved.

Identifying defects of any type as early as possible in the project cycle improves system quality and reduces costs to all parties. It also reduces the need for additional testing cycles, avoiding schedule overruns.

Testing needs to be performed in a manner that satisfies the agency's needs while providing meaningful feedback to the vendor to improve the system. This means identifying the testing requirements at the outset of a project and adjusting them as the project matures. Operational and functional testing should be requirements-driven, and these tests should be used as a supplement to the requirements gathering and design processes. Thorough requirements definition early in the project not only assures that the system functions and operates as intended but reduces the burden of functional testing and retesting. A complete requirements document will lead directly to an operating and functional testing script.

Often, functional testing does not occur until factory test or system deployment. Since development time is

proportional to the system defect rate, properly identifying and testing functional requirements as early as possible is crucial to maintaining system quality and schedule. The chart below shows the typical relative relationship between the timing of defect discovery and the cost (time and money) to repair that defect. The cost to repair increases dramatically when defects are discovered late in the project cycle.

Timing is everything

For example, if a business rule is improperly defined and discovered at a requirements gathering meeting, the cost to repair could be as little as one man-hour. If it is not discovered until post acceptance, the cost will include the initial development time, the repair time, documentation updates, regression testing, and the cost to fix operations that have occurred under the faulty rule.

Performance testing assures that the system is able to accept and process data at the maximum defined rate. This may exceed the typical or current operational rate of the facility. For example, an ORT zone may be specified to process

Need to know?

The many benefits of functional, operation, accuracy, performance and regression testing of a tolling system

- > Why testing improves system quality and reduces costs, while also reducing the need for extra testing cycles
- > Identification of the elements of a successful test strategy
- > The definition of performance validation as early as possible in a project is crucial
- > Providing metrics to measure system improvement throughout a project lifecycle



Video auditing of an ORT zone

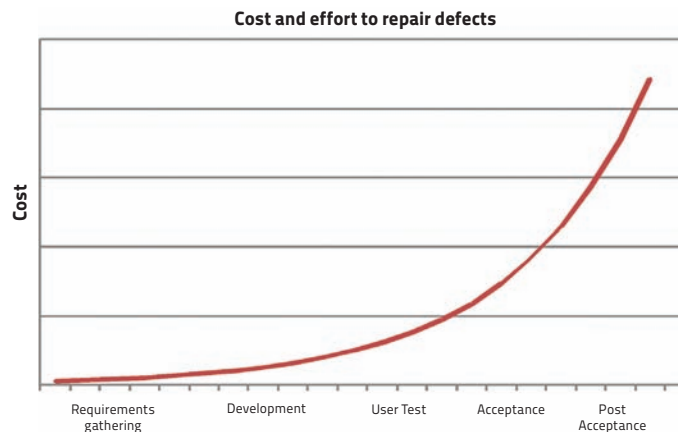


7,200 vehicles an hour, but the typical peak traffic rate for the facility may be only 3,000 vehicles an hour. To properly test performance, some form of synthetic test or simulation may be required. Early definition of this simulation is key to confirm that the simulation tests the system correctly, and that the simulation itself is defect-free.

Testing accuracy

Accuracy testing is closely related to performance testing since the accuracy of the system will typically be negatively impacted as it is exposed to increased stress (higher throughput). Accuracy testing becomes more resource intensive as specifications increase. For example, for a classification accuracy of 99%, a sample size of 500 vehicles will be sufficient, but when the accuracy requirement is increased to 99.96%, the corresponding sample size may need to increase by a factor of 10 or more to achieve the same confidence level. When the methods used to test accuracy are considered (video auditing, statistical report comparison and live observation) the cost to perform high sample-size testing can be considerable. When the cost to retest (due to test failure or when a big system change occurs) is considered, this cost can become unbearable.

The consideration of retesting leads to the final type of testing: regression testing. This is the





Extensive testing by TRMI yielded excellent VES results at the Benicia, California toll facility, pictured above

retesting performed to assure proper overall system operation when a change is made to a portion of it. Typically, this is performed when a software update has been applied. Since this can occur frequently both during and after deployment, it is important that the regression testing is both comprehensive and simple to perform. Even a seemingly simple software change can have a catastrophic impact if it is released without proper testing, since it's hard to predict the impact of a program change on another part of the system. Doing regression testing early on will increase system quality and provide metrics to measure improvement throughout the project.

Defining and performing system validation as early as possible in a project is crucial to both schedule and cost success. Create a detailed test strategy in conjunction with the system definition to ensure that testing is reduced and what testing that is performed is high quality. The cost of testing can be significant; the costs of not properly testing will be exorbitant. ○



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Tears in his eyes, distraction in his aspect; A broken voice, and his whole function suiting; With forms to his conceit?; And all for nothing...

W. Shakespeare, Hamlet

Distracted driving is certainly a hot topic. With apologies to the Bard of Avon, (mis)quoted above, I submit that distracted driving is also an old, important and transcendental topic. So long as a human – who is, um, driven to multi-task, whose mind wanders, who for the past 80 years has been tuning radio stations while driving – is behind the wheel, there will be distraction. What has changed in recent times? Certainly, an awareness brought on by the digital generation all of a sudden becoming drivers and even the older but not-quite-Bard-aged veterans getting behind the wheel with newfound Crackberry texting habits. Distraction from mobile, texting and very smart phones is confounding public policy-makers, providing fertile research opportunities for scientists, and is inexorably part of our lives, because whether or not we make the choice to use these technologies, enough other road users do use them that we are affected.

Some may dispute the issue. They remember driving 20 or 30 years ago. (I do.) Remember eating fast food while

driving? (I do.) Remember incessantly changing stations or deciding that AC/DC from your eight-track was a better alternative... oh, did the eight-track slip beneath my seat? (I do.) Remember unfurling paper maps across your steering wheel? (I do.) Remember those suction-cupped memo pads positioned on your windshield so you could take notes whenever the notion struck you? (I do.)

But the situation is indeed different nowadays. Those 20- to 30-year-old memories are sporadic as most of those activities which I described were rarely engaged. We knew they were unsafe, so we generally did not do them. (Yes, I confess. There was to my mind nothing more efficient than eating a McDonald's while driving.) So, the difference between then and now other than better clothing fabrics, is perhaps the exposure or the denominator in the risk equation. There certainly is a more tempting and thus more ubiquitous distraction in the car today, particularly with this fast-paced world and the professional and personal gratification we realize via instant communication.

I submit that a Smart Car is the ultimate solution to today's distraction problem. Consider a car that would sense and arbitrate; that is understand the unfolding situation and with awareness and alacrity suppress the phone when the surrounding is dangerous, and furthermore enable active safety systems when the road becomes more hazardous. Why? This would allow drivers to use their phones when, perhaps, they're driving a straight ribbon of road – such as those expanses of Texas highways I would travel, listening to AC/DC on my eight-track and spilling McDonald's ketchup on my polyester shirt and my open paper map. A phone conversation would have been a better alternative, especially when my Smart Car could intervene. Certainly, the car would "...confound the ignorant, and amaze indeed the very faculties of eyes and ears". Shakespeare said it. And so do I...

Consider a car that would sense and arbitrate; understand the unfolding situation and with awareness and alacrity suppress the phone when the surrounding is dangerous, and enable active safety systems when the road becomes more hazardous

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

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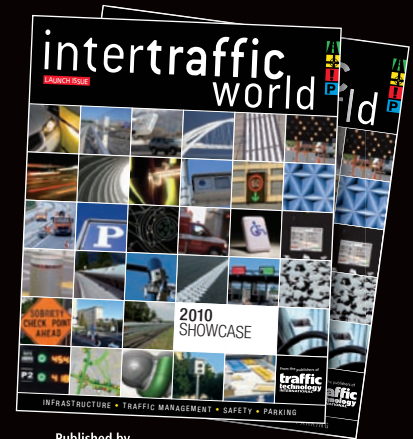


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Retrofit and forget

READER ENQUIRY NO. 509

The Siemens LED retrofit portfolio has been extended to allow Peek Elite incandescent traffic signals to be upgraded to low-power Siemens CLS LED technology. Offering carbon- and energy-savings of more than 75%, the newly developed retrofit option follows the success of Siemens' Helios retrofit technology and enables even more existing incandescent signals to be upgraded to LEDs, while maximizing the re-use of existing roadside infrastructure.

According to Keith Manston, Siemens' head of product management, the big carbon impact on the environment of existing traffic signaling equipment – which needs regular replacement and consumes large amounts of power – is a growing concern. "Having developed a proven retrofit solution for existing installed equipment manufactured by Siemens, this enables more existing signals with traditional incandescent lamps, such as Peek Elite, to be upgraded," he said.

There are many thousands of traffic signals installed by Siemens and Peek, but the majority are still fitted with

incandescent signal lamps. As well as consuming large amounts of power, the need to regularly replace these lamps has a notable carbon impact, both in the manufacture of the lamps and the VMT.

Easy to install and offering full lamp monitoring compatibility, the low-power LED retrofit provides a sustainable solution with minimum waste, high optical brightness, and outstanding phantom performance. "As a result of the continued use of the well-proven SIRA lens, the optical performances of the signals remain excellent," Manston added.



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Catering to all toll collection

READER ENQUIRY NO. 510

The main function of the Aselsan Integrated Toll Collection system is to provide all necessary infrastructure and mechanisms to operate a fraud-free, completely auditable toll collection operation. The company recently deployed one such system on 250km of the European Highway and on the second ring road in the greater Istanbul area in Turkey. Furthermore, the same integrated systems have been implemented on the 300km-long Southern Highway in Turkey. Both are perfectly capable of providing key performance data to their respective TMCs, at which the Highway Authority commands Turkey's busy road network. Here, the systems are put to the test on some of the world's most crowded toll plazas, with up to 200,000 transactions a day and so far more than 100 million transactions overall.

Aselsan offers various toll collection technologies, spanning cash-based systems, fully automatic smart card systems and fully automatic microwave-based non-stop ETC. All systems are compatible with each other and can easily be



upgraded to more sophisticated variants. Indeed, the Turkish Highway Authority itself has recently embarked on upgrading its cash-based systems to either smart card or non-stop ETC in a bid to end cash collection on its network.

Aselsan's field-proven systems are ready to be implemented on open or closed highways and are just as applicable for regional and countrywide tolling requirements without any extra effort to build a financial account infrastructure.

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A greener city through adaptive signal synchronization

READER ENQUIRY NO. 511

The City of Temecula in California has approved McCain as the sole supplier for its 'Citywide Adaptive Traffic Signal Synchronization System', which aims to improve traffic flow and safety along several of the city's major corridors, and at the same time reduce congestion and fuel consumption. McCain's QuicTrac adaptive control software is part of the solution, which will leverage the city's existing traffic control equipment and provide a system upgrade to the current control software.



"By utilizing our existing infrastructure, McCain offered us a turnkey and cost-effective solution," said Greg Butler director of public works. "Most importantly, the solution has been successfully deployed in other regions and can integrate with Caltrans intersections,

impacting drivers the moment they exit the freeway."

QuicTrac operates by collecting and analyzing real-time data from field detectors, loops or video, to establish traffic flow and demand. It then runs a series of advanced algorithms to determine and coordinate optimum signal timing for the entire corridor. By coordinating signals based on conditions, QuicTrac creates a series of green lights, expediting groups of vehicles through the arterial.

"A major cause of congestion for main arterials across the nation is that [traffic] signal

coordination does not respond to prevailing traffic conditions," said McCain's Steve Brown. "By implementing sophisticated monitoring and synchronizing programs, you will not only reduce congestion but increase safety and make a positive impact on the community and environment."

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In light of the recent backlash against safety cameras, what can be done to restore public confidence in their value?



A "In the UK, sections of the press are on a mission to discredit safety cameras. But the majority of people realize that there isn't a profit taken by Safety Camera Partnerships from the cameras; it is just not true. If they make any money over the budget they put in, it is removed and put straight back into government coffers. Independent surveys that have been carried out over the past 12 months show that the public does now have confidence in the systems: 79% agree that safety cameras should be supported as a method of reducing casualties. And 74% agree that they should be used on national roads."

John Harris
business development director,
Redflex Europe, UK



A "Road safety professionals must keep sharing the reasons for cameras to be part of the wider strategy. By decreasing vehicle speeds, safety cameras have contributed to the fall in road deaths. Contrary to how the issue is often portrayed, there is strong public support. However, when people are caught by a camera, the lack of human interaction can create a perception of 'unfairness', which can fuel opposition. There will always need to be the risk of punishment for breaking the law, but the greater use of speed-awareness courses is one way of adding the 'human element' to enforcement, as well as helping people find ways to manage their speeds in the future."

Duncan Vernon
road safety manager, RoSPA, UK



A "Part of this issue is simply the world we live in today. The whole nature of digital media – the 'blogisphere' and so on – means that somebody could be in a log cabin all by themselves but have a global voice. These particularly vehement camera opponents who publish vitriolic attacks online really do not have any sort of profile or awareness among the general public. If they have a rally, then occasionally they'll get around 30 people – mostly it's just four or five people and a dog! The media always want to get the opposing view. But these guys don't represent that at all; they are not the 15% who don't currently support enforcement cameras, they are the radical 3% that you're never going to shift. We don't attack them because we don't want to engage or legitimize their effort. Time and effort on the vendors' part and also their own experiences with safety cameras are helping the public come to understand the benefits of these systems. The 'backlash' is over and the majority of people in the USA are now in favor of safety cameras."

Jim Tuton
president and CEO, ATS, USA



A "To restore public confidence in safety cameras, we need to go back to the stage we were at when the cameras were first launched all those years ago. We need to ensure that they are only situated at sites that have the worst crash records – the hot-spots – and if that means losing up to 70% of the existing units, then so be it. The link between safer speeds and saving lives must be re-established so that the cameras really deserve the 'safety' moniker. Also, in the UK at least, the safety camera industry must not be privatized as that would be the kiss of death for public faith in the systems. Privatization would lead to the public having the belief that the cameras are merely deployed as revenue-raising devices."

Kevin Delaney
head of safety, Institute of Advanced Motorists, UK



A "Managing speed is vital and safety cameras work well, especially time-over-distance cameras. The AA says around 70% of drivers accept their use. For those who don't, we need to explain the dangers of speeding and how cameras help to protect us. Our graduated penalty point system works and speed awareness courses are really good, but not always available. We need standardized courses across the country. When we see speeding as antisocial, cameras are more likely to be accepted by even more drivers as an aid to better safety."

Adrian Walsh
director, RoadSafe, UK



A "I think the backlash has come at a time when, because there's not much money around, cameras are an obvious thing to cut back on. I also think it is fair to say that spot-speed cameras have had their day. A lot of people are now saying that average speed is the way to go and part of the reason is that the public actually perceive average speed cameras to be fairer. They don't resent the systems as much as they do getting caught by a double flash. Improved traffic flows also mean they actually perceive the systems to be beneficial as well."

Geoff Collins
sales and marketing, SCS, UK

Readers are invited to answer the Burning Question for the October/November issue:

With severe weather affecting many regions last winter, what technological and strategic measures will you introduce to lessen the impact on mobility?

email answers to:
l.smyth@ukipme.com

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