June/July 2015

traffic TECHNOLOGY INTERNATIONAL

WWW.TRAFFICTECHNOLOGYTODAY.COM

Self-enforcing cars
The law-keeping technology being built in to dashboards

Next-gen real-time info
To compile the best traffic data you need to predict the future

NEWS
Searching for a solution to the US highway funding crisis ▪ Technologies paving the way to vehicle autonomy ▪ International smart parking ▪ Traffic growth in Taipei City

Farewell to fixed cameras?

How lightweight quadcopter drones could revolutionize traffic monitoring and incident detection

EXCLUSIVE INTERVIEW

PLUS

A new era for WIM
It's no longer necessary to stop an overloaded truck to fine it – high-speed direct enforcement is here

Police in control rooms
Greater cooperation between traffic managers and emergency services is slashing response times

Dr Chris Urmson
Google's self-driving car is slated to hit roads in 2019. The project's director explains how it will happen

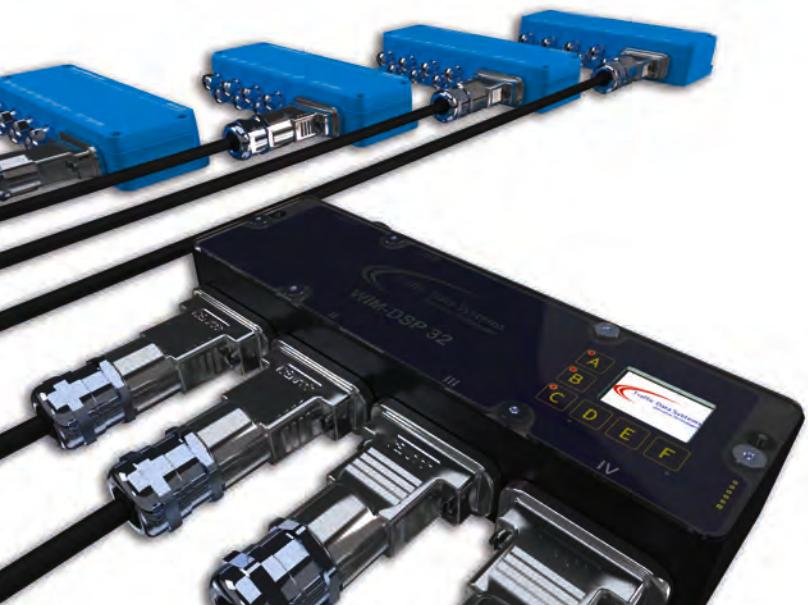
World's most compact and powerful

Weigh In Motion Systems

WIM-DSP 32 has been developed for use with Kistler Lineas sensors and Kistler charge amplifiers. The new design has an integral colour graphics display and touch keys for easy configuration and functional control.

Available with 32 input channels in a lead-sealable aluminium housing with IP67/EN60529 protection for use under stringent environmental conditions.

Well established international agents wanted!



The pin assignment of the four D-Sub connectors on the WIM-DSP 32 is compatible with the D-Sub connectors of Kistler 5163A10x charge amplifiers, thus enabling 1:1 cables to be used.

www.traffic-data-systems.com

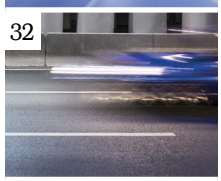
Traffic Data Systems
Innovative Technologies

Cover story

40 Eye in the sky

Could drones be the next big thing in traffic management?

Jan Stojaspal finds out how flying cameras can help manage incidents, congestion and special events



COVER ILLUSTRATION: MAGICTORCH. ADDITIONAL PHOTOGRAPHY SHUTTERSTOCK.COM

Technology Profiles

Linked in
Join our group via the banner at
www.trafficTechnologyToday.com

Editor's letter

The transportation industry is facing an onslaught of disruptive technologies. In the past two years, smartphone 'taxi' services, led by Uber, have begun a transformation of the private vehicle-hire market, and there's no telling yet where this transformation will stop – quite possibly with the wholesale destruction of all but a handful of traditional driver-for-hire businesses.

In June, the ITS America Annual Meeting took place in Pittsburgh, with representatives from Uber in attendance. Here, they talked about, among other things, the technology center they have set up in the city to conduct research into self-driving vehicles. And so it became clear that we are now witnessing the merging of two disruptive technologies that together will not only change how we hire cars to get around, but also dispense with the need for anyone behind the wheel at all. Any traditional cabbies hoping to simply switch to working for Uber if their business folds may want to have a plan B.

But the question on everyone's lips is just how long will it take before autonomous vehicles become a reality? Also in Pittsburgh was a man well placed to answer this question, the director of Google's self-driving cars project, Chris Urmson. Following his opening plenary, I was lucky enough to meet him and get down to brass tacks, finding out how his vehicle will work, both from a technical and legislative angle, and discovering exactly when it will be ready. Find out how our meeting went on page 56.

Another hot topic of discussion in Pittsburgh was lightweight drones. This further potentially disruptive technology is already being used for surveys and surveillance and could one day be used for incident management, congestion monitoring and even keeping night-shift workers in traffic control centers going by delivering pizza. We've uncovered the latest news from the field in *Eye in the Sky* on page 40.

Disruption, technological or otherwise, can be by its nature uncomfortable. Some with a vested interest in the old way of doing things will dig their heels in and desperately pick holes in the latest 'craze'. But, what was clear in Pittsburgh was that the ITS industry is different. Uber has become part of ITS America's Leadership Circle. Developers of autonomous vehicles are welcomed into discussions at every turn. And when talk in technical sessions turns to drones, the questions tend *not* to be, 'Why is anyone even bothering?' But, 'How can we make this work for us?' And, 'What do we need to do to make this viable?' Disruption doesn't have to be uncomfortable. Disruption can be exciting.

Tom Stone
Editor

Editor
Tom Stone
tom.stone@ukipme.com

Deputy editor
Lauren Dyson
lauren.dyson@ukipme.com

Production editor
Alex Bradley
Chief sub-editor
Andrew Pickering
Deputy production editor
Nick Shepherd
Senior sub editor
Christine Velarde
Sub editor
Alasdair Morton

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

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

Publication director
Mike Robinson
mike.robinson@ukipme.com
Sales manager
Godfrey Hooper
godfrey.hooper@ukipme.com
Australasia business manager
Chris Richardson
chris.richardson@ukipme.com

CEO
Tony Robinson
Managing director
Graham Johnson
Editorial director
Anthony James

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

The views expressed in the articles and technical papers are those of the authors and are not necessarily endorsed by the publisher. While every care has been taken during production, the publisher does not accept any liability for errors that may have occurred.

Traffic Technology International USPS 012-893 is published bi-monthly – in February, March, April, June, August, and October by UKIP Media & Events Ltd, Abinger House, Church Street, Dorking, Surrey, RH4 1DF, UK. Annual subscription price is US$125. Airfreight and mailing in the USA by agent named Air Business Ltd, c/o Worldnet Shipping USA Inc, 155-11 146th Street, Jamaica, New York 11434. Periodicals postage paid at Jamaica, New York 11431.

US Postmaster: send address changes to *Traffic Technology International*, c/o Air Business Ltd, c/o Worldnet Shipping USA Inc, 155-11 146th Street, Jamaica, New York 11434. Subscription records are maintained at UKIP Media & Events Ltd, Abinger House, Church Street, Dorking, Surrey, RH4 1DF, UK.

Air Business is acting as our mailing agent.

published by UKIP

Member of the Audit Bureau of Circulations

Average net circulation per issue for the period January 1-December 31, 2014 was 17,408
Annual subscription US$125/£78
USPS Periodicals Registered Number **012-893**

ISSN 1356-9252
Traffic Technology International

This publication is protected by copyright ©2015

Printed by William Gibbons, Willenhall, West Midlands, WV13 3XT, UK

Built for speed

Imagine a real-time speed-enforcement system relying entirely on high-definition, digital-image processing. That's just what Kria did with the help of Allied Vision's digital-camera expertise.

Read the full story:
AlliedVision.com/Speed

Allied Vision

The approaching storm

After months of procrastination and short-term measures, the new DRIVE Act is offering hope that funding for intelligent transportation and infrastructure will escape a deep crisis in the USA. **Tom Stone** looks to the future

Highway funding is at an all-time low in the USA, with the Trust Fund being propped up by short-term extensions – the latest 33rd such measure passed in June only secured solvency till the end of July, making long-term projects to fix crumbling infrastructure and install nationwide smart networks extremely challenging, if not impossible. In the face of this fiscal uncertainty, the Obama administration has, for the past 18 months, been pushing for Congress to approve the GROW AMERICA highway funding bill. Transportation secretary Anthony Foxx even conducted a whistle-stop bus tour of the entire East Coast of the USA earlier this year to promote it (see a video at tinyurl.com/growamerica). However, despite best efforts, there has been no movement in Congress. This has frustrated the ITS community because, as USDOT's website points out, along with the traditional infrastructure funding, the Bill commits more than US$3.4bn over six years "to advance research and innovations, ensuring decision makers at all levels will have access to enriched data and analysis, advanced research, and cutting-edge technologies".

Much of the frustration has been centered around the perception that a Republican-dominated Congress sees the Bill as a Democratic one, and as such, opposes

Prepare for your Future TRIP

Hot on the heels of the DRIVE Act, a US bill focusing on autonomous and connected vehicles has been welcomed by ITS America

In the days before this issue went to press, Congressman Dan Lipinski (D-IL) introduced the Future Transportation Research and Innovation for Prosperity (Future TRIP) Act, which aims to create a research and development framework aiding the future implementation of autonomous and connected vehicles across the USA.

Again it was welcomed by ITS America, with Regina Hopper (*left*) highlighting the critical nature of this research. "These technologies will have a transformative impact on our society by dramatically reducing vehicle crashes, and improving mobility and access to transportation services for all Americans," she said.

The Bill also recognizes the importance of protecting the 5.9GHz DSRC band of spectrum that was set aside for V2V communication, and ensures that efforts to free up additional airwaves do not jeopardize the safety of this technology. "ITS America's members are eager to work with Congress to support smart policy proposals like the Future TRIP Act, and provide critical funding for ITS research," concluded Hopper.

For a breakdown of the key proposals of the Act, see *On your TRIP,* opposite.

(Left) **Can President Obama's administration avoid the USA's interstate network being torn apart due to lack of funds?**

it, or at least chooses to push it to the back of the agenda. But, as USDOT's assistant secretary for research and technology Greg Winfree pointed out to *TTI*, "There are no Democratic or Republican potholes. These are core issues that hit all American citizens from all constituencies. All 50 states have the same issues with wanting safe and efficient transportation. We need Congress to realize that this is not political. This is a fundamental issue that strikes at the economic heart. We need to do right not just by this generation, but by future generations."

Now a way out of the deadlock looks possible with an alternative DRIVE (Developing a Reliable and Innovative Vision for the Economy) Act proposed, which draws on many of the key tenets of GROW AMERICA – including its six-year funding span – but crucially, it is proposed by a bipartisan committee led by Republican senator Jim Inhofe.

Anthony Foxx greeted the Bill with cautious optimism. "I thank chairman Inhofe and ranking member Barbara Boxer [D-Calif] for a good start on crafting a bipartisan six-year transportation Bill," he said. "They, and members of the Senate Environment and Public Works [EPW] Committee, took action on an increasingly urgent crisis: our roads and highways across America are falling apart." However, he added, "Unlike last year, when progress stopped at this point, I hope that the EPW Committee's work is just the beginning – not the end – of actions by Congress to address America's critical transportation issues and bring funding in line with our country's needs."

The estimated annual shortfall in the Highway Trust Fund is US$16bn (gas tax minus expenditure)

The Bill also drew positive comment from ITS America's new president and CEO Regina Hopper. She said, "The DRIVE Act recognizes the critical importance of a high-tech, connected transportation and infrastructure network. The legislation prioritizes federal programs to encourage new innovation, accelerate the adoption of ITS, and embrace the convergence of vehicle connectivity and automation, real-time data, and mobile apps and services. These innovative technologies will significantly reduce traffic deaths and injuries, provide people and businesses with more convenient and seamless transportation options, and equip state and local agencies with better tools to manage highways and transit systems."

Now the race is on to ensure the Bill is properly funded. "Our work is not finished," said senior Committee member Tom Carper [D-Del]. "In order to make the DRIVE Act a reality, we must provide full funding so that city, state and local governments have the certainty they need to make the investments we've outlined in this Bill. I am steadfast in my dedication to working with my colleagues in Congress, and Republicans and Democrats alike to find the bipartisan funding compromise Americans expect and deserve."

Hopper agrees that funding is key: "We need to get the right funding mechanisms," she told *TTI*. "There are all kinds of options on the table. It may be a series of options or collective options that they have to go to. But that's what's breaking it down. So the USA just needs to figure it out and hopefully we will soon, because it's becoming critical."

With any luck, before the next issue of this magazine is published, there will be a solution that avoids yet another short-term extension to the Highway Trust Fund. ○

On your TRIP

The key tenets of the proposed Future TRIP Act

- Prioritize connected vehicle research
- Improve transportation research at universities by removing burdensome restrictions on grant applicants
- Promote cross-agency research coordination
- Invest in efficient pavement research
- Remove restrictions on researcher travel
- Identify gaps in current data collection and provide safeguards for data collection, storage and dissemination
- Create a strategic research plan to improve efficiency and safety of freight transportation
- Test ground-based, satellite and unmanned aerial systems
- Establish an Intelligent Transportation Systems center of excellence
- Provide considerations to improve future strategic research, development and technology plans based on critiques from the national academies

> "I hope this work is just the beginning of actions by Congress to address critical transportation issues

Anthony Foxx, US Secretary for Transportation

Keep up with the latest on this story and all that matters in advanced traffic management on our website, **trafficTechnologyToday.com**, which includes features, events and video reports, as well as all the latest news stories from across the industry

Made in Taiwan

Taipei City, Taiwan's modern metropolis and capital city, is using ITS to accommodate growing numbers of vehicles, improve road safety and tackle congestion

Infographics: Anna Davie

Taipei's road network is governed by the Taipei City Government Department of Transportation and is patrolled by the Taipei City Police

2,141,328

traffic violations were recorded in the city in 2014

Taipei City has...

1.4 million parking spaces
2,499 sets of traffic signals
2,273 pedestrian signals
64,366 static road signs
156 variable message signs

Taipei City's transportation network comprises

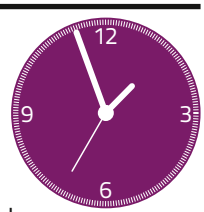
6,966 miles
(11,211km) of roads

The population of Taipei is estimated to be approximately

2.7 million
(December 2014)

Taipei City's roads are most congested on

MONDAY MORNINGS and FRIDAY EVENINGS



The cumulative delay for an average commuter with a daily 30-minute trip is an extra **92 hours** each year

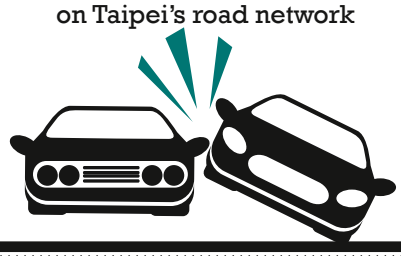
DID YOU KNOW?

Although it's commonly known as Taiwan, the island's official name is the Republic of China, which is different to the People's Republic of China. Most of the world's nations do not recognize Taiwan as an independent country

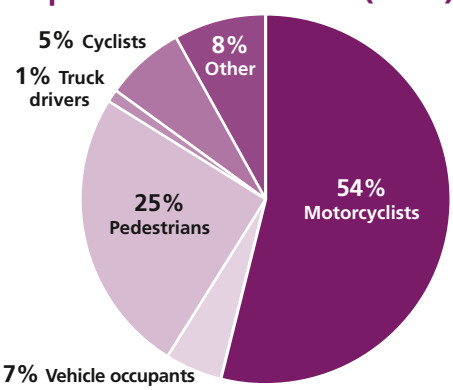
In 2014,

36,741

traffic accidents occurred on Taipei's road network



Taipei's traffic fatalities (2014)



More than

1.8 million

vehicles are registered in Taipei City

Taipei's ITS relies on

2,360

communication lines to transmit real-time data to the traffic management center

Sources: Taipei City Department of Transportation; Parking Management and Development Office, Taipei City Government; Taipei City Construction Management Office; Taipei City Police Department


NORBIT
- explore more -
The Independent DSRC Supplier
NORBIT technology at its best – Delivering performance, functionality and compatibility to the world of CEN DSRC.
NORBIT®
COVERING THE WORLD – UNCOVERING POSSIBILITIES
Explore more with NORBIT | www.norbit.com

Engineering efficiency

Lloyd Fuller highlights some of the most interesting recent developments in the parking sector

Wireless revolution

Advanced technology improves parking efficiency in Russia and China

A smart parking system is now being used in Russia and China. The applications feature Telensa's Ultra Narrow Band (UNB) system, which uses long-range, low-power, wide-area radio technology. Telensa's PARKet system is already helping to reduce congestion by directing drivers to free parking areas, and a recent upgrade means that drivers can also register electronic permits, enabling traffic wardens to respond more quickly. The result is a more efficient and transparent approach to parking, without the random detection common in visual checking. The new system also has the potential to halve enforcement costs.

Mobile guidance

App-based parking proves successful in Wales

The Welsh city of Cardiff has started a pilot program involving Smart Parking's SmartPark solution, which has seen the installation of 225 RFID-equipped SmartEye vehicle detection sensors, linked via SmartLink data transmitters, in some of the city's parking hot spots. Drivers can download the company's SmartApp and view a real-time picture of parking spaces near to them, and then get guidance to the nearest unoccupied bay. Drivers can also pay for parking via a remote payment solution. Smart Parking's SmartRep software collates and analyzes live information on how parking spaces are being used. Accurate real-time data gives the local council a leading edge in day-to-day management and future planning.

Sensor solution

Truck parking is optimized in Germany

A new truck parking pilot project has gone live on the A9 autobahn between Nuremberg and Munich in Germany. Siemens installed the system at 14 of a total of 21 rest areas, providing almost 600 parking spaces. The system delivers information about available parking spaces at rest areas and truck stops directly into truck cabs, through connected devices and a smartphone app. Laser scanners installed adjacent to the road measure the height and width of passing vehicles. Additional sensors incorporated into the road surface determine speed, length and direction of travel. The information collected can then be combined to count and classify the vehicles precisely.

Smart resources

Consortium will develop automated parking service

A new pilot project will develop the technology that will enable cars to be summoned to a pick-up point in a parking garage, and then return to their vacant space after use, all by themselves, using a smartphone application.

Bosch, Daimler and car2go have signed a contract to develop the system that they hope will revolutionize the parking process. The conceived operating scenario is that the smartphone is used to book a car-share vehicle via car2go. As soon as the user is ready in the pick-up zone of the parking lot, the car drives up independently and the ride can begin, with the vehicle operating as normal. When the car is returned, the customer parks it in the drop-zone of the parking lot, and completes the car-share transaction via smartphone.

The intelligent system deployed within the parking lot registers the vehicle, starts it, and directs it to an assigned parking space.

SIEMENS

RUGGEDCOM RSG920P – compact, high density Layer 2 switch

Big bandwidth for small spaces.

Compact. Multifunctional. Rugged.

RUGGEDCOM RSG920P switch with Power over Ethernet (PoE) is our solution to your growing needs for higher bandwidth.

This compact, high density Layer 2 switch reduces cabling costs and simplifies camera, radio, and peripheral device connectivity. Equipped with 20 Gigabit Ethernet ports, RUGGEDCOM RSG920P is suitable for applications that require high bandwidth and is ready to accommodate future network expansion.

Tested – and certified – to withstand extreme temperatures, shock, and vibration, the RUGGEDCOM RSG920P is redefining reliability for transportation systems and the oil and gas industry.

Contact us today to request a quote.

We invented rugged.

siemens.com/RSG920P

The road to autonomy

Welcome to a brand-new page keeping you up-to-date with the latest connected- and autonomous-vehicle news. In this issue **Mark Hall** looks at the recently announced projects paving the way for self-driving vehicles

Corridors to the future

AV testing opportunities expand with the introduction of Virginia Automated Corridors

The Virginia Department of Transportation (VDOT) and the Department of Motor Vehicles (DMV) have entered into a partnership with the Virginia Tech Transportation Institute, toll road operator Transurban, and Nokia's Here, to create 'automated corridors' in the state. The new scheme will streamline the use of Virginia roads and test facilities for automated-vehicle testing, certification, and migration toward deployment. The Virginia Automated Corridors will offer autonomous vehicle developers the opportunity to test their technologies on the state's roads, and will cover more than 70 miles of interstates and arterials in the northern Virginia region. The corridors also include two test-track environments.

Writing the rule book

UK sets different rules for the testing of different types of autonomous vehicles

The UK has released a set of rules for its four self-driving vehicle testbeds based in Greenwich, Bristol, Milton Keynes and Coventry. The new code states that a minimum of 30 seconds of data must always be available so the causes of accidents can be established. It also differentiates between driverless (M1 vehicles) and 'pavement pods', stating: "Pavement pods must have someone that can remotely control them, to bring them into a safe state in the event of a problem, although they do not need to be on board; the M1 must have a driver in the vehicle who can take over manually, if the autonomous system fails; if there is an accident, in the case of the M1 liability lies with the driver, and in the case of driverless pods, it lies with the remote controller of the vehicle."

The world's best simulator?

Virtual AV testing is given a boost as world's first five-screen high-resolution simulator is completed

A new research center has opened at Japan's Nagoya University, with the aim of developing automated driving technologies as one of its first key projects. At the Nagoya University National Innovation Complex (NIC), researchers from the university's schools of engineering, medicine, environmental studies and information science will work with their counterparts from six private companies.

Built at a cost of ¥4bn (US$32.4m), the NIC is home to the world's first driving simulator that incorporates five large high-resolution screens, as well as five experimental automated driving vehicles. The research team plans to conduct studies of automated driving technologies on public roads, in order to further develop the technologies for practical use within 10 years. The NIC researchers will also coordinate their work with the university's Green Mobility Collaborative Research Center, so that future automated driving systems and vehicles can be integrated into sustainable multimodal smart mobility schemes.

LUMENERA TRANSPORTATION CAMERAS

Lumenera's high performance USB 3.0 cameras are built with leading edge sensor technology from Sony, ON Semiconductor and CMOSIS, making these cameras ideal for traffic applications where high resolution, sensitivity, accuracy and precision are critical.

Automated Tolling • Safety • Monitoring • LPR • Speed / Red Light / HOT Enforcement • Parking Access

128MB of onboard memory for frame buffering ensures reliable image delivery even in the most demanding Intelligent Transportation System.

Contact us today to determine how you can benefit from Lumenera's high-performance cameras.

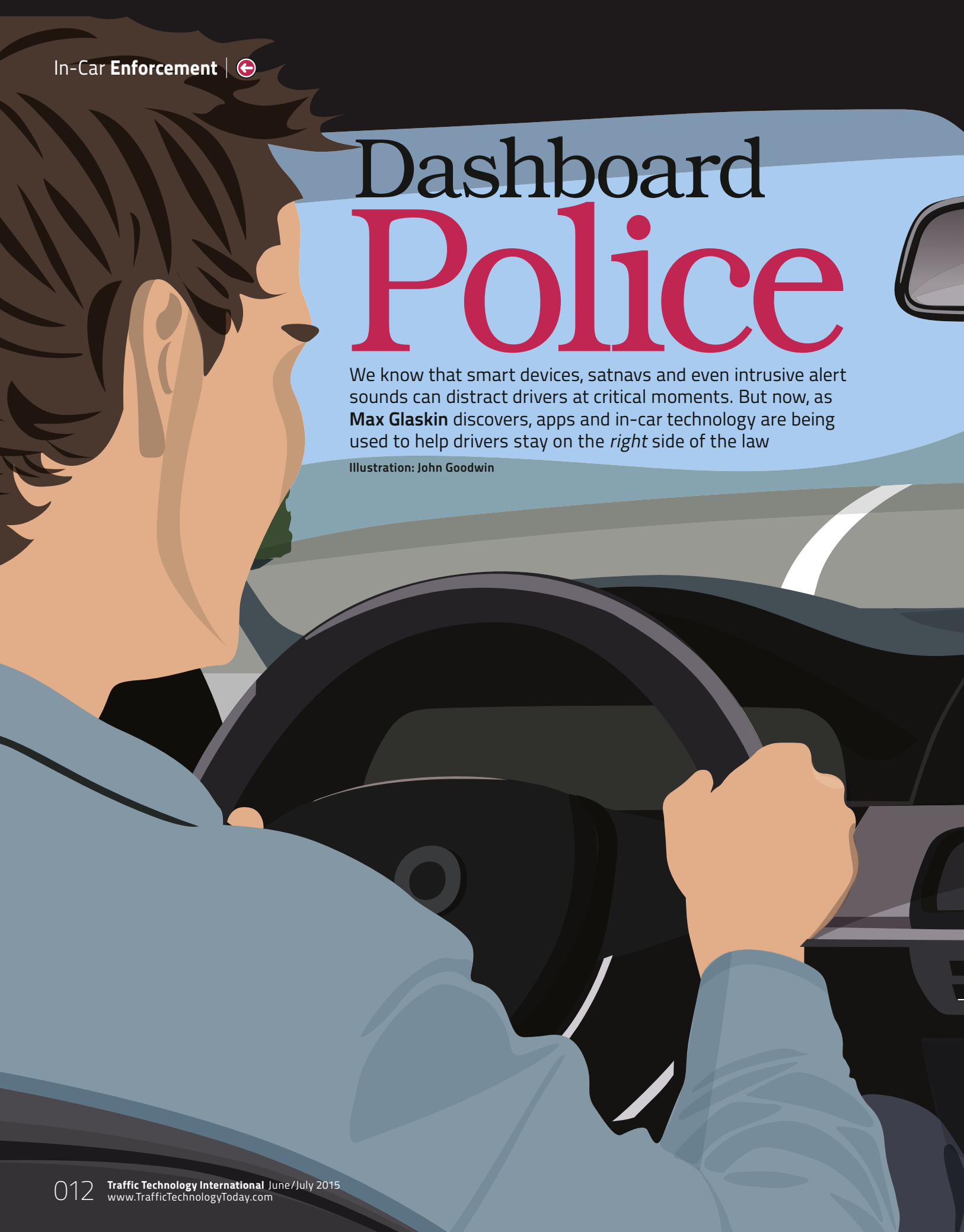
www.lumenera.com

Lumenera corporation

Dashboard Police

We know that smart devices, satnavs and even intrusive alert sounds can distract drivers at critical moments. But now, as **Max Glaskin** discovers, apps and in-car technology are being used to help drivers stay on the *right* side of the law

Illustration: John Goodwin



Staying lawful isn't easy on the road. It's not that the law is always severely restrictive, it's just that vehicles are built with so much potential and versatility, and are driven by humans who can overestimate their own abilities.

When you add smartphones, GPS, tablets and infotainment systems, it's no surprise that vigilance is required to keep to speed limits and respect traffic regulations. So in-vehicle technologies are evolving to help drivers stay on the right side of the law.

One way to reduce infringements is to reduce driver distraction. This could mean using systems that disable distracting devices when the engine is running. Fleet operators might be the keenest and earliest adopters of these solutions, prompted by the US$24m bill a Texas court handed Coca-Cola in 2012. A woman had been injured by an employee using a hands-free phone while driving. The cell phone safety policy in place wasn't enough for Coca-Cola to avoid the negligence claim because the company was already aware that talking hands-free is distracting and should have told its staff. The company would have avoided such problems if it had had technology to enforce the policy.

No contact zone

A smartphone app called Driver Protection, from Romex, goes some way to reducing the risk of a driver being distracted by their phone. It suppresses emails, texts and notifications while the vehicle is moving. Ironically, the app had started life as a mere add-on to a workforce management system for fleet operators.

"The suite of apps could be used to validate business mileage, schedules and so on, and then, with that, came a responsibility to make fleet drivers safer," says Steve Arscott, sales director at Romex. "We didn't want to give the drivers more reasons to use their phone while driving so it's now become the lead product."

He explains the problem the app can solve. "Drivers are often required to sign up to company policies, promising not to drive dangerously, for instance, but as soon as they leave the company parking lot they're free from any observation from superiors," says Arscott. The app keeps them from breaking company policies for safe driving and so would offer the employer protection from claims of negligence.

Prompted by requests for evidence that the app really does what Romex claims, Arscott asked TRL (the UK's Transport Research Lab) if it could provide an independent appraisal. Nick Reed, TRL's academy director, says everything was already in place to launch such a unique evaluation protocol of third-party in-vehicle safety systems. "TRL has undertaken work over many years in the evaluation of in-vehicle information systems," he explains. "The assessment protocol was developed using this experience, creating a suitable structure so that points could be scored in four categories: relevance, deployment, usability and resilience. The combined score allows for a robust, evidence-based recommendation status to be awarded to the system under test." The Romex safety system is now rated by TRL as Highly Recommended.

Visual challenges

The Driver Protection app aims to help drivers stay legal by reducing the chance of them being distracted by smartphones, but Reed knows other kinds of in-vehicle safety systems are on the way. "We know that things will change as connectivity increases through wi-fi, 4G and eventually 5G," he says. "As a result, we are likely to see systems that assess the driver's state of alertness – potentially restricting access to connectivity features at times of high attention demand and managing the influence of automated safety systems. TRL's evaluation protocol will evolve to provide a balance that enables people to achieve what they want with their third-party devices without compromising safety. It can draw a line in the sand."

Reed is right to anticipate new safety systems, judging from the number of research projects into advanced methods for monitoring human behavior and physiology. A team at the University of Illinois at Urbana-Champaign has tested a small patch that, when placed on the ear, reads the electrical activity of the brain. Could it recognize when a driver is sleepy and trigger alerts? And when they are focused and not to be distracted?

"Yes, such an application would, indeed, be very interesting," says Prof. John Rogers, the team's leader. "The key would be to develop algorithms that could identify signatures of a highly focused state from recorded brain wave information. This type of thing could form the basis of the next steps in research."

Extreme anxiety or stress can also increase the risk of a driver breaking the law and these emotional states could be identified by modified wi-fi, which is under development at the Massachusetts Institute of Technology. Its signals bounce off humans, like radar does off cars, and, when picked up and analyzed, they reveal breathing rate and heartbeat. If extreme vital signs are detected, they could activate an appropriate driver support and safety system.

Getting the right information to help a driver behave legally is another challenge. Distraction, again, raises its ugly head because it is known that displaying information visually can draw the driver's eyes away from the road and mirrors. As part of the Swedish government's Safe Interaction, Connectivity and State project, a team led by Pontus Larsson of Volvo Trucks has been sounding out how drivers react when sounds are added to visual displays.

(Left) **Bosch's stereo video camera has an emergency braking system that can function based solely on camera data**

Enhanced alcolocks

Advanced sensor technology could prevent drunk driving

There are already devices in thousands of vehicles around the world to stop drivers from driving when drunk. Alcolocks have been rapidly adopted by authorities determined to protect the wider population from drunk drivers – and drunk drivers from themselves.

Some require breath samples frequently and also confirmation that the samples are from the driver. One way to make sure that the driver is giving the breath samples is for the system to monitor their position throughout the journey – but this isn't always easy. Infrared sensors, vision analysis and radio frequency can suffer interference from light or heat.

So a team from University Magna Græcia, Italy, has begun trials using ultrasound to locate an occupant's position in a vehicle. "We are using sonar in a laboratory test, to support and cooperate with other sensors," says Antonino Fiorillo, team member. "The system is being integrated into a car." Should it work, it'll detect that the driver is in the optimum position for an automated breath sampler to obtain the most reliable reading.

> We are likely to see systems that assess the driver's state of alertness potentially restricting access to connectivity features at times of high attention demand
>
> **Nick Reed, academy director, TRL, UK**

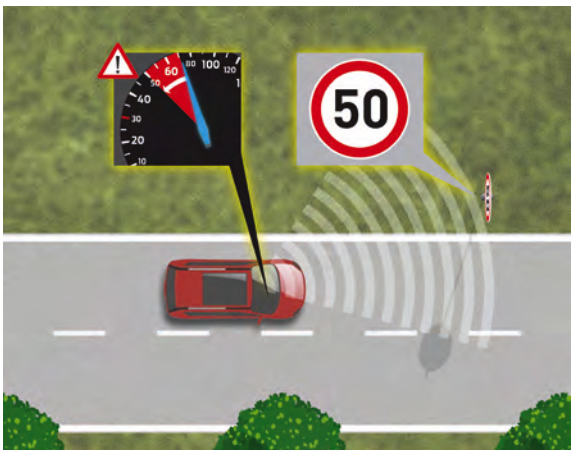
Enforce Anywhere, at Any Time

The new PoliScan FM1 – Fixed and Mobile Speed Enforcement with One Device

- » Fully automated
- » Multiple vehicles, multiple lanes
- » Intuitive touch screen user interface
- » Non-invasive detection
- » Differentation between vehicle classes

www.vitronic.com

VITRONIC
machine vision people



Judgment call

An onboard system could detect dangerous driving behavior

Traffic laws are largely intended to support road safety, so in-vehicle systems that reduce dangerous driving can also cut the risk of infringement. That's why the Brains4Cars project is relevant. It's an onboard system that monitors drivers and anticipates their maneuvers. It should alert a driver before they execute an illegal maneuver. The system, being developed by a team at Cornell and Stanford Universities, learns by analyzing information from several sources, including a database of street maps, GPS, vehicle dynamics and live video of the driver's face and the road layout. Further integration with the braking and steering systems might allow Brains4Cars to even prevent a maneuver if it judges it to be illegal.

The team used two families of sounds: musical notes and speech that has been compressed so much it's unintelligible, a mere human noise. Effectively each sound was an auditory icon, equivalent to the visual icons on the in-car display. What they've learned is that drivers spend less time glancing at the display – and make fewer glances – when it was supplemented by the compressed speech. So the right kind of sound can reduce visual distraction. Their next step is to try the experiments in real traffic.

Reducing drivers' tendency to glance repeatedly at an information screen has spurred auto manufacturer Continental to demonstrate a different innovation – a haptic touchscreen. It vibrates when touched, giving tactile confirmation to the driver that their input has been received so they don't need to look away from the road again and jeopardize their lawful driving. Continental says its haptic feedback display technology will be ready for series production by 2017.

A third way to reduce driver distractions has been put together by a consortium in Germany, including Daimler. It has been examining which kinds of conversations with onboard systems are less distracting. As part of the EU-funded GetHomeSafe project, it has explored whether a command-style dialog is less distracting than natural speech conversation. Using the OpenDS open-source driving simulation software and a Mercedes with a fully integrated system, they found natural language to be the best speech interface.

(Above left) **Ford's S-Max will have intelligent speed assistance as an option**

(Below) **The simple DropTag system comprises smart sensor pucks, an app and a secure server**

In-vehicle intelligence

UK product design and development firm Cambridge Consultants believes its DropTag system could help drivers keep to speed limits. The cheap windscreen-mounted tag detects accelerations and is used to record impact events for the vehicle rental sector.

"In isolation, the tag could only flash its LED as warning feedback," says Tom Lawrie-Fussey, product manager. "However the tag/smartphone combination could be a nice solution where, depending on the hazard, it could be configured to show a warning, even if the warning was derived from the phone."

A report for the European Commission, published in March, says that intelligent speed assistance (ISA) is now sufficiently sophisticated and robust to be mandated in all new vehicles. Soon afterward, Ford announced that the S-Max would be its first model to have ISA as an option. It uses cameras to scan traffic signs, adjusting the throttle automatically to help drivers stay within the legal limits. It works at speeds of 20-120mph and restricts fuel flowing to the engine, rather than using the brakes. If road signs are few and far between, it checks the speed database in its satnav unit. Either way, drivers can override it by pressing the gas pedal firmly. A Bosch stereo video camera is the eagle eye of a similar road sign-reading system for the Land Rover Discovery Sport.

It's not only drivers who'd benefit from systems to stop them breaking the law – their insurers should welcome it, too. Black box systems installed into vehicles can change a driver's premium dynamically according to their car's speed. These pay-as-you-drive systems, which are now offered in the USA, Italy and Germany, give the driver feedback by sending data to their phone. One such black box support company, UK-based BIG Telematics, has gathered data from almost two billion miles of driving, using route tracking from PTV xMapmatch. Although there is no way that it can directly influence the way the vehicle is driven, the indirect method of using personal economics can nudge drivers to obey sensible speed limits.

Cutting driving costs might be the most productive way to expand the market for technologies that help drivers stay legal. The method of encouraging lawful behavior through punishment with fines, bans and incarceration clearly has its limits. ITS could shift the paradigm to one that rewards the law-abiding driver.

Have you heard about colored licence plate?

NEW Vega COLOR family

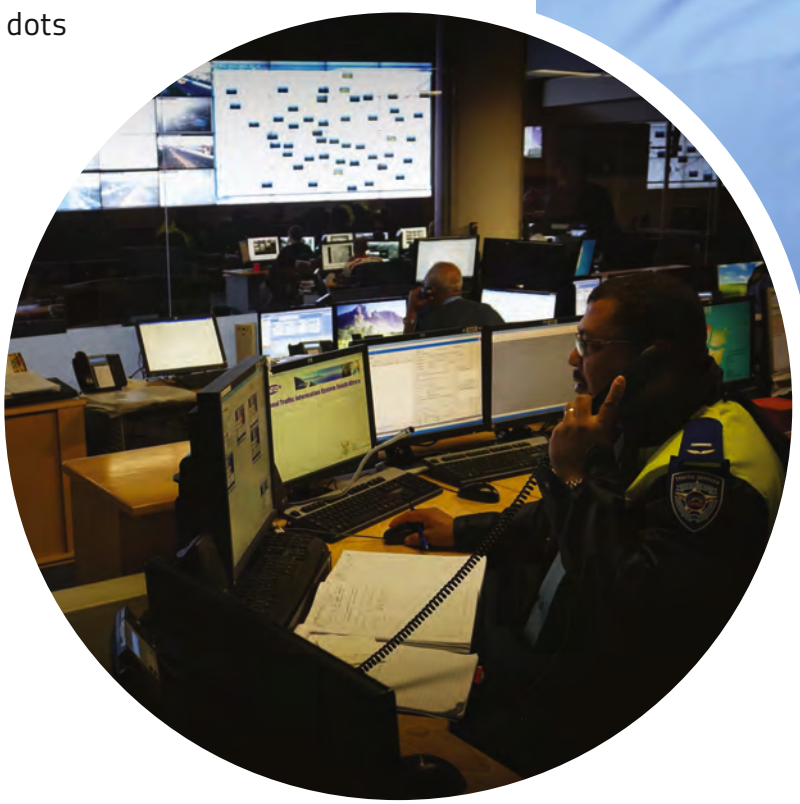
- All in one, plate Color detection and Licence plate recognition
- Integrated white light illuminator
- Micro Sd memory card up to 32 GB

www.tattile.com

Tattile
Custom Vision Solutions

Joining forces

If incident-detection rates and response times are to be improved, close collaboration with emergency services is essential. **Mark Hall** talks to jurisdictions around the world that are endeavoring to join the dots



One of the most important factors in reducing the impact of incidents on highways is cutting response times. When an incident occurs, every second counts – minor delays can quickly get amplified into major tailbacks on busy routes, and getting emergency services to the scene quickly can make the difference between life and death. State-of-the-art traffic management centers (TMCs) are beginning to come online around the world and they greatly enhance incident detection. However, they are also revealing a key inadequacy in some jurisdictions: full integration with emergency services isn't always as seamless as it could be. This can waste valuable minutes in the time it takes to respond to incidents and, moreover, lead to inefficient clean-up operations. That's why departments of public safety are starting to work more closely with transportation authorities – and are even positioning operatives within TMCs.

"It's a big issue nationally," says Don Hunt, former director of Colorado DOT. "We have a real problem in Colorado because firstly the state patrol is in a different department of state government, and secondly Colorado has extremely strong local government control, which means if an interstate or state highway is incorporated into a city, then it is controlled by the local government. They also control the emergency response.

"So we have had to build partnerships not only with the state patrol, but also with local government," Hunt continues. "The more we can get to consolidated traffic management centers, with the state patrol and eventually with large cities like Denver involved, the better our incident response will be. If the state patrol were still under the DOT, it would be easier to do. But almost all states created departments of public safety and moved the state patrol over to them. Plus there's the problem of law-enforcement speak and information on police radios that you aren't allowed to hear, so it's a lot of work to integrate them with DOTs."

Full integration

Wyoming DOT is one of the forward-looking departments that has already undertaken this kind of integration. "They have the state patrol and DOT personnel in the same room and they are able to talk with one another," says Hunt.

For the most part, this kind of cooperation is only achieved in the USA by breaking down barriers to cooperation – both physical and legislative. By contrast, across the Atlantic in Cape Town, South Africa, the building of a new TMC for the FIFA World Cup in 2010 offered the opportunity to design full integration with emergency services right from the start.

"My previous work in Johannesburg with SANRAL [South African National Roads Agency Limited] developing its Freeway Management System [FMS] helped me gain real expertise in terms of how a TMC should operate, who the different parties and stakeholders are, and the parties you need in such a building," says Francois Nell, who is now in charge of Cape Town's TMC, which is designed around a shared space for all stakeholders, including the city's Metro Police, breaking down the usual silos that exist in such set-ups.

(Above and left) **In Cape Town, South Africa, traffic enforcement officers are co-located with traffic managers in the city's traffic control center**

Randall Cable, operations engineering manager for SANRAL, worked closely with Nell on the genesis of the FMS. He outlines how efficient incident management is supported by operators being housed in the same area as traffic-signal controllers and having access to law enforcement agencies. "An incident on a freeway, such as a crash causing a delay and queue build-up, can be alleviated by diverting traffic via alternative routes with FMS operators liaising directly with traffic signal controllers to change ramp terminal signal timing plans to accommodate increased traffic flows at affected interchanges," he explains.

Now other regions in the country are looking to follow Cape Town's example. Kersen Naidoo, who manages ITS for SANRAL in KwaZulu-Natal, one of

> We have to build partnerships with the state patrol and local government. The more we can get to consolidated traffic management, the better
>
> **Don Hunt, former director, Colorado DOT, USA**

0.3 Second

A Total Quantum Leap in ETC

With more than 10 years of experience in the toll industry, Transpeed is a leading manufacturer of high quality, durable and reliable automatic lane barriers. On top of the conventional 0.6s, 0.9s, and 1.4s barriers, we are the world leader in the design and manufacturing of the Transpeed ultra fast automatic lane barriers, delivering an unprecedented speed of 0.3 seconds.

- 10 years of proven product track records in various weather conditions
- Captured over 70% of the ETC toll highways in China
- Wide installation bases in the Asean region

Other key products:

- Transpeed automatic and semi-auto smart card dispensing/receiving machines for total smart card management in toll collection
- Transpeed automatic vehicle classifier
- Transpeed number plate recognition camera

TRANSPEED

Web: www.transpeedsg.com E-mail: international@transpeedsg.com

---

DERECH ERETZ HOLDINGS

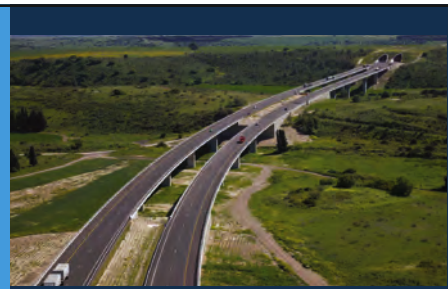
Specializes in Operation and Maintenance of PPP transportation infrastructure projects, including ETC 100% free flow, complete post-trip paid, highways and tunnels, toll shadow highways, PFI projects and others.

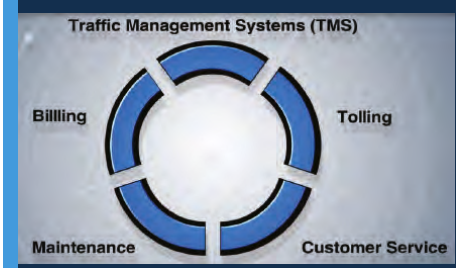
We offer rich experience in a wide range of fields:

- Complete end-to-end Operation and Maintenance customized solutions for toll highways and tunnels: technology, operation, safety, customer services, and marketing
- Characterization, establishment, operation and management of various technology systems including Tolling, Billing, TMS & FMS technologies
- Highways systems engineering management - supervision, quality control and safety surveys
- Highways infrastructure services and transportation asset management services
- Technological and integrative approaches to projects various stages (bid-construction-operation)
- Long term high collection rates from customers
- Consulting Services

Group projects:

- Highway No. 6 (Cross Israel Highway) - one of the longest 100% free-flow ETC roads (PPP) in the world
- HaCarmel Tunnels – first toll tunnel in Israel, 6km long, which includes tolling, TMS and FMS systems
- Highway No. 431 – 22km shadow-toll highway
- PFI projects – 270km of roads
- Road infrastructure services and transportation asset management services





Derech Eretz Holdings
Office Tel: +972-9-9662302
Fax: +972-9-9662303
Email: info@adv-so.com
www.adv-so.com

Desert dreams

The fast-growing city of Dubai is addressing its fast-growing traffic problems

Dubai, home to Burj Khalifa – the tallest building in the world (pictured right) – is growing at such a rate that it is creating soaring traffic volumes, meaning that effective network management is a high priority. Maitha bin Udai, CEO of the Traffic and Roads Agency at Dubai's RTA (Roads and Transport Authority), singles out a shift toward system integration as key to helping with the challenge

"This brings different information sources together and therefore reduces the workload for operators," she says. "We have also increased the use of our integrated reporting system to improve incident recording and management.

"A lot of time and effort is devoted to identifying incidents quickly and initiating the most effective response," she continues. "We maintain close working ties with the Dubai Police, which includes having staff in their control center."

She adds that to ensure that traffic control systems work at their best, there is a rolling program of review and improvement. "Engineers undertake SCOOT [Split Cycle Offset Optimization Technique] re-validation and timing improvements throughout the year," she explains.

Bin Adai also underlines the importance of having systems that are accessible. "Our operator workstations are set up to provide easy access to all the systems the operator requires on a daily basis," she says. "We also have dedicated workstations for specialist tasks."

Looking to the future, monitoring journey times across the network and providing routing guidance and live traffic diversion via a mobile app are in the pipeline.

the nine provinces that make up South Africa, believes it is the streamlining of incident detection through cooperative working practices that really makes Cape Town's TMC stand out. "It is a very good example of what can be achieved with close cooperation between authorities," he says. "I think that the situation there is ideal and all our centers are moving toward that example." He confirms that in KwaZulu-Natal the provincial traffic police have expressed interest in co-locating their command center with the TMC. "There would be tremendous benefits for both entities in doing this because we can leverage off their enforcement duties and we can give them eyes on the road from our center's CCTV system," says Naidoo.

Additional benefits

Back in the USA, Hunt points out additional benefits of greater cooperation between traffic managers and emergency services. "It's not just about detection; it also helps when it comes to managing incidents," he says. "The state DOT on a state highway or interstate can close the road, primarily due to adverse weather or flooding, but if you're going to block the road when there's an accident, it's 100% controlled by the state patrol; and if you're in an incorporated city, it's 100% the local police. Trying to merge that together is difficult. We have to do it through careful partnership and persuasion.

"The DOT knows about it first, but has no control over it. We can start putting up messages, but in terms of lane blockages and clearing the road we have no control over the accident scene. Law enforcement does."

Now, Hunt believes, DOTs should start to move to a situation where – if there isn't substantial property damage or injury – they can take over from first responders in managing the incident, freeing up the police, fire and ambulance crews to deal with more pressing emergencies. "We're starting to make some progress on that in the Denver metro area," says Hunt. "Our folks roll up and it's a dangerous place to be, so we make it clear to the emergency responders that the DOT can take care of it. If we don't get the road clear quickly, secondary accidents can happen."

Of course, when there is serious property damage or personal injury it's still important for the emergency services to be in control. It's ultimately all about better communication between them and the DOT, to enact the best possible solutions on a case-by-case basis.

> "TMC operators can view incidents and congestion without the interruptions we experienced using the former analog system
>
> **Reza Karimvand, assistant state engineer, Arizona DOT, USA**

Going digital

Greater communication between departments is made much easier by the latest technology. Arizona Department of Transportation (ADOT) has recently installed an impressive, giant, curved video wall in a US$2.1m renovation of its TMC. However, it's not the size of the screens, but the speed of the data that is really making a difference – facilitated by a state-of-the-art digital multicast stream.

"TMC operators can view incidents and congestion without the interruptions we experienced using the former analog system," says ADOT assistant state engineer Reza Karimvand. "Every second we save helps us clear the roadway, preventing secondary crashes."

Embedded intelligence

In Singapore, incident management is being made more efficient through automation

The city-state of Singapore is a major commercial and financial hub, boasting the world's third-highest per capita income. With a population of nearly 5.5 million in an area of 276 square miles (715km²), it is not surprising that this urban environment necessitates careful traffic management, with a strong appetite for system integration.

Germaine Tay, manager of one of the Land Transport Authority's (LTA's) TMCs, explains that, from a technology standpoint, the LTA's i-transport system – first developed internally in 2002 – provides a powerful integrated operation platform for various ITS elements. "Many mundane tasks that previously needed to be carried out by our operators are

automated through i-transport," she says. "As a result, there have been sharp improvements in efficiency and effectiveness." One area where, in Tay's estimation, i-transport has the greatest impact is in a swifter overall response to traffic incidents in terms of detection, diversion routes, and the announcement of relevant information to motorists.

Alongside automating traffic and incident management, Tay emphasizes the need to carefully monitor the human side of things, specifically the workload of staff. "We put in place a good shift and rest system, and provide an open channel for feedback and discussions with our operators," she says. Sufficient training and refresher courses are also critical, in Tay's opinion, to ensure operator competence.

Although Singapore's emergency services are not co-located with OCC staff, CCTV feeds are regularly shared with agencies such as the police and the Singapore Civil Defence Force (the city's firefighting agency), which helps to coordinate management of traffic incidents. Beyond this, should a prolonged emergency arise, communication and video-feed facilities in a conference room mean it can be quickly converted into a fully fledged command post.

And, just as other jurisdictions are discovering, it is important to share this data as much as possible. Accordingly, Karimvand reports, other local agencies – cities, Maricopa County, local and state law enforcement – all have access to the same video feeds.

The Pennsylvania Turnpike Commission (PTC) is also benefiting from a similar multicasting system, which allows operators to instantly bring up feeds from any one of the 67 cameras on the system on their consoles – and following a redevelopment there are now 20 of these consoles, rather than just eight. Asked how this impressive uplift in capability got out of the starting gate, Tim Scanlon, director of traffic engineering and operations for the PTC, points to a number of factors coming into play: "Over the past 25 years we have expanded from roughly 460 miles of roadway to 550 miles, and our lane miles and volumes have probably doubled in that time. We were even looking at tolling I-80 – which didn't come to fruition – when sizing our center."

Another consideration, says Scanlon, was housing other agencies during emergencies. "Our DOT and some of the PEMA (Pennsylvania Emergency Management Agency) operatives can now be in the same room," he says. He reflects that in the old center there was no room for additional bodies. "We now have spare consoles in the main room, as well as an additional situation room – which we refer to as the 'war room'."

Scanlon is confident of the operations center's ability to deal with the unexpected. "Because we are co-located with our data center, we have numerous back-up systems and power coming in from two separate feeds," he says. "If we lose power from one feed, we still have the other. Two generators can keep us on power for 10 days – which is a decent amount of time – and we have UPS too." The upshot of this, Scanlon says, is that even if utility power drops out, the center's consoles stay up and running, so they are confident they can detect incidents and deal with them 24/7. "The video walls may go momentarily, but they come right back up," he explains. "We don't lose anything whatsoever on the operations floor."

Stronger together

Around the world, it's clear that improving the speed and effectiveness of incident detection and management relies on ever closer cooperation between DOTs and law enforcement agencies. Technology is helping to enable this cooperation, with digital multicasting systems and state-of-the-art traffic management centers enabling stakeholders to work more closely together than ever before, both virtually and physically. But to get the greatest possible benefit from these new systems, it is also incumbent upon users to work at breaking down traditional bureaucratic barriers between government departments, so that a fully coordinated response can be mounted for every incident. Only then can transportation departments ensure that roads are kept moving, emergency resources are used efficiently, and ultimately lives are saved.

> "Our DOT and some of the PEMA (Pennsylvania Emergency Management Agency) operatives can now be in the same room"
>
> **Tim Scanlon, director of traffic engineering and operations, PTC, USA**

ortana

ORTANA Offers METEOS, a New Line of Weather Station Solutions

METEOS is a new line of meteorological sensors within the ORTANA family which can be integrated into ITS systems to detect and measure functional microclimate conditions on the roads.

www.ortana.com info@ortana.com

Inside job

Lauren Dyson finds out how ITS and infrastructure expertise have combined in a multifaceted safety project that will mitigate the effects of a fire incident in one of the most important tunnels in the UK

The A55 trunk road in North Wales is a major arterial route linking Wales to the northwest of England – as well as to Dublin on the east coast of Ireland, via ferry from Holyhead. The busy route, which has two lanes in each direction, is reliant on the operation of its critical infrastructure, notably its three tunnels, which together cover a distance of 2.5 miles (4km). The most famous of these tunnels is the one at Conwy, which carries the A55 underneath the River Conwy estuary. When Her Majesty the Queen opened the twin-bore immersed tube tunnel in October 1991, it was the first of its kind in the UK. It has since been described as one of the most important feats in UK civil engineering history.

The Penmaenbach Westbound Tunnel and the Pen-y-Clip Westbound Tunnel, which opened in 1989 and 1994 respectively, are also vital to this strategic route. They are both unidirectional undivided highways in a rock tunnel bore that carries the A55 across two major headlands.

A camper van once caught fire just outside of the Conwy tunnel, but there have never been any serious fire incidents inside any of the A55 tunnels. However, as each tunnel reached its 20th birthday, the operators were aware that the infrastructure was lacking the important safety provisions that would save lives in an emergency situation.

(Inset) **Highly visible lane-use signs aid traffic management in the A55 tunnels**

"When the A55 tunnels were designed – in the late 1980s – the safety standards were completely different," says James Price, director general of the Welsh government's department for economy, science and transport. "The designs included a few safety elements, such as ventilation to clear pollution and extract smoke in the event of a fire, as well as crossover doors to aid escape and CCTV to monitor activity in the tunnel – but that was all. There were not many safety requirements in those days."

> When the A55 tunnels were designed – in the late 1980s – the standards were completely different
>
> **James Price, director general of economy, science and transport, Welsh government**

In fact, all tunnels were, at one time, considered to be safer than the open road. It was thought that the 'controlled' environment, with uniform lighting

(Above) **New LED luminaires in Pen-Y-Clip tunnel**

and few junctions reduced the risks for drivers and also protected them from adverse weather effects.

Then, in March 1999, a truck carrying flour and margarine caught fire in the Mont Blanc tunnel between France and Italy. Quickly escalating out of control, the fire burned for 53 hours and reached temperatures of 1,000°C (1,830°F), destroying the tunnel infrastructure. Meanwhile, the toxic smoke overcame the drivers and passengers trapped by the blaze. Thirty-eight people died and many more were seriously injured.

"After the Mont Blanc tunnel incident, the industry started thinking about tunnel safety more seriously," says Price.

Indeed, in April 2004 the European Parliament adopted the EU Directive 2004/54/EC, which specifies the minimum safety requirements for tunnels in the Trans-European road network. This was the first piece of legislation to set minimum safety standards for European road tunnels and it was designed to coordinate safety management across the region.

Then in 2007, the UK government published its own Road Tunnel Safety Regulations (RTSR), which detailed specific technology and signage requirements for road tunnels in England, Scotland, Wales and Northern Ireland. Both the EU and the UK regulation documents gave the operators of existing tunnels until April 30, 2014 to comply with the new regulations.

"We needed to upgrade the tunnels to improve safety and meet these regulations," says Price.

Risk management

Following an extensive risk analysis, risk assessment and gap analysis, several projects were identified as necessary in order to comply with the EU and UK regulations. These included the installation of an incident detection system, a public address system, wayfinder signage, evacuation lighting, initial evacuation point communications, cross-bore drainage isolation for Conwy Tunnel, and fixed signage within the tunnels and on the tunnel approaches.

"The main safety risk in these tunnels is vehicle collisions resulting in fire," Price explains. "Fires build up really quickly in enclosed spaces and they are difficult to control."

(Above) **The Conwy tunnel prior to refurbishment**

"Vehicle fires in road tunnels are dangerous for several reasons," says William Connell, technical director of mechanical engineering at Parsons Brinckerhoff (PB) and the current chairman of the National Fire Protection Association (NFPA) Standard 502 – Road Tunnels, Bridges, and Other Limited Access Highways. "The fire load itself [vehicles, fuel, cargo] is transient and constantly changing so when a fire does evolve, its potential severity cannot be immediately evaluated. When a vehicle in a road tunnel catches fire, there is a high risk of the fire spreading to other vehicles that may be trapped either behind or adjacent to the burning vehicle.

"Furthermore, when a vehicle fire occurs, the typically restricted confines of a road tunnel severely limit the ability of the smoke and heat to disperse and, instead, act to contain it," Connell continues. "Because of this potentially deadly environment, large capacity mechanical ventilation systems are needed to control the movement of the heat and smoke, so that motorists trapped behind the burning vehicle remain safe."

The longitudinal ventilation systems that previously existed in the A55 tunnels have all been replaced as part of the recent improvement works. The tunnels now also have new pollution and visibility sensors (CO-Nox-Vis), as well as a linear heat-detection system. "This is a cable that runs all the way through the tunnel," Price explains. "If it detects a heat spike at a certain point, an alarm is raised. This system will alert operators to a fire much more quickly than CCTV would, but it is our hope that the improved incident detection system will enable us to identify any potentially dangerous situations before a fire even has the chance to start."

Detection and mitigation

According to PB's Connell, the most effective way to mitigate the effects of a tunnel fire is by having the ability to identify a fire incident and its location within the tunnel as quickly as possible. "Devices such as automatic fire detectors, CCTV cameras, gas monitoring instrumentation and vehicle motion detectors are ideal for identifying when a possible vehicle fire has occurred," he says. "Early identification of a tunnel fire will lead to the earliest possible intervention by emergency responders – and thus the best opportunity to mitigate the incident."

One of the major improvements to the technology in the A55 tunnels is a new system that enables incidents to be managed more quickly and effectively.

"We now have a two-pronged approach to incident detection," says Price. "The tunnels have always had CCTV, which is used by operators at the control center to monitor the tunnels 24 hours a day, but they now also have automatic incident detection systems that detect anomalies in the traffic flow."

Using a number of new cameras installed inside the tunnels, the automatic system alerts operators about unusual activity with an alarm and on-screen

Priority vision

Lighting plays an essential role in optimizing safety in tunnel environments

Tunnel lighting should maintain a suitable, continuous level of light and minimize any optical disruption for drivers entering or leaving the tunnel. It is also essential for guiding people to safety in an emergency situation. Therefore, a substantial number of LED luminaires have been installed at high level along the center line of the A55 tunnels. The new lighting is fully compliant with regulations for traffic traveling up to 70mph.

To support the LED luminaires, steelwork has been fixed to the ceiling of the tunnels, and lighting controllers, photometers and LED drivers have been installed.

The lighting system is designed to have minimal maintenance, which could subsequently minimize the requirement for future tunnel closures. Furthermore, the LEDs facilitate reduced power consumption, resulting in a smaller carbon footprint.

highlighting, within a few seconds of an incident occurring. Faster responses to incidents means less risk to the public and reduced damage to infrastructure. The risk of secondary accidents is also reduced, as real-time warnings can be issued to drivers approaching the incident site. The system is designed to detect stopped vehicles in both fluid traffic and congested traffic, as well as slow vehicles, pedestrians, wrong-way drivers, debris in the road, loss of visibility, and smoke. Permanent digital recording allows for post-incident auditing and assessment.

Efficient evacuation

Following a series of assessments, it was decided that fire suppression systems were not necessary in these tunnels, due to the number of evacuation processes being introduced as part of the upgrade project.

"Evacuation measures were our priority," Price confirms. "So, if a serious incident does happen in one of the tunnels, we have the systems and procedures in place to get people out quickly. The new evacuation signs play a critical role in this. There are highly visible signs every 50m within the tunnels, guiding road users to the nearest exit."

The tunnels also have new public address systems. "This facility enables operators at the control center to give verbal instructions to people inside the tunnel," Price explains. Often people do not recognize the danger they are in and their reactions can be unpredictable. Many of the victims in the Mont Blanc tunnel disaster, for example, did not leave their cars. "The public address system can be used to broadcast urgent instructions to motorists – to either stay where they are or to evacuate the tunnel – during the important first few minutes of an incident," says Price.

> The typically restricted confines of a road tunnel severely limit the ability of the smoke and heat to disperse and, instead, act to contain it
>
> **William Connell, technical director of mechanical engineering, Parsons Brinckerhoff**

(Below) **Modern ventilation in Pen-Y-Clip tunnel**

The PA infrastructure across the three tunnels encompasses more than 44 miles (70km) of cables and 142 loudspeakers fixed to the concrete lining of the structures. Meanwhile, nine racks of amplifiers and control equipment provide live speech and pre-recorded message broadcast facilities at the North Wales Traffic Management Centre and at a standby control room.

The new technology extends to outside of the tunnels, too. Large variable message signs (VMS) situated on the tunnel approaches can now be used to advise approaching vehicles about a possible incident. "If something does happen inside one of the tunnels, it is critical that we stop more people going in there," says Price. "Operators in the control center can update the VMS in real time, to prevent any more drivers entering the structures."

Some of the more modern tunnels, such as the Dublin Port Tunnel in Ireland, have VMS in the roof to provide up-to-date information to people inside the tunnel. "Unfortunately we didn't have the height to install that in the A55 tunnels," says Price. "We do have lane-use signs within the tunnels, though – red crosses and green arrows."

"Lane-use signals positioned throughout a tunnel are used to identify when a lane is available to motorists or has been closed due

Road Weather Decision Maker – Meet iRWIS

Introducing iRWIS – more than a product, a best practice philosophy. iRWIS consists of intelligent roadside hardware (RWS200), making its own decisions, and sophisticated decision support software (RoadDSS™) that makes "making the call" easier and more accurate.

Learn more about how iRWIS can help you at **www.vaisala.com/iRWIS**

www.vaisala.com/iRWIS

VAISALA

Traffic Technology International **FREE APP** now available!

GO TO THE APP STORE **NOW** TO DOWNLOAD THE APP FOR YOUR TABLET

DOWNLOAD NOW!

PLUS

THE LATEST NEWS & **FREE** MAGAZINE ARCHIVE

Available on the App Store

ANDROID APP ON Google play

to a traffic incident or for maintenance," Connell adds. "This type of traffic management is extremely important for road tunnel operations in both normal and emergency situations."

Advanced guard

Reliable operation of the tunnels' new safety systems is dependent upon a network communications system. As such, a new fiber-optic TCP/IP ring circuit with industrial switches has been installed, as well as a new, more resilient, fiber communications network that will support both existing and new safety-critical tunnel assets.

"We have also made critical investments in asset protection," says Price. "Notably we have installed passive fire protection for the electrical and communication distribution systems in all of the tunnels, as well as better protection for the tunnel joints in the Conwy tunnel."

> If something does happen inside one of the tunnels, it is critical that we stop more people going in there
>
> **James Price, director general of economy, science and transport, Welsh government**

(Above left) **New cabling optimizes the performance of the safety systems** (Above) **Installation of LED lighting in the Pen-Y-Clip tunnel** (Left) **The new public address system in Conwy Tunnel**

Tunnel closures can have a huge social and economic impact. The Mont Blanc tunnel was closed for three years following the 1999 disaster. "The A55 is probably the only viable route for drivers wanting to get to Dublin by road, via the Port of Holyhead," says Price. "It is hugely important to the local area. If a serious incident does occur in one of the tunnels, it is essential that we are a667ble to open it again as soon as possible. These fire protection measures will enable us to achieve that."

"Fire protection of the tunnel structure itself is an effective means of mitigating the effects of a vehicle fire," PB's Connell confirms. "Some vehicle fires have the potential to cause severe damage to the structure, which could result in loss of its use for extended periods of time. Passive structural protection systems such as fire boards or panels are an effective way to protect the structure from fire damage."

The completed works have improved the resilience and safety of the A55 tunnels to a standard above that required by the EU and UK regulations. Furthermore, additional works are being planned, with completion scheduled for 2017.

Black CAT Compact

- **3 sensor card** positions which can be populated with any combination of 8 channel inductive loop cards, 8 channel Piezo (axle) cards or Bluetooth® card.
- **Communications** options are GSM, 3G & GPRS.
- **Power** can be provided by battery or a combination of battery & solar panel.

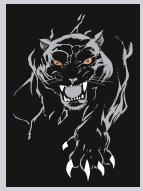
Black CAT Midi

- **3 sensor card** positions as Black CAT Compact, with additional cards for Piezo WIM, Kistler WIM, Bluetooth® and options for connecting to other devices such as ANPR cameras.
- **Communications** options are GSM, GPRS, 3G and Ethernet.
- **Power** would be provided by permanent mains power connection. However, there is an internal battery back-up for short term mains failures.

Black CAT Rack

- **Total of 8** sensor card positions which can be populated with any combination of loop cards, with additional cards for Piezo WIM, Kistler WIM, Bluetooth® and Switch I/O card (Max 4 cards of any one type).
- **Communications** option are GSM, GPRS, 3G and Ethernet.
- **Power** would be provided by permanent mains power connection. However, there is an internal battery back-up for short term mains failures.

Catalyst in-station Platform



Built upon a flexible and scalable architecture, the Catalyst in-station platform grants easy access to impressive levels of functionality while maintaining usability.

- Catalyst harnesses the flexibility of the Black CAT, allowing multiple data objects to be output to multiple destinations.
- Information about location & equipment assets are stored within the applicatioin
- Catalyst can be deployed on one server, or scaled over many servers to support thousands of devices & algorithms.
- Integral fault management at every level of architecture
- UTMC adaptors available to a export data to a UTMC common database
- Real time data validation

Black CAT WIM

- The mains powered Black CAT Midi and Black CAT Rack can be fitted with Piezo WIM or Kistler WIM cards to offer Weigh in Motion systems.
- Black CAT WIM systems can be supplied either as a stand-alone devices or connected to CA's range of Evo ANPR camera systems.

CA Traffic

DELIVERING QUALITY DATA SERVICES TO THE UK OVER 20 YEARS

GLOBAL TRAFFIC MONITORING

Go to www.ca-traffic.com for product literature

CA Traffic Limited, Griffin Lane, Aylesbury, Bucks HP19 8BP F: +44(0) 1296 333 498

@CA_traffic

T: +44(0) 1296 333499 enquiries@c-a.co.uk www.ca-traffic.com

The road ahead

Transportation authorities are being mandated to deliver timely traffic data to road users. But as **Tom Stone** discovers, simply knowing what's going on in real time often isn't enough – there's now an increasing need to predict the future

Photography: Bezikus, FCG/shutterstock.com

Both the UK and the USA are in the midst of their biggest-ever coordinated roll-outs of traffic information systems. In the USA the deadline for the implementation of first stage of federal regulation 23 CFR 511,[1] mandating the introduction of real-time information programs on interstates, has already passed. DOTs were required to have such systems up and running by November 8, 2014. Now the focus is on expanding such systems so that they also operate in metropolitan areas. The deadline for this second phase is November 8, 2016.

Meanwhile in the UK, Network Information Services Limited (a joint venture between consultancy Mouchel and electrical systems provider Thales) are halfway through a seven-year contract with Highways England to transform and operate the National Traffic Information Service (NTIS). The £57m project is providing up-to-the-minute information to the users of the UK's Strategic Road Network (motorways and A-roads) in an effort to make journey times more predictable and help customers to make alternative route (or even mode) choices should incidents occur.

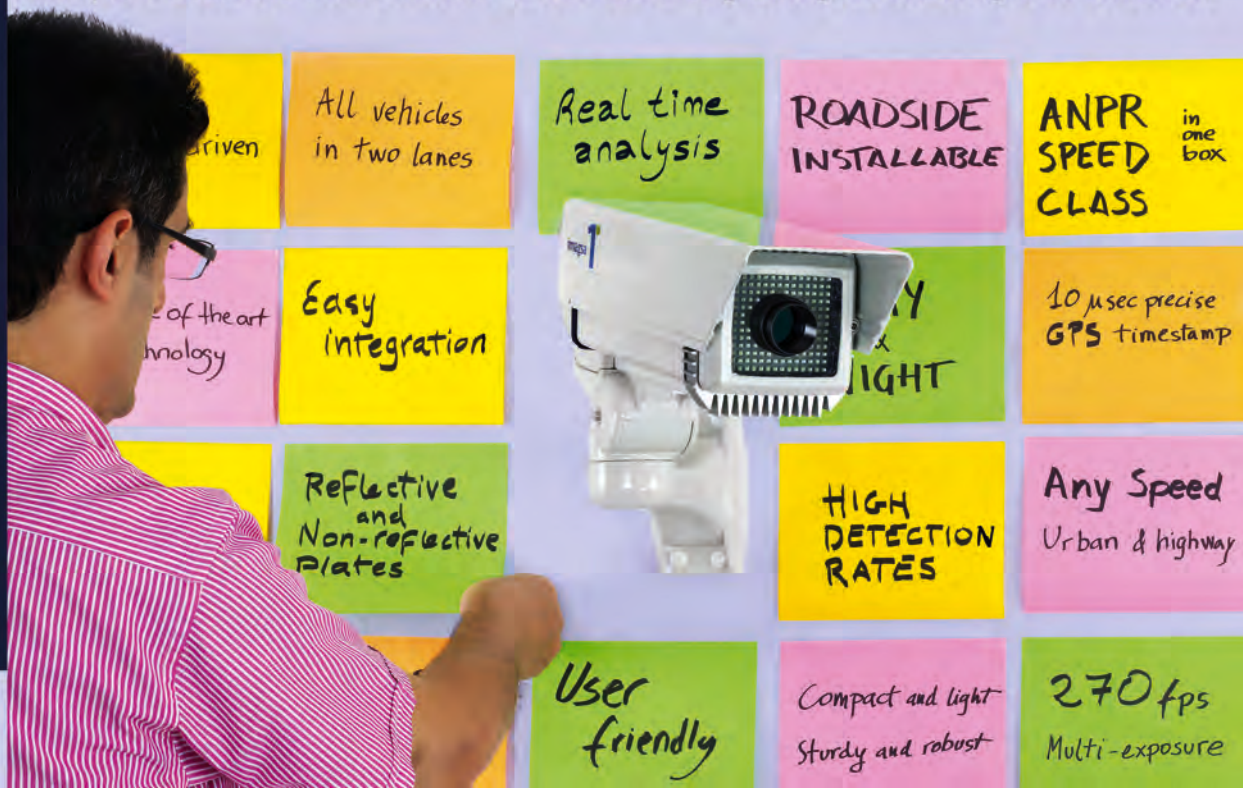
An American tale

The legislation in the USA breaks real-time systems down into four distinct data streams that need to be provided by the state DOTs. They are: construction, incident, weather and travel time information. Each of the different data streams has different requirements in

> "We know in general how the 'tides' of the city are going to work… Now we're trying to find the traffic jams in that data so we can predict the trends"
>
> **Jane Macfarlane, chief scientist and head of research, Here**

Atalaya'Micro

Imagsa Technologies is proud to share the launch of Atalaya'Micro V2: the most complete dual lane smart camera to face the ever-growing ITS challenges of tomorrow



imagsa
imagsa.com

---

ird | PAT Traffic

Detect. Measure. Analyze.™



- Commercial Vehicle Enforcement
- Toll Systems
- Data Services
- Fleet Management
- Bridge Monitoring & Safety
- Security & Access Control

irdinc.com | info@irdinc.com

INTERNATIONAL ROAD DYNAMICS INC.

terms of timeliness, accuracy and availability, and this can vary between phase one (interstates) and phase two (metropolitan areas).

In implementing phase one of the real-time systems, many DOTs found that, while they already had good systems for reporting the first three types of data (construction, incident and weather), getting travel time information accurate enough to present to the public represented a greater challenge. Connecticut DOT (ConnDOT) was typical. On assessing its systems, it discovered its travel time functionality was based on old traffic-flow sensors that weren't providing the level of detail required, as they weren't initially installed with real-time functionality in mind. To meet federal requirements, some enhancements had to be developed.

James Sorenson, an associate at consultancy IBI, worked with ConnDOT on the project. They looked at a variety of ways to collect real-time traffic data and ultimately it was decided to employ the expertise of a third-party vendor who could offer state-wide coverage. "We made adjustments to their Crescent ATMS (advanced traffic management system) to enhance functionality for travel times and allow them to use any third-party vendor," Sorenson told the ITS America Annual Meeting in Pittsburgh in June. "And once they selected that third-party vendor, we did additional modification to ensure they were using that third-party data appropriately.

"Now they have real-time travel time data available internally, so all the operators are able to see exactly what's being displayed on every VMS and access live, color-coded maps showing traffic density, as well as being able to see what travel times are being calculated. This data is also available to third parties via an XML, so it can be used for app development." The Federal Highway Administration concluded that the system represented full compliance with its requirements.

One advantage ConnDOT's system has is that all the data is now consolidated in one place, which allows for slicker dissemination both to the public and among government departments such as police, construction and maintenance. It also makes internal planning and research easier and makes it easier for outside agencies to do research on the state's behalf.

Public-private sharing of data is really beginning to gain momentum. In the past year, smartphone app Waze has formed partnerships with public authorities across the USA including Florida DOT, Oregon DOT and most recently, Maryland emergency services, to share its crowdsourced transportation data in return for more traditionally sourced feeds. Nokia's Here is also enabling forward-looking DOTs to deliver the best-possible real-time information to road users.

(Right) **All of ConnDOT's real-time information is available to the public online on its Interactive Travel Information Map**

> ConnDOT now has real-time travel data available internally, so all the operators are able to see exactly what's on every VMS and access live, color-coded maps showing traffic density
>
> **James Sorenson, associate consultant, IBI Group**

The here and now (and the future)

Nokia's real-time mapping service, Here, uses cloud computing to predict the 'tides and waves' of traffic flows – but the future could bring processing closer to home

Here's models work by first establishing what Jane Macfarlane, chief scientist and head of research at Here, calls the 'tides' of traffic. "We know in general how the tides of the city are going to work," she says. "So we're capturing all that information in this modeling paradigm in the cloud."

Once these tides have been established, it is possible to look deeper and try to predict the waves that occur at various times of day, or perhaps only in certain seasons, such as when there is

a lot of traffic visiting the beach on a hot day. "The waves are like chaos, where everything goes crazy and those tides don't work any more," says Macfarlane. "So we're trying to find the traffic jams in that data so we can predict the trends of those jams.

"We're really trying to find the needles in a haystack, but once you have all these patterns and you start figuring out what the general congestion is and you normalize that congestion, then you can pick out these small incidents. Very distinct clusters come from the data and that's what's captured in the predictive models. We can then create seasonal patterns."

This kind of big data analytics requires extraordinary amounts of processing power. However, Macfarlane predicts that this problem will be partly solved in the future by harnessing the power of what she refers to as spatially distributed computing. "That means that the computing that's being done in the cloud is going to come down to the edge – to the network," says Macfarlane. "Some of it is going to be done on devices. This is going to completely change how we build our applications going forward. It's very exciting. You can imagine traffic management doing localized computing at the cell tower."

(Above) **Drivers on London's orbital M25 now get updated with real-time information on how long it will take them to get to the next junction**

Better roads for the UK

In the UK, private-sector vendors are also involved in the National Traffic Information Service (NTIS). Giles Perkins, who is intelligent transport systems business development director for Mouchel[2], JV partners on the project, points to the breadth and richness of data being employed.

"One of the important new areas for us is floating vehicle data in its widest sense," he says. "So, it's vehicle location data and looking at how you can use that. It is collected from a myriad of sources, some of it is direct from fleet vehicles. There's an interesting stat that came out recently – Scania said 93% of its trucks are now connected in some way. There's lots of data being collected from commercial vehicles, smartphone data, apps running via smartphones, satnav data and so on. All sorts of things are being collected and fused together to provide a single viewpoint.

"We're continually working with the new system – the enhancements have been coming on stream for a while now, and over the next few months we will have fully realized the benefits of the new system. We don't stop at this point, we will continue to move forward with further developments and enhancements – it's an ongoing process of continual improvement."

The NTIS project began in 2011 and Perkins is able to look back at some of the real-time information that is already available to road users through the system.

"You've seen various enhancements over the years in the sort of information that's available on the strategic road network… such as variable message signs that tell you how many minutes it will take you to travel a certain distance," says Perkins. "Clearly people drive from door to door, not junction to junction. But knowing they can get to a certain place which is usually only 10 minutes from their house is hugely valuable in terms of estimating personal journey times.

"And we're not just getting richer information out to customers via VMS but also out on the various radio, TV and new media. The NTIS service provides information over a myriad of channels."

Using data for management

Of course, real-time traffic information isn't just useful to drivers on a network, it can also be invaluable to network operators. "Floating vehicle data is used alongside traditional fixed ITS data (loop or camera-based data," says Perkins, "So it gives you a much richer picture of how the network is performing. Having that large data set allows you to do much cleverer things, such as looking at not only what is the real-time picture like, but also what is the historical picture like, which in turn enables you to look what the traffic situation is going to be at 4:00pm this afternoon. That predictive element is hugely beneficial for network operators in terms of planning events and dealing with incidents."

Back in the USA, a new Connected Corridors program is being implemented in California, which creates a framework that moves traffic management into real time. "We've picked some top-priority corridors in California that have the highest congestion in the United States," says Joan Sollenberger, division manager at Caltrans' Office of Strategic Development.

> "Having a large data set allows you to do cleverer things, such as predicting what the traffic situation will be at 4:00pm this afternoon"
>
> **Giles Perkins, intelligent transport business development director, Mouchel**

"We're using our real-time data system in California – the Performance Measurement System (PeMS) gives us 30-second data, so we have instructions to our management center staff within a few minutes of an incident so we can start rerouting folks."

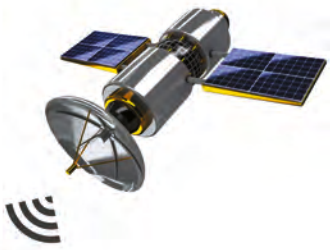
PeMS operates traffic speed and queue detection using hard sensors embedded in lanes, alongside visual systems. Plans are in place to install more sensors, particularly in ramps, so operators can see volumes coming on and going off freeways, and to use probe data to assist with that in the future.

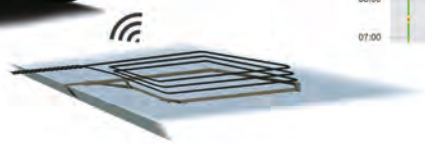
Caltrans is also further developing its decision-support systems – known as playbooks – to help get incidents cleared quickly. This involves working with local jurisdictions so the entire network can be used. The plan is for traffic signals to be automatically re-timed on arterial roads so that a temporary 'off freeway' route is created, eventually leading back onto the freeway once the incident is passed.

be-mobile
TRAFFIC & MOBILITY

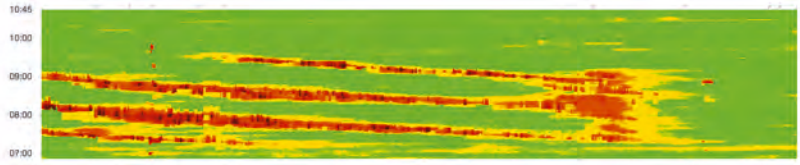
Be-Mobile is **world leader** in Fused Traffic Data.

We fuse and filter GPS based floating car data and road based detector data, eliminating the need to install and maintain part of these detectors while gaining a more in-depth understanding of traffic flow.

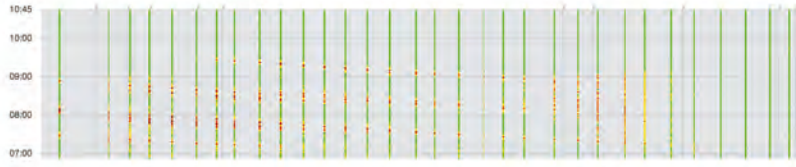




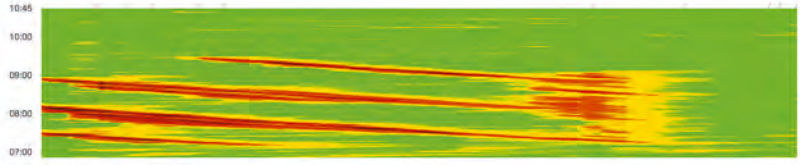
Floating Car Data



Induction Loop Data



Fused Data



Your results:

- a better understanding of traffic flow
- automatic speed advice
- less road based detectors

Smart Fusion, Smooth Traffic.

Learn more at be-mobile-international.com

"When we work with our partners, we know that it's chaos right now when people bale off the system and try to find their way around. It's very difficult. It doesn't work too well. So this will be more ordered and with the intent that we would flush the system out," explains Sollenberger. "And this could work the opposite way if something happens on an arterial and they could be directed onto a freeway."

However, getting the system up and running isn't without its bureaucratic obstacles. "Right now in California there's a different owner-operator for every part of the system, so we have many stakeholders," says Sollenberger. "So we're working with all of them including the California Highway Patrol and coroner's office. It takes a lot of partnership building." For more on the greater cooperation between public agencies that is becoming increasingly necessary in all areas of traffic management, see *Joining Forces* on page 18.

"Eventually we could be using public transit," continues Sollenberger. "We could have transit ready with parking. But that's a difficult part because people have usually made the decision, once they get in their car, that they're not going to park and take the train. But we're going to explore that as well."

Going multimodal

As Sollenberger points out, one area where real-time information is vital is in the development of multimodal information systems. A key pillar of the European Commission's ITS Action Plan is the development of these systems and there is a plethora of smartphone apps now on the market around the world, mainly dedicated to travel in cities. Often, real-time systems are focused on one mode of transportation such as rail, bus or cycle hire schemes, but Citymapper is one that provides truly multimodal information and is currently available in 22 international cities. It scans real-time data for all possible modal choices to guarantee users the fastest route to their destination.

Now North Carolina-based company Passport – a specialist in mobile parking payments – is taking multimodal systems to the next level by facilitating not only real-time information via smartphone, but also the ability to buy public transit tickets through the same app. "We're pulling in the Google GTFS (General Transit Feed Specification) data right now, so every time a transportation option is available, it will show you," explains Passport's vice president of transit products, Devin Patel. "And you can actually buy the ticket on the app, so it's completely integrated. It's not just an information system – it gets you all your tickets in one place and you can link it up with PayPal."

(Above right) **The Passport app not only gives real-time travel information, but allows users to buy public transit tickets, too**

Tucson, Arizona, is already trialling the system and Passport is now looking to partner with DOTs across the USA, on a revenue-share model, to integrate its paperless tickets with public transit. "There are two phases of the ticketing system," explains Patel. "Phase one is just visual inspection. We can launch that tomorrow. It's very simple. You just show the bus driver the ticket on a screen. It's dynamic, there's a countdown timer and other fraud protection. We'll pilot that for around anywhere from three to six months. Phase two is a hardware Bluetooth reader – basically you walk onto the bus and tap your thumb on the area and it attenuates the signal and validates the ticket. That's where it gets interesting. You get entry-exit data, how it's being used on the bus… it opens up a ton of avenues."

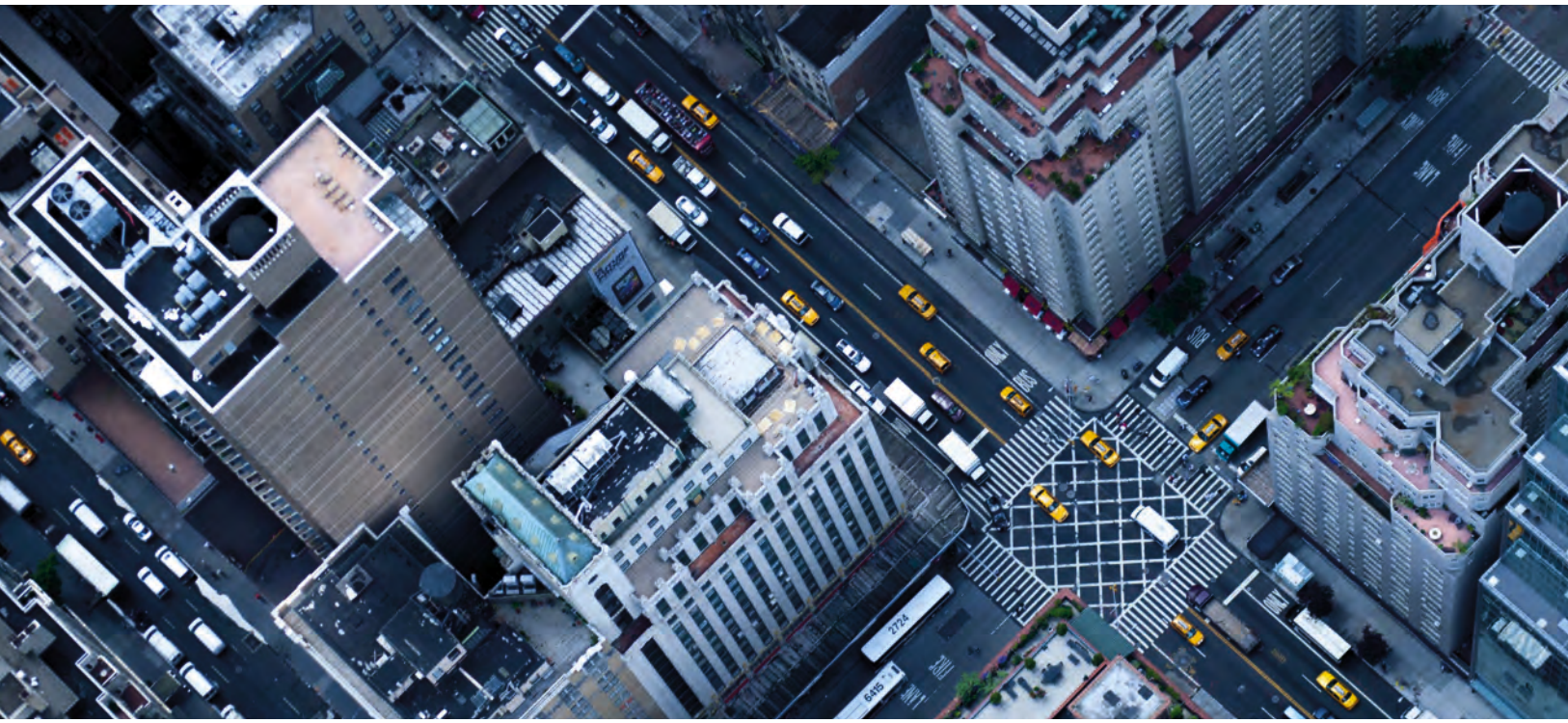
> We could have transit ready with parking. That's difficult because people have usually made their [modal] decision, once they get in their car. But we're going to explore that as well
>
> **Joan Sollenberger, division manager, Office of Strategic Development, Caltrans**

There are ever-widening applications for all types of real-time data. "Active traffic management means getting real-time data and making decisions right there about opening or closing ramps or lanes," says HNTB national technology leader Jason JonMichael. "But you can't do it if you're in a totally reactionary state. You've got to know what the future holds. It's no longer just about real time, it's about predicting the future."

1) tinyurl.com/FHWA-23-CRF-511

2) Giles Perkins is also communications director for ITS UK. He recently appeared at the Digital 2015 conference in Newport, Wales, on a panel discussing the future of digital developments across all modes of transport (digital2015.co.uk)

HERE Traffic
Make sense out of chaos



With services offered across 100% of the roads in 50 countries, HERE keeps people moving.

HERE Real Time Traffic is built on our highly accurate map and enhanced by billions of GPS data points and more than 100 data sources – from global information hubs to road works data providers and our own traffic operations centre.

We transform this complex data into useable insights, updating it every 60 seconds with current traffic conditions and incidents that could cause delays.

With 30 years of experience, HERE is your trusted partner to help ensure drivers get to their destinations efficiently and stress-free.

Drivers may keep their eyes on 1 road. We keep our eyes on 100% of the roads.

Learn more: here.com/heretraffic

here

Eye in the sky

Breaking free of sinister sci-fi scare stories, drones are beginning to appear on the horizon, ready for integration into many areas of everyday life. Jan Stojaspal investigates how they are already changing the transportation industry

Illustration: Magictorch

It typically takes traffic police from the Belgian city of Genk about half an hour to survey the scene of a simple two-car collision. An Altura AT6 drone carrying a 24MP camera and flying at an altitude of 100ft (30m) got the job done in five minutes during a demonstration flight in 2013. And the resulting images were so sharp that it was possible to measure every skid mark and every gouge in the asphalt to within less than a centimeter. (A measuring wheel would have produced an error at least 10 times as large.)

For drones and traffic management, the list of potential uses goes on and on. There is congestion monitoring during rock concerts and soccer games. Crowd control during strikes and demonstrations. Surveys of roads and bridges. Search and rescue missions where flying a police helicopter would be too expensive or too dangerous.

In fact a study conducted between 2013 and 2014 by the Georgia Institute of Technology for the Georgia Department of Transportation found more than

40 tasks where the GDOT could benefit from drones, also known as unmanned aerial systems (UAS), unmanned aerial vehicles (UAV) and remotely piloted aircraft systems (RPAS).

"Technically there is no problem whatsoever," says Peter van Blyenburgh, president of UVS International, a Paris-based association of manufacturers of remotely piloted systems, their service providers, research organizations and academia. "You have all the motion software required, the sensors, the aircraft that can carry them. You can always get an exemption for trying something for a period of, let's say, two hours on one day. But that's not what we are talking about. We are talking about authorities being able to do it on a routine basis."

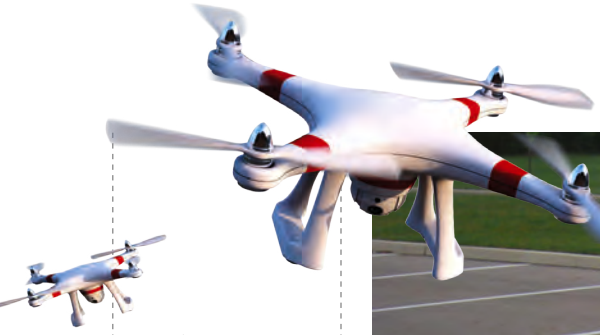
Indeed, until recently, regulators in the USA and Europe seemed uncomfortable with letting drones fly out of sight of the operator, and equally uneasy about permitting flying over densely populated areas, limiting practical use. However, in the past few weeks there has been evidence that this stance is beginning to change. Recent advances in detect-and-avoid technologies that guard against mid-air collisions, growing public acceptance and prices dropping to the point of making hobby drones one of the most popular gifts last Christmas, have all no doubt contributed to the gradual change in thinking.

The flight path to acceptance

In February 2015 the journey toward freeing up the use of drones in the USA looked as if it was going to be a long haul. The Federal Aviation Administration (FAA) proposed a framework of regulations that would allow 'routine use' of drones by commercial operators. The framework, which could still take up to two years to formalize, was initially limited to drones weighing less than 55lb (25kg), flying at no more than 500ft (152m) in altitude and only during daylight hours, with line-of-sight maintained at all times, among other criteria that effectively limit testing to all but the most routine of operations.

> You can always get an exemption for trying something for a short period… But we're now talking about authorities using drones on a routine basis
>
> **Peter van Blyenburgh, president of UVS International**

In the interim, the FAA went on to grant a broad airspace authorization to commercial drone users as long as they limit their flying to an altitude of 200ft



(Below) **Marc Bellinkx, chief of R&D and IT at MidLim police, tests a drone for use with traffic accident surveys in Belgium**

(Above) **An airplane-style drone being tested by Benjamin Coifman at Ohio State University**

(61m) and this has to be least two nautical miles from airports and heliports, which eliminates many important urban areas, where drones could be particularly useful.

"Here in Columbus our main airport is roughly two miles away from our main freeway," says Benjamin Coifman, associate professor of civil, environmental and geodetic engineering, at Ohio State University, who in 2003 published one of the first ever studies on using drones for road traffic monitoring. "And if you go five miles on from that then you already get to our secondary airport." So the restrictions that are in place in effect eliminate the testing drones from a lot of important urban areas.

The FAA ruling led most drone developers to predict that legislation permitting flight beyond

> 66 It's like going from a hard-wired phone to a cell phone. You are no longer tied to your fixed infrastructure locations
>
> **Benjamin Coifman, associate professor, civil, environmental and geodetic engineering at Ohio State University**

line-of-sight and over urban areas was a long way off. "It is not going to happen within the next two or three years," van Blyenburgh said at the time. However, at the beginning of May the FAA unexpectedly announced that it would allow two companies – PrecisionHawk, a North Carolina-based remote sensing and data processing company, and BNSF Railway – to test drones beyond line-of-sight for surveying purposes. In addition the FAA announced that it would also allow CNN to test them in densely

FREE SERVICE!

LEARN MORE ABOUT OUR ADVERTISERS **NOW!**

Visit **www.ukipme.com/info/tfm** to request exclusive and rapid information about the latest technologies and services featured in this issue

traffic TECHNOLOGY INTERNATIONAL

www.ukipme.com/info/tfm

Up in the gods

Tethered blimps get around current regulations facing drones – and are particularly useful at special events

For longer periods of observation, such as during rock concerts or sporting events, tethered blimps are evolving as an alternative to drones.

"Let's say there is an important sports match, or the president is coming into town and you need to watch an intersection that is suddenly a lot busier than usual," says Colin Brooks, a senior research scientist at Michigan Tech Research Institute. "You can send your tethered blimp up, transmit real-time video to your traffic operations center, which is already able to handle this kind of video, and take it down at the end of the event and move it to the next place."

Not only are tethered blimps a cheaper alternative to manned aircraft or stationary traffic cameras, but they are also easier to deploy and operate than traffic drones, which typically require a fresh set of batteries every 20 to 25 minutes and are subject to stricter licensing and flying regulations.

"It's also a technology that the public is comfortable with because it has clear benefits for traffic cameras," Brooks adds.

(Above right) **A tethered blimp like this one has recently been tested by Colorado DOT to monitor traffic on I-25**

populated urban areas for news gathering. Suddenly it seemed that the predicted long haul could turn out to be merely a short hop. The industry will be watching carefully how the tests conducted by this trio of pioneers unfold in the coming months.

Early adopters

When flying beyond line-of-sight and over urban areas, things are not that different in Europe. Although about a dozen countries already authorize the operation of drones for commercial purposes, and some have hundreds of certified operators, the vast majority of operations still take place within line-of-sight at an altitude of less than 500ft (152m) and with drones no bigger than 55lb (25kg). But there is no Europe-wide policy on their operation.

Nevertheless Europe is ahead of the USA regarding the use of drones in traffic management. Police in Genk, Belgium, have for example, flown drones for crowd control and search-and-rescue missions since 2012. And they are about to test a new generation of drones for traffic accident surveys. While the system mentioned earlier, tested in 2013, required the placement of scale markers around the scene and also had to be manually piloted, the new system is self-calibrating and the flight sequence is fully automated.

According to Marc Bellinkx, chief of R&D and IT at MidLim police, which covers Genk, there is enthusiasm among local police chiefs about the use of drones, but there is a general wait-and-see attitude for technologies to mature and become easier to use. "We were the first in the Belgian police service and at the moment the only one," he says. "We have many followers, but they are all waiting to see how things develop."

It is a different story in Sweden, where the national police have opened a tender for the purchase of an unspecified number of small drones. According to Stephan Ray, a national police press secretary, the drones are to be used not only for traffic monitoring but also for crime scene investigations and reconnaissance missions during SWAT operations.

The plan is to begin testing before the end of the year and for the Swedish military to help with training of operators, he adds. "It's the imagination that limits their use," Ray says. "It can be anything from a traffic accident to a demonstration or anything that involves the police needing to get an aerial view. And they are also to be seen as a complement to the use of police helicopters."

And while most of the focus has so far been on smaller drones, Italy is now also exploring civilian uses for military drones when they are not flying combat missions.

According to *Defense News*, the Italian Air Force agreed late last year to let the Italian police use its unarmed Reaper and Predator drones to monitor traffic and pedestrians around soccer games and during demonstrations in Rome, Milan and Turin, for example.

> "Everything is ready for use. There are some more advanced technologies that are still being worked on… but the technology is mature"
>
> **Javier Irizarry, director of the CONECTech Lab, Georgia Institute of Technology, USA**

"We discussed the possibility of finding synergies with the Italian police, and realized it could be beneficial for both," the publication quoted Colonel Michele Oballa, head of the 32nd Wing of the Italian Air Force. "The mission would be similar to some types of operations that we have done in Afghanistan,

Familiar spirit

One prototype car has an 'on-board' drone to guide it

On the scale of imaginative drone projects, no one appears to have pushed the envelope in quite the way Renault did last year when it unveiled its Kwid concept car.

Presented at Auto Expo 2014 in New Delhi, the compact five-seater, with its rugged exterior and sculptural interior, was billed as the first vehicle in the world to explore the idea of cars coming equipped with their own traffic drone – whether for scouting traffic ahead, watching for potholes in the road or simply amusing passengers with aerial photos of the car and its surroundings.

According to a Renault press release, the Kwid was designed to target young customers who are "basically gamers" and seeking an immersive digital experience even while driving. "This concept car meets those needs in a variety of ways, but mainly thanks to the Flying Companion, which makes driving safe and fun," Serge Mouangue, a brand manager at Renault, was quoted as saying. "This is the first time we have been able to drive on the ground with an eye in the sky."

And while it's too early to tell whether Kwid's 'flying companion' will ever see the light of day (the car itself was launched in India recently, minus drone technology), it is important to dream, says Frédéric Favre, a spokesman for Renault: "In the future we can imagine many things." And should the traffic drone idea turn out impractical, "we will also explore other solutions, such as car-to-car or car-to-infrastructure communication that would comply with regulations and offer some benefits," he adds.

(Above) **Georgia Institute of Technology is testing the surveying capabilities of drones**

while for the police, the Predators offer persistence and concealment, something they cannot always get in certain situations."

The start of a revolution

While these early adopters remain few and far between, they are all adding up to a critical mass that will eventually transform the field of transportation, industry watchers say.

"It's like going from a hard-wired phone to a cell phone," Coifman says. "You are now no longer tied to your fixed infrastructure locations, where you've got the cameras, for monitoring traffic. But don't expect things to happen overnight. There will be a lot of seemingly small advances that enable the whole. Look at how many features have been added to a thing like the cell phone. Ten years ago, it was, 'Look I've got a phone that flips open.'"

According to Javier Irizarry, a co-author of the Georgia Institute of Technology traffic drone study, the technology is essentially ready to go. "Everything is pretty much ready for use," he says. "There are some slightly more advanced technologies that are still being worked on, in sensing, image processing and video capture from the devices, but the technology is mature."

What's more, the public seems to be coming around. "When we started working on the research, the publicity that UAVs had was for the most part negative because of the historical use of UAVs by the military," he says. "A few years ago the French company Parrot came out with its AR.Drone toy and paired it with a cell phone, which everybody has. It became a story everybody was interested in and people started to see drones in a less negative way."

Waiting for the future to begin

But until regulations become more permissive and sophisticated, drone applications in the transportation sector will largely have to wait. When regulations are in place, it's likely to be a long time (if ever) before drones replace roadside cameras altogether. Coifman envisages a more likely scenario of them flying up and down a highway to fill gaps in coverage by stationary traffic cameras at busy times, or a drone with an infrared camera fitted to provide a specialist pair of eyes during a whiteout. Specialist functions will lead the way: it's easier to picture a drone flying ahead of emergency services to help coordinate first response to an accident, than one conducting speed enforcement.

However, once drones are safe enough to fly in concert with manned aircraft, more applications will become possible. "Once you open airspace to unmanned vehicles, all sorts of applications can be developed," says Gary Clayton, chairman of the UK-based Unmanned Aerial Vehicle Systems Association. "They'll be able to help with freight monitoring, traffic monitoring, search and rescue… The list is endless."

Heavy loads, poor roads.

HAENNI
A Baumer Company

Swiss Quality

Ecological tyre prints.

Mobile weighing on the spot is 30 times more effective in detecting violations than permanent weigh stations.
(According to a study of the University of Manitoba, Canada)

Weigh up the benefits: www.haenni-scales.com

Improve 24/7 Traffic Control Under the Darkest and Brightest Conditions

with FLIR Thermal Imaging

Images for illustrative purposes only.

Sun glare, shadows, darkness, and wet streets often pose problems for standard video cameras, confusing software that controls traffic lights. FLIR high-performance thermal cameras help overcome those challenges, providing more reliable detection of vehicles, cyclists, and pedestrians for smoother flow and greater safety day and night.

- Sees in total darkness and bright daylight in practically any weather
- Serves as a simple plug-and-play replacement for visible cameras
- Extremely affordable and easy to use

See how thermal imaging keeps traffic flowing at www.flir.com/traffic

FLIR® | The World's Sixth Sense™


OVERSIZE L

Worth the weight

The technology and processes associated with weigh-in-motion have remained largely unchanged over the past 20 years, but recent developments in ITS suggest that a new era is on the horizon, as **Saul Wordsworth** discovers

Heavily loaded vehicles accelerate pavement wear; that much we know. The repeated action of loading causes damage to the bound layers, which eventually warp and crack, leading to permanent deformation of the road. By how much is truly shocking.

"Traffic is most often reduced to units of equivalent standard axle load," says Aleš Žnidarič, head of bridges at ZAG, the Slovenian National Building and Civil Engineering Institute. "It estimates the so-called aggressiveness of an axle according to the law in power, which typically is four. This means that 10% overloading does not increase the damage by 10% but by 47%. Using the same principle, the damage caused by a 40-ton truck is 10-20,000 times greater than that done by a 1.5-ton car."

> WIM systems remain the most reliable and proven technology to acquire traffic loading information
>
> **Aleš Žnidarič, head of bridges at ZAG, the Slovenian National Building and Civil Engineering Institute**

The economic downturn of the last seven years, combined with sporadic spikes in fuel prices, have led companies to seek cost-cutting measures. With a clear line between goods shipped and profit, overloading trucks is more common than ever. If caught, the penalties can be high, but the density and frequency of checks remains low on account of the priority to focus on safety, speeding and drunk driving.

Now
OIML-certified!
(R134)

Kistler Weight Enforcement

The Kistler WIM Data Logger and our unique Lineas® Weigh-In-Motion (WIM) sensors help you detect and identify overloaded vehicles with maximum accuracy in real time. Maintenance-free operation thanks to extremely durable quartz crystal technology will cut your costs.
Our experts are at your service worldwide.

www.kistler.com/wim

KISTLER
measure. analyze. innovate.

An intelligent solution

Camea's systems can be adapted for a variety of WIM applications

As technology has advanced and WIM systems have become increasingly accurate, there has been an increased demand for these solutions from road authorities. "Overloaded vehicles are a worldwide problem," says Otto Fučík, technical director at Camea in the Czech Republic. "The growing number of these vehicles needs to be actively addressed."

Camea is a high-tech organization with 20 years of experience in image and signal processing for traffic monitoring and industry inspection. To date, the company has installed nine high-speed WIM stations in its home country. "Most of these meet the strict requirements for direct enforcement without the need for further weighing," says Fučík. "The systems are not yet in full operation, due to legal reasons, but the last legislative steps are underway."

The bidirectional traffic mode of Camea's WIM system prevents vehicles from avoiding the weigh station and it also ensures municipalities that the system works well in situations where the road is closed or vehicles are queueing in one lane.

"We provide various levels of WIM solutions: from entry-level applications for statistics, to complex turnkey systems for direct enforcement," says Fučík. "An Advanced Traffic Classifier with wide-range traffic monitoring purposes (vehicle counting, precise classification, gap and headway measurement, axle counting) can also be added to our WIM system."

Overloaded vehicles can result in extra costs for the maintenance of damaged road infrastructure and they can also increase the risk of traffic accidents. "WIM has proven to be a powerful technology with applications in many areas," says Fučík. "Our WIM and speed-enforcement system

can provide safer transportation and optimized traffic flow.

"Our system can further be expanded with a certified speed measurement, which many municipalities welcome," Fučík continues. "The single system can address two road safety issues – weight and speed enforcement."

Overloading might compromise competitiveness and the environment, but is of little interest to the police. Static weigh stations can be effective, but can easily be avoided and take too long. This means the collection of data via weigh-in-motion (WIM) technology is more critical than ever.

Progress and reliability

Not all European countries have WIM networks, and few developing nations do. However, it remains the most reliable solution to the problem. If we compare the situation in Europe to 15 years ago, it can be observed that where previously sporadic WIM installations were in place, proper WIM networks that often cover the entire road network now exist, while many countries previously using lower-quality WIM systems have switched to fewer but more accurate and reliable solutions. The quality of WIM data is becoming the main imperative for most users. In general, a steady growth in the number of WIM installations can be observed, not only in Europe but worldwide.

"Although the technology has not developed as rapidly as anticipated some 20 years ago, especially with respect to accuracy and price, more and more infrastructure owners and traffic managers express the need for a tool that provides quality traffic loading information," says Žnidarič. "Despite some other emerging technologies, WIM systems remain the most reliable and proven technology to acquire such information."

"Not much has changed in WIM technology, as far as the in-road equipment/hardware is concerned," says David Fifer, an intelligent transportation systems specialist in Oregon, USA, expressing both minor frustration at the lack of progress, while reflecting the 'if it ain't broke don't fix it' school of thought. "The single-load-cell platform WIM scale by International Road Dynamics is the same today as it was in 1997. It continues to be among the most accurate and

(Right) **Oregon DOT's Green Light Program has used WIM to preclear more than 19,600,000 trucks over the past 14 years**

> The Czech Republic has been the first to implement and use high-speed WIM for direct enforcement
>
> **Hans van Loo, international WIM consultant**

longest-lasting WIM hardware available. Similar to the SLC [single load cell], there hasn't been much advance in bending plate scales either. The basic principle behind any WIM hardware is the same: they are all based on measuring pressure."

Most advances in WIM/AVI (automatic vehicle identification) systems have come largely in the areas of systems electronics and computers, methods of vehicle identification and other added functions. Many systems' electronics, the brains behind the overall operation, have improved in ease-of-use functionality and efficiency. With direct remote access, it's simple to reconfigure or recalibrate a site in minutes. Many of the electronics systems offer features

camea

20 YEARS EXPERIENCE

High-Speed Weigh-In-Motion Solution Partner

» From entry-level up to direct enforcement
» Free-flow bidirectional measurement
» Speed enforcement extension
» From OEM to turnkey solution

CAMEA, spol. s r. o.
Kořenského 25
621 00 Brno
Czech Republic
WWW.CAMEA.CZ

52,1 t

Weigh-In-Motion Solutions

ITS Data Collection • Enforcement • Ports & Freight Terminals • Toll Stations

Weigh-In-Motion Strip Scale Sensors

Exclusive load cell based WIM technology for superior accuracy and long-term reliability.

intercompcompany.com
+1 763-476-2531 Worldwide
+44 118 932 0578 UK

Intercomp®
advanced weighing technology . . . by any measure

(Above left) **Kistler's WIM Data Logger is specifically designed to interface with Lineas WIM sensors** (Above right) **The WIM Data Logger is typically mounted in a roadside cabinet close to the WIM site**

that allow for added components such as readers, tire-pressure sensors, infrared brake monitoring and measuring equipment, and infrared or laser over-height detectors. Although this might all be true, there is a storm brewing at the heart of high-speed WIM.

The enforcement revolution

"Weight compliance checking today is organized on a national basis, with different intensities and focuses between European member states," says Žnidarič in his report, *Heavy-duty Vehicle Restrictions in the EU*. "The basic principle is if the offenders are to be fined,then the evidence for overloading needs to be court proof."

Traditional WIM involves preselecting vehicles that are then weighed again elsewhere. The ideal scenario is a system that can enforce and penalize on the move. France and Germany have dedicated low-speed WIM sites, in both cases in the presence of police, but a greater revolution is already in motion.

"The Czech Republic has been the first to implement and use high-speed WIM for direct enforcement of overloading," says internationally renowned WIM consultant Hans van Loo. "Direct enforcement means that the measurement of the WIM is used to issue a fine in the event of overloading without the need for any secondary measurement. So the WIM system itself has been legally approved as a measurement instrument for enforcement. Many countries are investigating the possibilities of introducing direct enforcement."

The system in the Czech Republic was installed by two companies, Cross and Camea, both using Kistler piezoelectric Lineas quartz WIM sensors. Although details are difficult to find, the system is deployed by the Traffic Police Agency, having been tested and certified by the International Organization of Legal Metrology (OIML) before making them operational. It is thought that the enforcement aspect has been used only sporadically to date, although other countries are quickly catching up.

The difference with the new, certified solution by Kistler is that Lineas WIM sensors are now interfacing with a Kistler Data Logger to provide very accurate vehicle data, meeting OIML standards in accuracy classes 5 and 10.

"The Kistler WIM system has received an OIML R-134 certification," says Rodney Oakley, head engineer with Southern Traffic Services of Florida. "This means that the system has been tested and certified as having the precision to be used in legal measurements. The USA has not yet adopted this technology for weight enforcement, but it is only a matter of time. The exponential growth of truck shipments over the next 10 to 20 years will dictate that a more advanced system be used for weight enforcement, as well as traffic management. Enforcement is a necessity to protect our tax investments, but it will create a tremendous amount of congestion, not to mention greater costs, if the system is not updated. The technology to meet traffic management and enforcement challenges is available right now. All we have to do is begin putting it to use."

> "The technology to meet traffic management and enforcement challenges is available right now"
>
> **Rodney Oakley, head engineer, Southern Traffic Services**

Instant enforcement would act as a massive deterrent to those looking to gain an advantage. However, in order to be able to use a WIM system for enforcement or weight-based toll collection, the legal framework first needs to be created. This takes time. In parts of Asia, the legal framework for weight-based toll collection has already been established and the framework for direct enforcement is in preparation. Several systems are being put in place.

"We are working closely with the local authorities, as well as our partner integrators, to drive relevant

and promising projects to their success and we look forward to getting new automatic weight enforcement services operational soon," says David Cornu, head of road and traffic at Kistler Instrumente.

Other manufacturers are gearing up to join this marketplace. Meanwhile DOTs the world over remain keen to get in at the sharp end of what promises to be a true revolution in road management.

"This is an area we are looking at in partnership with the police to enforce a bridge weight limit," says Neill Bennett, senior project officer, transportation data and analysis team with Derbyshire County Council in England. "It is early days, but we are hoping to progress a project along these lines this year."

Other developments

Tolling by weight at high speed, in a multilane, free-flow environment where the toll fee will be related to the actual axle loads or gross vehicle weight is likely to take off in the next five years. This allows for a fairer and more realistic calculation of the toll fee as it is related to the damage a specific vehicle is doing to the road.

"This is a development you will see in several Asian countries, such as China and India," notes van Loo.

Although not strictly speaking a WIM technology, onboard weighing (OBW) could yet change the face of HGV weight and prosecution. OBW sensors communicate remotely with inspectors at the roadside. The only country with a notable quota of OBW installations is Australia. For now, axle-load OBWs need to be checked and recalibrated regularly. However, as the technology advances and prices drop, we are likely to see a surge in this self-contained solution.

(Above and right) **In Pakistan, high-speed WIM is not an option due to the associated costs, but some low-speed applications are in place**

Economic factors

Weight compliance checking is slow and costly. It was estimated by the American Trucking Associations that a 5- to 10-minute stop at a weigh station costs the economy US$10. With freight transport expected to grow by 60% during the next 25 years in both Europe and the USA, it is clear that accurate solutions are required to ensure that, wherever possible, HGVs are weighed on the move.

Of course, this is not an option for all. According to Mubasher Ahmad Shahid of National Engineers in Pakistan, "High-speed WIM systems are not considered anymore due to limited resources." He also notes that, "When overloading is extreme, many drivers are unable to pay and the fine is overlooked."

In Thailand, weigh-station queues can stretch 6 miles, but according to Manat Chitwattanagorn, managing director of TMS Engineering, the price of WIM is too expensive compared with the static system. "Thailand is not a rich country," he says. "The government needs to develop education for children first."

In the West and parts of Asia, meanwhile, the growth of WIM, and in particular the potential for instant enforcement, could yet mean that overloading becomes a thing of the past.

Asset protection

Why is WIM important for critical infrastructure?

Pavement design and reconstructions can be optimized if it is known what loading to expect. This prevents construction workers from making the pavement too weak and thus requiring intervention sooner than expected, or can save money where a strong pavement is not needed. The same is true of bridges, especially the old structures that were not designed for today's traffic loading. Over half of Europe's bridges are more than 50 years old.

To keep them in service, without intervention causing distress to users and the local economy, engineers need to know the true loading in order to select the optimal measures. This is why bridge WIM (B-WIM) is essential.

Photos Trafika AB

(Above and left) **Bridge WIM systems enable operators to make informed decisions based on real-world data**

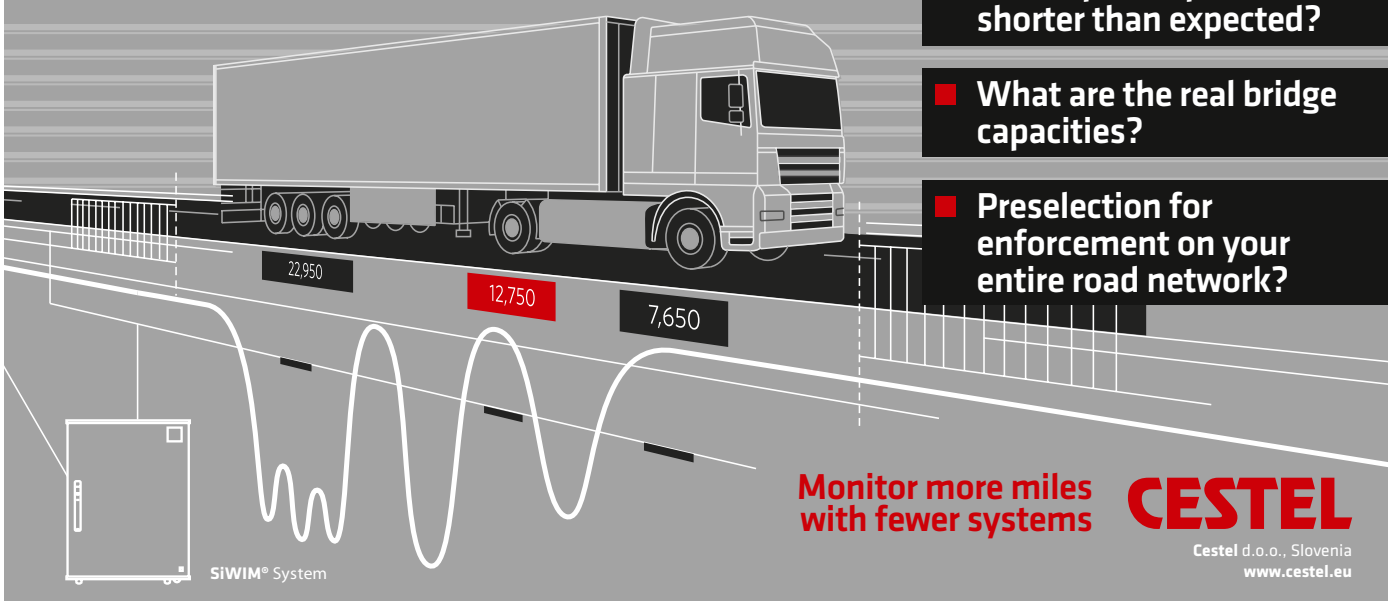
Efficient enforcement, which in Europe is still mostly static, with police support, needs WIM for pre-screening or pre-selection. This enables operators to only pull over the vehicles that are likely to be overloaded and to keep the 'good' ones in operation, without disturbance.

World leading producer of Bridge Weigh in Motion systems

SiWIM®
www.siwim.com

Completely portable multi-purpose system

- Is life span of pavements shorter than expected?
- What are the real bridge capacities?
- Preselection for enforcement on your entire road network?



Monitor more miles with fewer systems

CESTEL
Cestel d.o.o., Slovenia
www.cestel.eu

---

cross®

ROAD TRAFFIC TECHNOLOGY

TRAFFIC CONTROL

TRAFFIC DETECTION

WEIGH IN MOTION
AND DIRECT ENFORCEMENT

ROAD WEATHER

PARKING SYSTEMS

SOFTWARE SOLUTIONS
INVIPO

www.cross.cz

CROSS Zlin, Hasicska Str. 397, Zlin 763 02, Czech Republic Tel +420 577 110 211 cross@cross.cz

If **Chris Urmson** succeeds in delivering Google's self-driving car to the world by the end of the decade, he may well be remembered as one of the 21st century's greatest inventors. It all started in Pittsburgh...

Interviewed by Tom Stone

Chris Urmson, director of Google Self-Driving Cars, has a strong affinity with Pittsburgh, Pennsylvania. He spent six years at the city's Carnegie Mellon University as a graduate student, from 1998 to 2004, and continued working with its Robotics Institute as assistant research professor until 2011; he is still an adjunct professor. He gained his PhD in robotics from the university in 2005 and led the Carnegie Mellon team that won the 2007 DARPA Urban Challenge for robot cars. It is appropriate, then, that it is in Pittsburgh – at this year's ITS America Annual Meeting – that we catch up with Urmson. The view from the convention center's balcony brings to mind the theme of the conference, which is also appropriate to our discussion – Bridges to Innovation.

The four-year plan

Just hours before our chat, Urmson told a packed ballroom about his very personal ambition – to make Google's self-driving car available to the public before his son, Ethan, turns 16 in just over four years' time – thereby allaying his fears, as a father, about the dangers teen drivers put themselves in.

However, while the technology might be in his hands, the legislative side is not – nevertheless Urmson is bullish about the prospects. "We don't really see there's much of a regulatory challenge," he says. "There are only certain states that have a law that talks about testing of self-driving vehicles. So four or five states have those laws. Otherwise there isn't a law preventing it.

"American law is permissive, which means if there isn't a law that says you can't do it, then you can – this is one of the ways that the USA has been innovative over the centuries – you can try something out.

"We have a legal system that backstops that. So if you do something unreasonable or unsafe, then the lawyers come after you. In our case, we're doing it incredibly thoughtfully, we're putting an awful lot of effort into safety, and we talk frequently with NHTSA and other regulators."

Of course, Urmson's confidence would be misplaced without also having a clear idea of how autonomous vehicles might be insured. Here he envisages some big changes, with responsibility shifting to manufacturers. He puts it simply: "If I tell you this is a self-driving car and you use it as a self-driving car, then it should work." He does admit, however, that it might not always be quite as clear-cut as that. "It might be a little more complicated because it might be the other vehicle that's at fault, because that's what happens," he says. "So there will still be a process to go through."

Google vs auto manufacturers

Google is the new car on the block – and despite its low speed (urban prototypes are currently limited to 25mph) it has provided a turbo boost to the rate of change in the field. Traditional manufacturers are now incorporating autonomous features into their vehicles at a speed that even two years ago would have seemed unlikely. There's a certain amount of friendly competition: "I think we're all working toward the same common goal, which is to make driving safer. We're just taking different paths to get there," says Urmson. "The incremental features-based approach is what most of the automotive companies are doing and they have products in the market, so they can do that. We don't sell cars, so we have different pressures – and different opportunities."

Indeed, ultimately Urmson believes that the fact that Google doesn't have a traditional car to sell is what will give it the edge. "I'm not convinced you can follow that incremental path and get to a fully self-driving car," he says. "Making sure the combined system of driver and vehicle is always paying attention, and knowing who's responsible at any one time, is a tough problem. And technologically it's quite challenging. If you're designing a system where you know a person is available to backstop it, then you don't necessarily have to put the same effort into it. You don't have to have the same levels of redundancy that you do if you are counting on that system.

"But auto manufacturers are going to have some amazing products and nobody really knows how this is going to play out – but we're pretty convinced that taking that full step to autonomy is important."

This philosophy is borne out in the design of Google's car. "A car that is built to be driven has a steering wheel and it's all centered on that," continues Urmson.

Urmson's presentation at the ITS America Annual Meeting included graphical representation of how the Google car sees the world

The latest Google car prototype was unveiled in May this year
(Below) **Urmson on the balcony of the David L Lawrence Convention Center in Pittsburgh**

"In contrast, a vehicle that's supposed to drive you places shouldn't feel like that. If you have a steering wheel, there's this implicit understanding that you're going to use it. But if a vehicle is fully self-driving, you don't need a steering wheel. You still need to be in command, but much more like a captain than a helmsman. The captain says where he wants to go, while the helmsman holds the wheel. We want people to be more like captains."

Autonomous vs connected

The big automotive technology that is developing alongside autonomous vehicles is connected vehicles. Urmson confirms that Google self-driving cars are already connected to each other. "They talk over a cell phone link," he explains. "If one vehicle sees a construction zone, all the other cars then know about it. But they're not connected in the V2V, V2I, DSRC sense. And that's just because there isn't anyone else to talk to. If DSRC becomes widely deployed, we will look at that as just another modality. Our cars today have laser, radar and camera and that's how they see the world; if they also get a V2V feed from another car, then we can put that in."

While many have seen connected vehicle technology as the forerunner to autonomous vehicles, Urmson believes self-driving cars may be ready first. "We don't want to be in a chicken-and-egg situation where the car is ready to be self-driving, but won't deploy because we have to wait 15 years for DSRC," he says. "Let's let the two technologies advance in parallel and then connect them as makes sense."

The next stage

Now Urmson is looking forward to the next stage of testing the Google car. But, as with all things to do with this project, he is determined it will be done slowly, carefully and thoughtfully. "When these vehicles are out in the community and driving themselves with nobody in them, that's going to be a big step," he says. "The 25mph limit is one of the ways we are trying to be thoughtful. We wanted to think deeply about that. These vehicles will eventually make mistakes – they're human-engineered systems – so by reducing the speed they're operating at initially, you reduce the consequences of an accident. I don't know yet how far we can push them. There will still be limitations – they're never going win an F1 race – but there will be enough capability to be useful."

Adoption and commercialization

While there has been much debate in recent years over whether the public is ready for autonomous cars, Urmson has found that when people actually try them out, they get used to them fast. "People very quickly adapt – the academic conversation of 'Would I accept it or not?' gets trumped by the experience. We've seen that when we bring someone in who's apprehensive about the concept, within 10 or 15 minutes they're saying, 'Is that it? It's pretty cool'."

So if the public is ready and the regulatory challenges will fall away, is there already a Google car business model? "I don't think there will be a one-size-fits-all solution," says Urmson. "But I do think that using self-driven vehicles in shared mobility systems makes a world of sense because you buy your car and it sits still 90% of the time – it's an incredibly inefficient use of a resource. So sharing it – maybe it's you and your wife, or you and your community, or maybe there's a service that you pay for to use it – makes a ton of sense. But there will still be people who want to own these vehicles – so you could have it both ways." Coming from a company that has already conquered the information superhighway and now has its sights set on actual highways, that sounds about right.

> I'm not convinced you can follow the incremental path [of auto manufacturers] and get to a fully self-driving car

Police officers are helped by modern, in-vehicle camera solutions

Modern digital camera equipment, connected to the officer's in-vehicle laptop, actively supports police work

The costs associated with modern, advanced camera technologies are creating a financial dilemma for ITS operators. These sophisticated camera solutions, with high-resolution sensors, are ideal for complex traffic applications such as free-flow tolling and high-speed enforcement systems. However, smaller, simpler traffic applications need a stripped-down version of this technology and place emphasis on efficiency.

In-vehicle ALPR solutions, for example, are demanding applications, given the speed of passing vehicles, and therefore require camera equipment with high sensitivity and medium-to-high resolution. However, at the same time, ALPR in vehicles serves the sole purpose of supporting police officers in their duties. It will not generate income in the way as ALPR used in tolling or enforcement applications.

As a result, the cost of installing sophisticated and expensive equipment is more of a concern in applications that don't generate revenue, as opposed to so-called 'cash-cow' applications.

Efficient in-vehicle ALPR systems need digital cameras that not only match the technical requirements for sensitivity, resolution and global shutter, but are also available at a reasonable price.

They must furthermore be designed to fit into very limited space, either inside the vehicle next to the police officers, or on the roof, integrated into the light bars. Compact, lightweight cameras with small footprints enable easy integration; their convenient functionalities and high bandwidth ensure reliable and fast data transfer.

Need to know

In-vehicle ALPR requires specific technical and operational consideration

- As vehicles pass an ALPR camera, their license plates are read and checked against a database
- Police officers can intercept and stop a vehicle, check it for evidence and, where necessary, make arrests
- ALPR assists police in the detection of many offenses, including stolen vehicles, terrorism and organized crime

Highway patrol

Cameras in police vehicles are a powerful enforcement tool. Naturally they should be easy to use and efficient, and officers should benefit from their advantages quickly.

Police cars are often used for many years and are frequently not equipped with the latest camera equipment. However, they can be retrofitted with modern technology quite easily. With its new pulse camera series, Basler offers an easy to integrate, attractively priced digital camera to upgrade existing police vehicles with ALPR functionality. Integrators can combine these cameras

(Clockwise from top left) **The dart offers multiple options for a variety of imaging tasks; one-cable setup and tripod mount make the pulse easy to integrate; the dart is high-tech vision for small spaces; the USB 3.0 interface provides plug-and-play functionality**

with available ALPR software running on the officer's laptop.

The Basler pulse features a compact metal housing and one-cable setup, plus a tripod mount that enables easy and convenient installation on the vehicle's windshield, dashboard or rear window. For lateral viewing, its low weight and small size also make it easy to attach to the side windows with a suction pad. Thus officers have access to views from all angles, using easy-to-use, efficient and modern camera technology. In comparison with conventional camera boxes mounted on the hood or trunk, these small digital cameras are much easier to connect to an officer's PC and therefore make image and data recording more convenient.

After a period of test runs in police cars, the evaluation of modern in-vehicle camera-based ALPR systems may drive demand for a more comprehensive approach. What if police vehicles could be equipped with powerful camera equipment from the beginning?

This kind of integration would call for bare-board cameras which, due to their tiny dimensions, would fit easily into roof-top light bars. Modern LED technology has been replacing the conventional mirror-reflecting light bulbs, leaving sufficient space for modern S-mount or CS-mount board-level cameras.

Intelligent engineering

The latest additions to Basler's ITS portfolio, the pulse and dart camera series, have been specifically designed to meet the requirements of in-vehicle enforcement. The dart, in its bare-board variant, for example, combines a 27 x 27mm footprint at a weight of only 5g, with CMOS sensors that have resolutions of 1.2-5MP and frame rates up to 54 fps.

Being USB3 Vision Standard-compliant, the dart fully exploits advantages such as secure data transfer and easy integration with plug-and-play functionality, plus a high bandwidth of up to 350MB/s, and data and power supply via one cable.

Even in its S and CS-mount versions, the dart's size of 29 x 29mm and 15g weight fits into any imaging system. The dart camera series combines high-tech vision and a cost-driven design in very limited space. It is therefore ideal for integration into devices such as modern roof-top light bars in upcoming police car models, as well as for upgrading existing surveillance systems in older vehicles.

Free reader inquiry service

Basler inquiry no. **501**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

A new approach to DSRC that enhances the driving experience

DSRC (dedicated short-range communication) plays an essential role in electronic toll collection and road-user charging applications. Until now, the technology has mostly been used to manage electronic toll payment from passing vehicles. However, Portuguese firm Via Verde is taking it one step further and is using the technology for several additional services.

All services are available using the same principle: a driver needs to be registered in the Via Verde customer database and have a valid Via Verde onboard unit (OBU) attached to the car's windshield. The OBU is linked to a debit card and the exact amount is deducted with every use. It is easy, convenient and there are no extra charges linked to the services offered by Via Verde.

In addition to electronic toll payment and payment for inland waterway transport (ferries), Via Verde has also made fueling at Galp gas stations across Portugal much easier. By pressing the Via Verde button at the pumps, the purchase is automatically registered to the OBU in the vehicle.

The company has also developed an innovative way to handle parking payments. The OBU is registered at the entrance of the parking lot, and again at the exit, in order to record the parking time. The accurate amount is charged to the debit card linked to the Via Verde OBU. The company is also developing electronic invoicing, OBU rental for foreign vehicles, prepayment and customized business solutions.

Proven reliability

Via Verde has recently asked Norway-based Norbit to supply more than 100,000 OBUs that comply with the guidelines set by the European Committee for Standardization (CEN DSRC).

"We have very high standards and we continuously update our requirements, so we look for the best solutions and suppliers," says Pedro Mourisca, CEO of Via Verde. "The OBUs went through technical and operational testing before we signed the contract with Norbit."

Norbit has been in the market with its own DSRC products for more than a decade and has delivered over 70% of the 1.7 million installed OBUs in Norway. The company has also delivered RSUs (roadside units) for the majority of the country's toll systems.

The OBUs for Via Verde are being manufactured at Norbit's

(Above) **Drivers with an active Via Verde tag can pay for their McDrive order electronically**

Need to know

Innovative DSRC applications require robust, flexible and reliable OBUs

- Norbit's VTR850 family of OBUs are designed to have a compact size and to provide optimized performance at any speed
- An integrated high-speed microprocessor enables it to handle up to eight applications in minimum transaction times
- Fast DES and 3DES in the hardware ensures the VTR850 supports all relevant security operations

ISO TS 16949 (automotive) certified factory in central Norway. Investments in new, fully automated, high capacity manufacturing lines are one of the reasons why Norbit is in the position to deliver a high volume of products in a swift and cost-effective manner.

This is not the first time Norbit has supplied DSRC products for use in Portugal. There is already an installed base of roadside antennas in the Algarve and the company has also supplied products to Brisa Auto-Estradas, the founder of Via Verde. The multilane free-flow application uses Norbit's dual-standard RSUs with support for both the new EN15509/MDR and the legacy LDR standards.

One OBU – multiple uses

A further development to the established DSRC infrastructure is to facilitate traffic management, such as safety warnings, intersection control and the collection of traffic information. The information exchange can go multiple ways: vehicle to infrastructure (V2I) and vice versa; and vehicle to vehicle (V2V).

However, DSRC technology can be used for much more than avoiding congestion. The Norbit OBU supports up to eight applications, so the industry can use it innovatively.

With solutions covering more than 1,865 miles (3,000km) of highways, more than 110 parking lots, and approximately 100 filling stations across the country, as well as the recent contract with McDrive, Via Verde's technology makes a difference to the lives of people all over Portugal.

"Seamless compatibility with an existing infrastructure is essential," says Per Jørgen Weisethaunet, CEO, Norbit Group. "The market demands interoperable technology that enables innovative exploitation of DSRC technology."

(Above) **Norbit's OBUs will optimize the Via Verde payment system**

(Above) **Via Verde tags enable vehicles to be identified automatically**

Inspiring cooperation

Via Verde's pioneering technology enables users to pay for a service electronically, without having to stop their vehicle or wait at a pay station. Its focus is on acting as a single point of contact between clients and operators in the mobility services business.

"Via Verde has set itself the objective to continuously conceive solid ideas and practical solutions for new business, in a marketplace where the rules are subject to incessant change and where optimum efficiency is a constant challenge," says Nunes de Sousa, chairman of Via Verde. "From incremental to game-changing innovation, our business culture has produced solutions that have added value to our business and to our market offer." ○

Free reader inquiry service

Norbit Group inquiry no. **502**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

Optimizing road user safety on Israel's Highway 6

Maintaining road user safety is a challenging task – particularly on long toll roads where the volume of users is high. Safety is also one of the most crucial requirements for successful road operation.

Israel's Highway 6 is a US$1.5bn project operated by the Derech Eretz Group. It includes an 87-mile (140km) complete free-flow post-paid trip ETC highway, which accommodates 200,000 trips every weekday. It also incorporates the 4-mile (6km) tolled bidirectional Hacarmel Tunnels, which carry more than 60,000 trips on weekdays, as well as the 14-mile (22km) shadow tolled Highway 431.

When Highway 6 fully opened in 2004, the Derech Eretz Group made a strategic decision to collect and maintain detailed statistics (including images) on all 'unusual events' (UEs) that occur on the highways and tunnels, and to save them in a special information system. The rationale behind the system is to help the operator identify potential reoccurring UEs that could occur at certain locations on the network before any major problems develop and manage them at that point in time.

One of the main features of the system is the method by which UEs are recognized and counted. In addition to UEs that result in damaged property and infrastructure, or casualties, the Derech Eretz Group also recognizes and counts all other UEs, such as vehicles slipping on the road or drivers losing control over the vehicles. This enables operators to trace new and recurring safety hazards that cause the UEs that require immediate attention and repair.

(Left) **Israel's Highway 6 is also known as the Cross-Israel Highway** (Below) **Annual fatalities on Highway 6 per 1,000,000,000km traveled**

Need to know

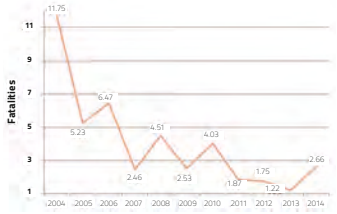
An innovative approach to project management is achieving impressive safety results

- Highway 6 is the first toll road project in Israel
- The project has created a revolution in the country with regard to computerized traffic management and tolling
- The road was built as a BOT (build-operate-transfer) project, combining business sector capabilities and funding with benefits to the public sector
- Highway 6 comprises 14 intersections, two bidirectional tunnels, an ecological passage and 150 bridges

The result is a comprehensive picture of the safety conditions on the roads, coupled with an ongoing analysis of accidents that result in property and infrastructure damage, and casualties.

Knowledge transfer

The group also strategically decided, when Highway 6 opened, to establish a semiannual experts forum, at which all collected data from the preceding six months is presented and analyzed. Forum participants are project stakeholders, such as the local ministry of transportation, the Government's Implementing Authority, the National Road Safety Authority, local police, the national emergency medical and ambulance service, concessionaires and various engineers. They have all been working together since the forum was established to emphasize the third 'P' (partnership) in the term PPP.



It is important to mention the Group's highways and tunnels patrol units, which operate 24/7 and provide immediate assistance, free of charge, to drivers encountering mechanical problems, such as a flat tire or an empty fuel tank, or are involved in other UEs. This service also helps to minimize the time that vehicles are pulled over to the side of the road – reducing the risk of collateral UEs.

Each forum assembly compares recent data with

that collected in preceding years. It includes the number of miles traveled, the number of UEs and their distribution according to type and location, the distribution of types of casualties, information on UEs, types of assistance provided by patrol units, and descriptions of UEs resulting in fatalities. Actions taken as a result of preceding forums and required future actions are also discussed.

The fact that the data has consistently been collected in the same manner for more than a decade makes it reliable. This in turn enables the forum to determine required future actions. The outcome is a low rate of casualties considering the increasing number of miles being traveled, both on the highways and in the tunnels.

Free reader inquiry service

Advanced Solutions
inquiry no. **503**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

by **Mike Schagrin**

How important is connectivity in the automated vehicle environment?

There has been a lot of debate recently about whether connectivity is part of the automated vehicle or not. There are two sides to this discussion. On one hand, car makers will not rely on connectivity to launch their automation capability. On the other, automation can't function safely without connectivity. Both sides have a point.

Those delivering automated vehicles can't afford to wait for an established connected vehicle environment to launch their capability. Nor will connectivity replace onboard sensors for supporting automation functions. Automated vehicles need to be fully aware of their immediate environment at all times. Relying on V2V connectivity would mean that having even one vehicle unequipped could cause a problem. Therefore an automated vehicle must be fully capable of sensing its immediate environment on its own.

However, relying on on-board sensors alone will never enable automated vehicles to reach their full potential. The next level requires optimization at the system level, meaning that automated vehicles will need to 'talk' to each other (which also means a vehicle will 'see' beyond the car in front of it).

Adaptive cruise control (ACC), for example, operates using onboard sensors to 'see' the vehicle in front. Depending on the setting, the following vehicle will have 1-2 seconds of headway. When the vehicle in front brakes or slows down, the following vehicle will do the same. And then when the lead vehicle speeds back up, the following vehicle will again do the same (up to predefined speed limits). However, because of the sensors being used there is a slight delay, which results in an 'accordion effect' with close headways. And if there are multiple vehicles involved, the effect will gradually grow, causing the string of vehicles to become increasingly unstable and incapable of sustaining collective movement (platooning) for very long.

There are two approaches to solving this problem. The first is to establish greater headways, which will account for the accordion effect and enable the platoon to stay operational. The other approach is V2V communications, otherwise known as cooperative adaptive cruise control (CACC). I've experienced

"Cooperative adaptive cruise control means no 'accordion effect'"

both ACC and CACC, and there is a huge difference. With CACC there is no noticeable delay. The lead and following vehicles operate 'as one', so there is no response delay or accordion effect. Furthermore the vehicles will sense other connected vehicles further upstream for any sudden changes. As a result, CACC vehicles can operate much more efficiently with much closer headways. This means much greater throughput and energy efficiency while maintaining a high level of safety.

The ACC versus CACC debate is just one of many examples that illustrate how automation can be initiated based on onboard sensors, but whose performance is greatly enhanced by connectivity.

Vehicle automation is making its way onto roadways and will continue to evolve. V2V communications will improve as well. At some point these two paths will converge, creating a highly effective 'connected automation' environment.

Mike Schagrin is former program manager for the ITS Connected Vehicle Safety and Vehicle Automation research programs at the USDOT's ITS Joint Program Office. He has now established Schagrin Consulting International, supporting clients in connected and automated vehicles
mike@schagrin-consulting.com

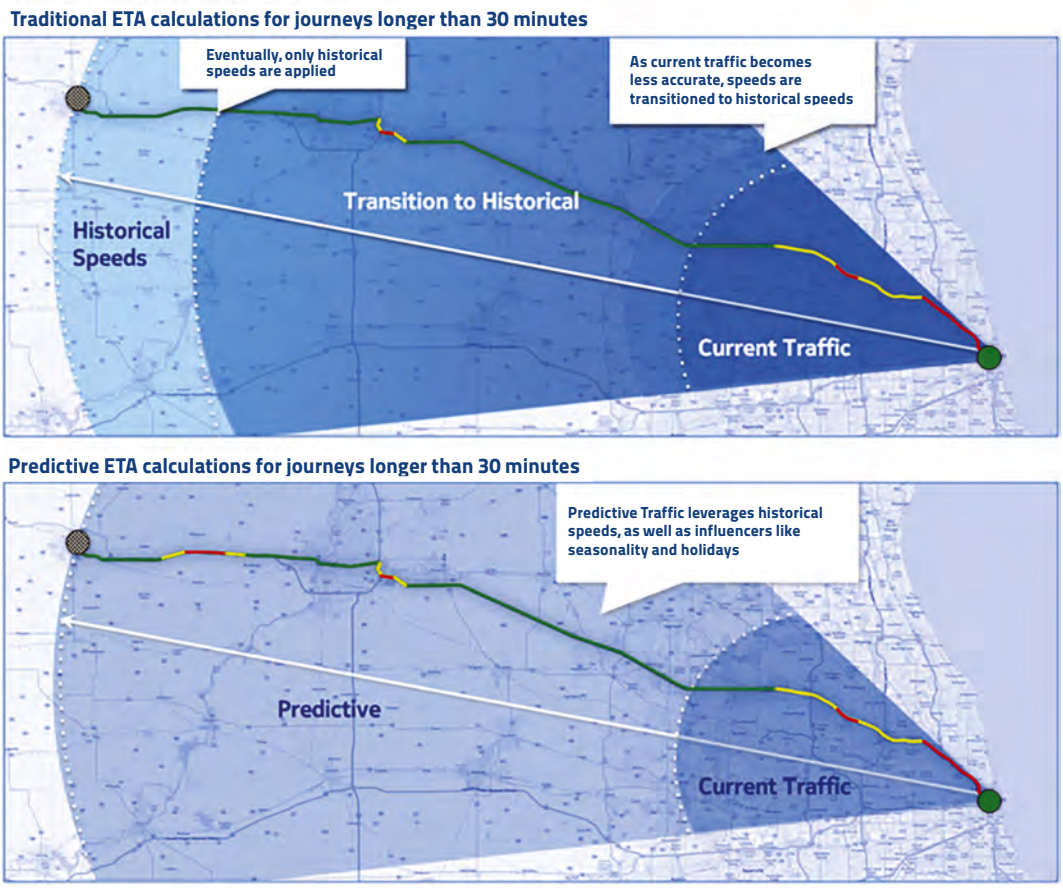
Intelligent solutions that turn big data into a big advantage

Live traffic updates have been helping people get to their destinations faster for more than a decade. Since 2004, Here Real Time Traffic has been leveraging GPS probe points, road sensors and its own traffic operations center to help drivers get from point A to point B efficiently and without stress.

Here gathers information from millions of probe points every day and uses this data to support its customers in innovative ways. Using its powerful, intelligent traffic engine, the company is able to process the data and turn it into useful insights.

Here's traffic engine is a distributed, highly scalable message processor. Built with advanced open-source big data tools, it is an ingestion and processing powerhouse. It validates GPS probe points from all over the world, places them on a map, and processes them with advanced, statistical algorithms to create real-time traffic flow speeds.

Using speed and scale to accurately model traffic conditions, the company's traffic engine turns raw data into meaningful insights about traffic, and takes advantage of the most relevant sources, and local expertise and knowledge about specific location conditions.



(Above) **Highly precise routes and ETAs that are up to 20% more accurate with Here Predictive Traffic**

Need to know

Past, present and future traffic information can be obtained with data collection and analytics

- Here delivers up-to-the-minute information about current traffic conditions and incidents that could cause delays, including slower than normal traffic flow, road works and accidents
- To ensure the information is available 24 hours a day, real-time data is collected and updated every 60 seconds from more than 100 reliable sources
- Real-time traffic information from Here is now available in 50 countries around the world

Using the past to drive the future

Predicting future traffic conditions is very different from reporting what's happening right now. It takes a deep understanding of past traffic behavior, as well as the analytics know-how to turn those insights into predictions. Here is doing just that with two new products that provide valuable insights for automotive companies and government agencies: Predictive Traffic and Traffic Analytics.

Here Predictive Traffic combines real-time updates with accurate and relevant historical trends, empowering drivers with pre-planning, alerting and re-routing tools to make the best, time-saving decisions, at any time of day.

Pre-planning enables a driver to plan a trip in advance and know what time to leave to ensure arrival at a destination on time. For example, Here Predictive Traffic can let you know what time to leave the office to make it to the airport on schedule. Deciding whether to take your last conference call in the office or in the taxi on the way to the airport is now much easier.

Notifications or alerts let drivers know that something has occurred on the route that is going to cause long delays. It offers them the option to either

(Left) **Here Traffic Analytics provides a real-time assessment of incidents and their impact on the road network**

change course or leave at a different time.

It also means fewer changes to estimated arrival times or inconvenient re-routes as the system has already planned appropriately for future road conditions in advance. By knowing that traffic is likely to be delayed along the most direct route home if you leave at a different time than normal, Here Predictive Traffic could help suggest an alternative route to get you home faster.

Auto makers, transportation agencies and other companies can build applications that seamlessly integrate Here Predictive Traffic data across all devices. Pre-planned trips could be synced to the cloud, for example, allowing for automatic integration with the car and real-time notifications via connected devices. Dynamic message signs on highways could broadcast better travel times to the public. According to an internal study, drivers' estimated arrival times were up to 20% more accurate when using Here Predictive Traffic for journeys lasting more than 30 minutes than when using real -time traffic.

Big data

The other recent addition to the Here portfolio is Traffic Analytics, which supports better analysis and decision making for those who build, manage and use the road networks to move goods and people. Government transportation professionals who want to better understand the impact of investments can leverage Here's rich historic traffic data set to inform their decisions. For instance, understanding the impact on traffic flow during a construction project, and how certain highways are performing compared with previous years, are important questions for many road operators, as they allocate funding for future projects.

Here Traffic Analytics enables easy identification of where a problem exists, measurement of the impact of making a change, and communication of the effectiveness of the solution. The data is customizable, using a self-service portal, and is delivered based on the user's particular need, including timeframes, geographies and data attributes. It can help assess the impact of work zones, conduct a before and after construction analysis, compare seasonal impacts on traffic, and most importantly, help facilitate an efficient transportation system.

Alerting drivers to real-time incidents, predicting future traffic delays and supporting the analysis of road network performance are huge tasks requiring large-scale information and powerful, proven insight processes. Here's traffic engine is one of the few systems in the world that can deliver accurately and at scale. It's an enormous capability, driving reliable, useful traffic information to give the company's customers a huge advantage. ○

Free reader inquiry service

Here inquiry no. **504**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

Advanced road traffic management with data fusion

Road operators can improve their traffic management capabilities by combining traffic data from different sources. Data fusion can result in a complete network of monitored traffic conditions for all traffic parameters.

This means that traffic management measures can be implemented based on the need to intervene, rather than on the availability of a traffic detection system. Traffic data becomes a resource for managing the road network, independent of detection technologies.

Need to know

Combining data sources can lead to a more comprehensive picture of the road network

- With data fusion, high-quality data can be achieved with a limited number of road-based detectors. This works out cheaper then investing in a complete traffic detection system
- Applications are not limited to public road administrators – data fusion can be offered as a service where investments and risks are taken up by private partners

There are now several ways to monitor traffic. Road-based detection systems are a traditional method often adopted by road operators. Loop detectors, license plate recognition and Bluetooth sensors play an important part in measuring traffic conditions They are installed at fixed locations and the road operator bears most of the costs.

However, vehicles have also become a valuable source of information. Floating car data uses vehicles as sensors to monitor traffic conditions. As the number of connected vehicles has increased, the relevance of this data has been recognized in other sectors. Navigation devices, the media sector and logistics services all use vehicle-generated data for understanding traffic.

Roadside detection systems focus on monitoring all vehicles in certain locations. In-car data monitors certain vehicles at all locations. This difference makes it difficult to switch the data source of existing road management applications.

The fusion of different traffic data sources, however, is creating a new kind of traffic management, where it is possible to take advantage of the different detection methods. By combining and integrating traffic data, operators are able to achieve network-wide insight.

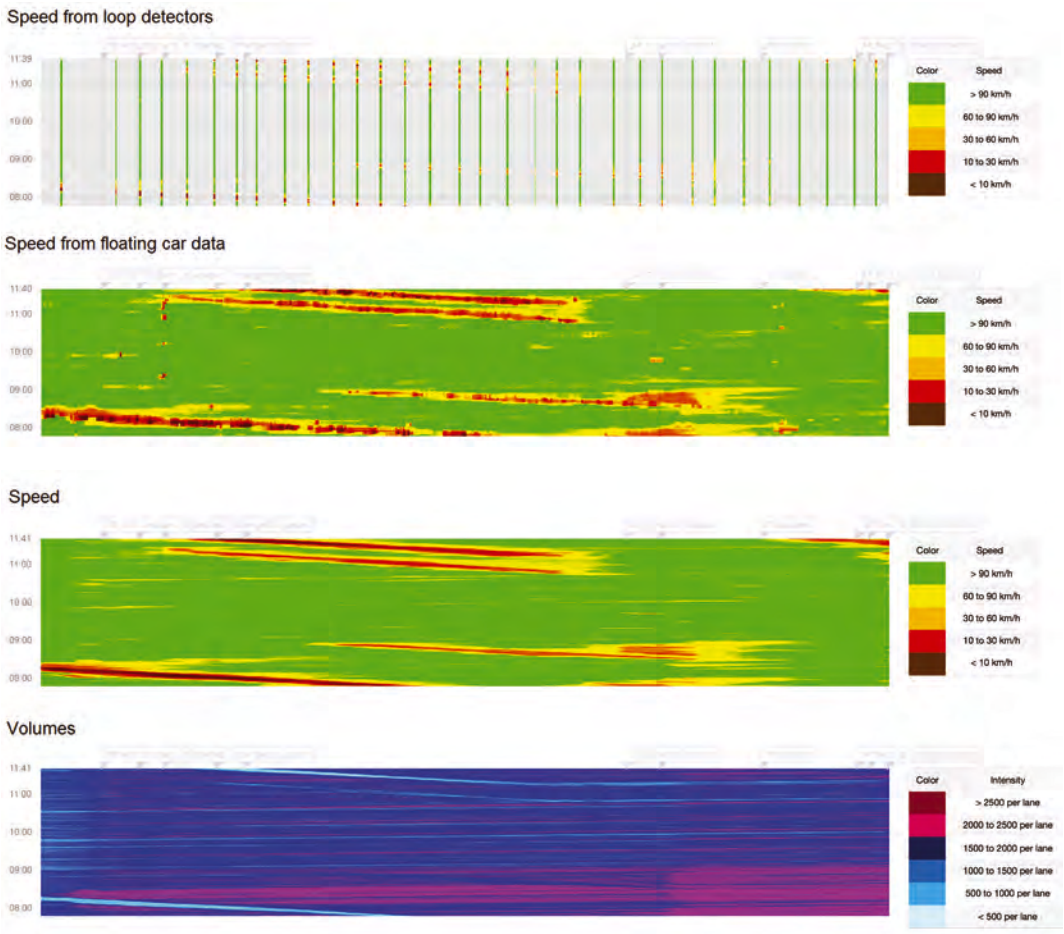
Data fusion for accuracy

The basic process of data fusion can be split into four steps.

It starts with measuring traffic in different ways. Roadside detectors can count and measure traffic at specific locations on the road or can deliver information over a specific road section. In-car sensors deliver driving conditions directly measured in the vehicle. Crowd sourcing applications and personal devices measure the travel behavior of individuals. Even non-measured user input becomes a valuable data source.

Each method has its own properties, with varying quality, latency and frequency of data availability. No data source is able to measure the complete traffic situation for all vehicles at every location. Therefore it is important to understand the different properties of all measuring methods.

As a result of the diversity in the measured data, making the data consistent is an important step. Measured data is typically related to a location and a time stamp. Consistency in location is not straightforward, however. Point detectors are not standardized within different road operators and wrong



(Left and below) **Figure 1. Traffic measured with loop detectors and floating car data on a 13-mile (21km) highway over a five-hour period** (Below) **Figure 2. By fusing both sources a complete traffic report can be delivered for both speed and traffic volumes**

detector localization badly affects road-based data systems.

For real-time use, it is important to include the time stamp of the different detection methods. Combining data sources also overcomes a lot of latency problems in current detection architecture.

When all the different traffic variables are integrated into one framework, a calculation method can be used to define how a lack of data and the overlapping of data are dealt with. A complete description of all traffic variables in the road network is determined using mathematical techniques.

The integration of traffic parameters will make it necessary to make decisions about the envisaged use of the data. The fusion is optimized for individual applications. Scenarios focused on traffic intensity and vehicle classification have different needs to real-time queue-warning applications. Different applications can be delivered, even in parallel, but a good understanding of the data requirements is essential to delivering the expected quality.

Based on network-wide traffic data, a further improvement can be made. Information, such as the cost of travel time or emissions statistics, or derived traffic parameters, such as predictions, can be calculated directly. This makes other traffic data applications possible as part of the platform.

On-site success

Data fusion is being practiced on the A58 motorway between Tilburg and Eindhoven in the Netherlands. On this two-lane highway, which is 13 miles (21km) long, road-based loop detectors deliver vehicle intensities and speed values at 32 different locations. There is also floating car data that is based on more than 3% of the total vehicle population. Figure 1 illustrates the monitored speed values from both detection systems during rush hours. By fusing these two data sources, a complete traffic state can be delivered for both speed and traffic volumes (Figure 2).

This stretch was further tested with a reduced number of loop detectors and it was found that this did not result in a reduction of data quality.

Industry impact

Traffic data fusion makes it possible to take traffic management to the next level, as more effective traffic detection can be achieved with fewer roadside detectors. Furthermore, a more complete insight that includes travel times and network-wide detection is feasible. ○

Free reader inquiry service

Be-Mobile inquiry no. **505**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

An innovative WIM system improves truck management in Belgium

Freight transport on Belgian roads is increasing at a rate of 2.5% per year and it is predicted to reach a record peak in 2030. While this is great news for the economy, overloaded trucks cause substantial damage to the country's roads and related infrastructure. There is also unfair competition between suppliers, since drivers with overloaded lorries are able to offer cheaper transport costs.

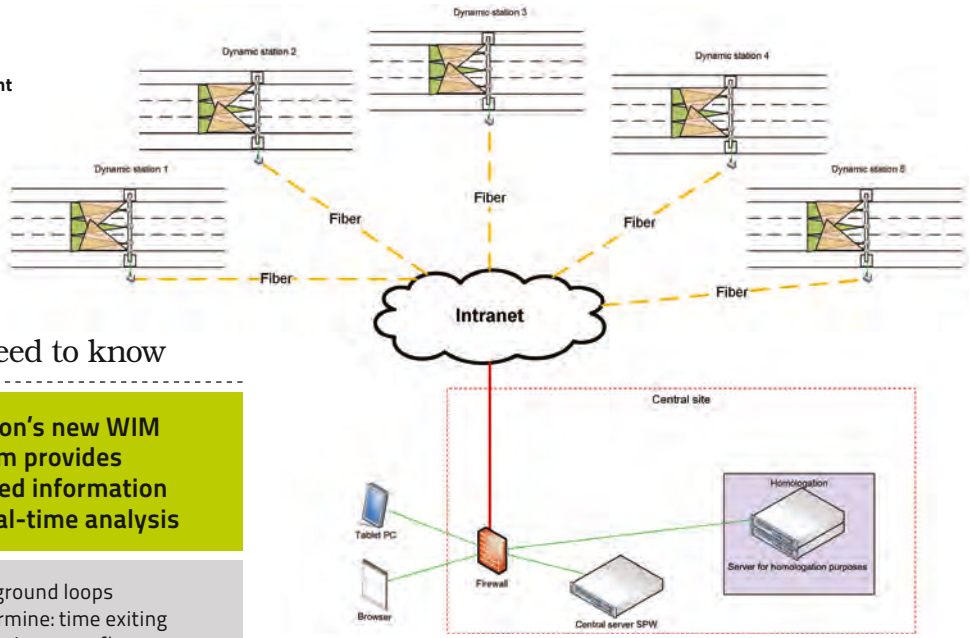
In December 2014, the government of Belgium's Walloon region decided to implement a dynamic weighing system for trucks on its roads. Its current network comprises several static weigh scales next to the highways. The traffic police use sight alone to choose which trucks to pull over, but this is often not accurate enough. Also, the number of trucks that can be assessed this way is only a small percentage of the total number of overweight trucks that cause damage to Walloon's roads.

Intelligent network

Figure 1 shows the new weight management network. The local sites are defined as those where the WIM stations are positioned, in addition to the existing static weighing stations, which are situated approximately 4 miles (6km) further up the highway. This ensures that when an overloaded truck is detected, the patrol cars are warned and the truck can be intercepted. This truck will then be brought to the static station where its weight can be checked manually and confirmed by officers.

The new weigh-in-motion (WIM) system, which is being provided by Tein Technology and its infrastructure partner, Yvan Paque (a subsidiary of Eiffage Energy), will automate the detection of offenders and ensure that mobile units receive information in real time. This makes it possible to audit only highly suspicious vehicles, with minimum delays. In the near future, the system will be homologated, which means it will be able to automatically issue tickets to offenders.

(Figure 1) **The weight enforcement system is managed via central software**



Need to know

Walloon's new WIM system provides detailed information for real-time analysis

- The ground loops determine: time exiting detection zone, flow direction, speed, vehicle length, category of vehicle and number of axles
- The ALPR camera captures an image of the vehicle's license plate
- Height sensors identify vehicles exceeding the height limit
- 3D scanners detect the exact height of the trucks
- The context camera generates a picture that is better in quality and size than the one from the ALPR camera
- The system is ready to be homologated in the near future

Although the WIM stations will deliver weigh results from B(7) to A(5) accuracy (according COST323 standard, with III-R2 conditions), a manual check is still needed until the system has been officially homologated.

Each WIM station comprises a robust gantry over the road, which incorporates equipment for height detection (based on 3D radar), overheight detection (using lasers), video recording, ALPR, ADR and ground loops. The data captured by the stations will later be processed at the Perex traffic center in Namur.

Software solution

The central software application is an important part of the project. Data from the WIM stations is gathered by Sterela. The software to monitor and configure the system together with the centralized management tool has been developed by Tein Technology.

The central system is a web-based service with centralized storage. It can be accessed via mobile devices, either by using an app, which needs to be installed separately, or as a web service run via a browser.

The new WIM platform is based on open architecture using the latest software. The solution has been split into four main components, which are functionally independent from one another:

1. The collector module, which is responsible for gathering information from the WIM system and the ALPR sensors.
2. The database. The solution chosen is called MongoDB. It facilitates flexibility regarding the data that can be stored, and is thus 'open'. It also offers horizontal scalability, which means that the performance of the solution can be increased easily and cost-effectively.
3. The analysis service. Tein Technology created the reporting tool, ensuring that the reports are dealt with efficiently.
4. The front end, which has been

designed as an attractive web interface for multiple devices.

Fit for purpose

Due to the critical environment in which the platform is running, it has been built to the following requirements:
1. High availability: Achieved by a 1+1 redundant architecture (that can also accommodate load balancing) on every element of the system.
2. Security: The platform only exposes the required interfaces to the external world, keeping some of the internal interfaces within the secure network.
3. Monitoring: Tein Technology is using PRTG to centrally monitor HW and SW installations. This enables service engineers to be proactive once the system is in production and to react before real problems occur.
4. Data privacy: Given the sensitivity of the data stored in the system and in accordance with privacy laws in Europe, data is properly encrypted end-to-end and privacy concerns are considered.

Project management

Within this project, a clear split of responsibilities was required. Yvan Paque (Eiffage Energy) was charged with all infrastructure work and Tein Technology was the technology provider. Tein Technology also played the role of integrator, creating a customized software solution that met the needs of the Walloon government.

Free reader inquiry service

Tein Technology inquiry no. **506**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

by **J J Eden**

It's time for the industry to shift its focus away from technology

Interoperability challenges and opportunities exist in every marketplace and industry. In fact, one of the most mature forms of interoperability is monetary currency. Currency was developed to create a medium to exchange goods and services, and establish a measurable standard for that exchange. This system has been in existence for several hundreds of years and there is still not a uniform currency for the world – and there won't be in our lifetime. However, currency is interoperable through a common set of information and rules between banks and other financial organizations.

Toll interoperability parallels currency and monetary policy in many ways. Transportation can be federated to some extent, but policy and transportation funding in the USA is regional. This regional control is needed to continue the maintenance of existing assets and build new capacity where it makes sense to support the local and regional economy. The business case for toll interoperability is not just to promote mobility, but rather to provide a simple, standardized approach to how the industry offers a product or service to its customers.

Toll interoperability is not about technology; it's about reciprocity, a common agreement and a common set of information to process transactions uniformly. There are two types of information required to achieve toll interoperability: traffic and financial. For traffic information, each operator needs to collect a vehicle identifier (such as a license plate or transponder) and the date, time and location of travel of that vehicle. This information is all that is needed to determine how much money is owed by customers traveling on a toll road, bridge, managed lane, or any user fee facility.

The second set of information is financial data to collect the money due for use of the service. The only basic data needed is a customer identifier, the amount due, and payment method. Currently, several toll operators within states or within several neighboring states and regions are already interoperable using this basic information. This approach may be scaled to larger regional or national interoperability.

Toll interoperability is not about technology; it's about reciprocity

Toll interoperability must focus on a common set of information required to process traffic and financial transactions. The industry must take a step back from the technology discussions and continue the dialog about how to exchange a common set of information and uniform (where possible) policy to achieve toll interoperability. The industry should allow for new and indifferent technologies. We must let the customer and free market dictate the technologies and platforms that are most appropriate for that geographical region, as no single technology fits all locations.

Policy makers must enable free markets that support current legacy and emerging technologies, while providing the security and financial requirements that provide interoperability. The danger of adopting a single technology is that it limits the market. Toll agencies are already operating payment systems for parking, while telecoms and others develop commercial mobile applications. If we choose the adoption of a single technology, we will keep the toll industry in the dark ages of transaction processing.

J J Eden, is the director of tolling at Aecom,
james.eden@aecom.com

Intelligent software solutions for modern traffic applications

To optimize the performance of its technology, CA Traffic's experienced in-house engineering team has developed smart, reliable in-station software for all of the company's data collection products. This includes all Black CAT variants (counter/profilers, weigh-in-motion (WIM), radar and Bluetooth), traffic monitors and variable message signs (VMS).

Built on a flexible and scalable architecture, the company's Catalyst in-station is a powerful, real-time data acquisition and distribution solution, which can either be hosted by CA Traffic or on the client's own PC.

Once Catalyst has acquired the data from the outstation systems, the software can then distribute it to any combination of target systems, including the Catalyst Algorithm Engine, VDA-Pro R2 data analysis software, UTMC in-stations, VMS and bespoke integration for third-party systems. This distributed data can be a fusion of underlying vehicle data, fault information and algorithm status. The flexibility of the architecture means new output methods can be rapidly developed and integrated seamlessly, if required.

The Catalyst Algorithm Engine has a flexible framework for the creation of bespoke automated responses to real-time conditions (such as congestion alerts). Catalyst also offers integral fault management at every level. Equipment, location and data faults can be grouped and filtered, enabling easy identification and informed diagnosis of current and historic issues. Furthermore, Catalyst has the ability to self-manage and inform external users of both equipment and system faults, for example via real-time or daily email summaries.

Information about location and equipment assets is stored within Catalyst. Information includes sensor type, site layout, equipment type and communications methods. This enables automatic configuration of equipment, with setups automatically issued once assigned to a location.

Designed for data

For data analysis, CA Traffic has created VDA-Pro R2, a comprehensive database system for traffic data management. VDA-Pro R2 builds upon the success of the company's VDA-pro by delivering a familiar interface, in a more powerful and functional solution.

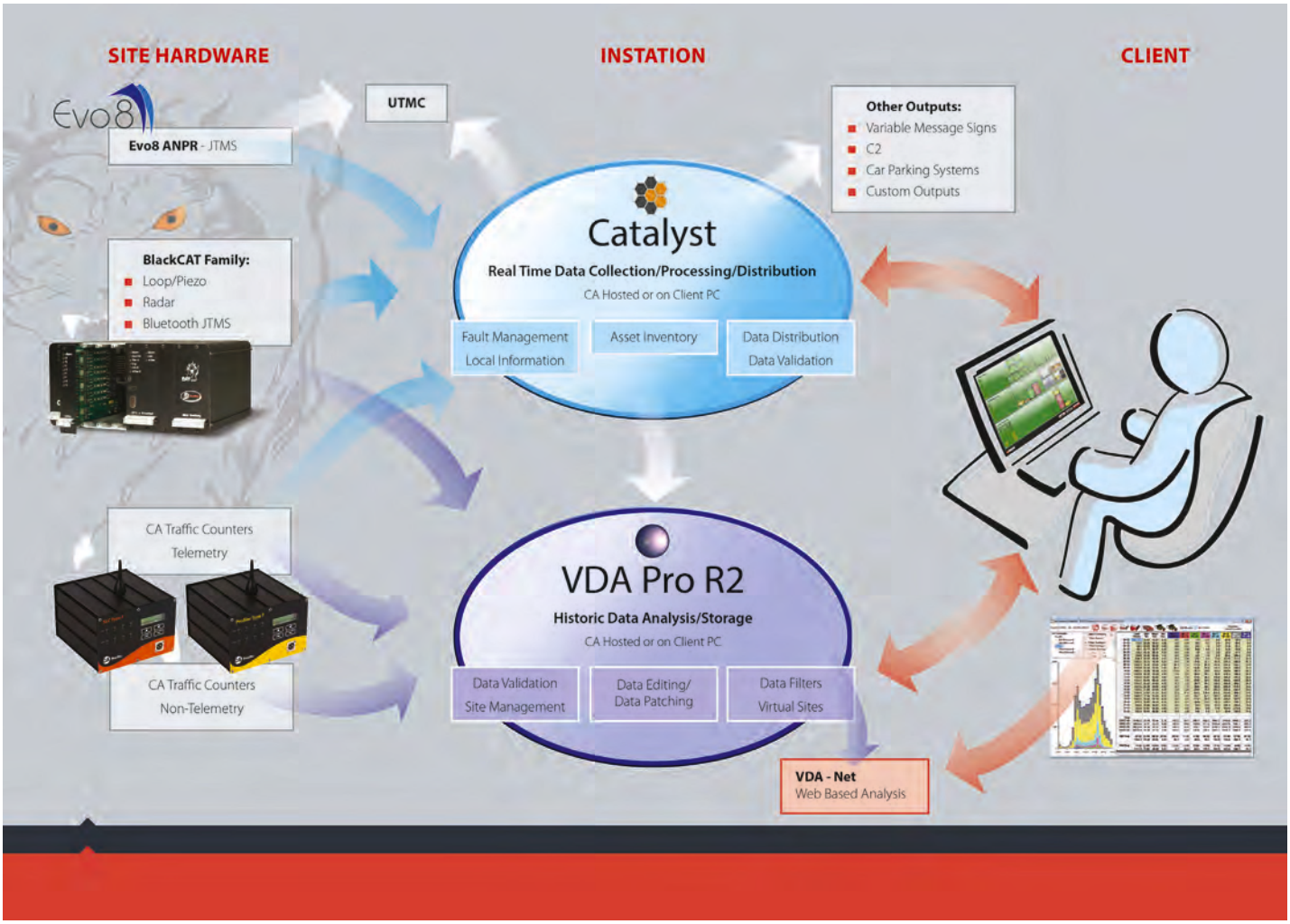
VDA-Pro R2 is a client-server-based system built on the power of Microsoft SQL Server. The solution excels at rapidly delivering large data sets requested by users for analysis. Multiple sites can be connected into the system for a large variety of equipment types. The telemetry module also enables users to see the site's current status, view or collect the recorded data and set up the recorder.

(Below) **Detailed traffic information can be managed with intelligent software applications**

Need to know

Effective roadside operations require the support of sophisticated software

- The VDA-Pro R2's Global Event calendar enables operators to mark a day that is unusual so that it can be optionally excluded from calculations such as averages
- Features for group reporting and data editing and validation are also included within VDA-Pro R2



VDA-Pro R2 supports binned and vehicle-by-vehicle data with reports displayed in a grid along with the appropriate graph. Users can manipulate their view of the data by switching to different reports, moving date, or summarizing data. Users can then print or export the results, as required.

Customizable filters can be applied to data sets, allowing for detailed analysis of subsets of data. For example, an off-peak HGV filter, when applied to a speed report, will show speed statistics for off-peak HGVs only.

(Above) **CA Traffic's range of traffic data collection and management solutions**

Missing data can be patched at the click of a button, whereby new values are created based on the selected seasonal distribution or data from a similarly located 'buddy site'. This facility enables averages to be calculated for a site with missing data, while still taking account of seasonal variations.

Optional modules available for VDA-Pro R2 include a map interface, VDA-Net Web Application and a newly released Journey Time module for the reporting of journey time data from Bluetooth journey-time recorders or ALPR-based journey-time camera systems.

Free reader inquiry service

CA Traffic inquiry no. **507**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

Taking weighing applications to the next level

The International Organization of Legal Metrology (OIML) requires weigh-in-motion (WIM) systems to accurately measure at least 162 vehicle passes and 540 axle passes before it can be certified according to the OIML R-134 standard. If just one of the vehicle measurements does not meet the accuracy specifications, the entire system cannot be certified.

The specifications of OIML R-134 are very strict. For WIM systems certified according to accuracy class 5, the maximum permissible error (MPE) in operation is ±5%. During the certification process, however, the MPE is only half of that.

Kistler is the first WIM manufacturer to receive the OIML R-134 certificate for in-motion vehicle weighing with strip sensors according to accuracy classes 5 and 10. The certificate, issued by the Swiss Federal Institute of Metrology (METAS), is based on extensive performance tests, including lab tests, EMC tests and in-motion tests. While the lab test verifies the accuracy, linearity and stability of the sensors and electronics (in relation to loading, temperature, humidity, etc), the in-motion test verifies the accuracy of the system installed in the road under real conditions.

Enhanced operation

The OIML-certified Kistler WIM system, comprising the WIM Data Logger and Lineas quartz WIM sensors, will open up a new range of applications and is a promising alternative to existing applications. So far, the only certified systems available are static scales or slow speed scales. These systems are limited regarding vehicle speed, and involve complex installation and frequent maintenance. Kistler's WIM system promises better results in a wide variety of applications.

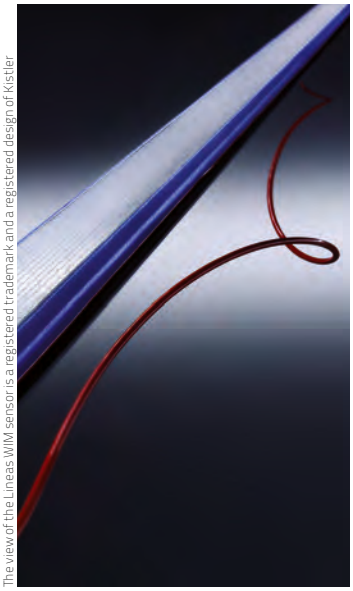
With weight-based road tolls, road users pay according to the actual weight of their vehicles and can even be penalized in the event of overloading. Kistler's WIM equipment can be easily integrated into manual or electronic toll collection systems for greater efficiency and it meets the legal weighing requirements from low to medium speed (up to 40mph). Weight-based toll fees are collected automatically and vehicles do not need to stop.

An enforcement WIM system monitors all traffic 24/7 and enables operators to automatically identify overloaded vehicles without the need to stop them. By operating a certified WIM system within a specific legal framework, enforcement agencies can use the WIM measurements as a legal evidence to pursue loading limit violations. Penalties for overloading can be issued automatically, without stopping the vehicle for a secondary weighing process.

When loading ships or trains, operators of ports and loading terminals pay great attention to the weight of trucks and goods being loaded. A traceable or certified weight measurement system is usually a must – and speed is key, since ports and terminals tend to be congested. Kistler's WIM system provides certified weight data by accurately measuring the vehicles while they are moving.

Industrial, mining and other facilities processing or moving highly valuable goods may be constrained to use static high-precision weigh bridges. For other operators with a focus on an automated weighing and invoicing process, however, using a Kistler WIM system may be an option. Besides offering great accuracy over a wide speed range, the system provides legally certified weighing data as a base for the invoicing of goods.

The view of the Kistler WIM Data Logger is a registered trademark and a registered design of Kistler



The view of the Lineas WIM sensor is a registered trademark and a registered design of Kistler

(Above) **Kistler's WIM data logger**
(Right) **The Lineas quartz WIM sensor**

Need to know

An OIML-certified WIM system offers optimized results in a variety of scenarios

- OIML-certified WIM systems can be used in applications such as road pricing with weight-based toll collection, automatic enforcement of weight limits, weighing at ports and terminals and industrial weighing
- Kistler's OIML-certified WIM system can be easily integrated into existing applications
- The Lineas WIM sensor, with its extremely durable quartz crystal material, guarantees a very long product lifetime without requiring maintenance

Free reader inquiry service

Kistler inquiry no. **508**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

Flexible WIM for optimized traffic management

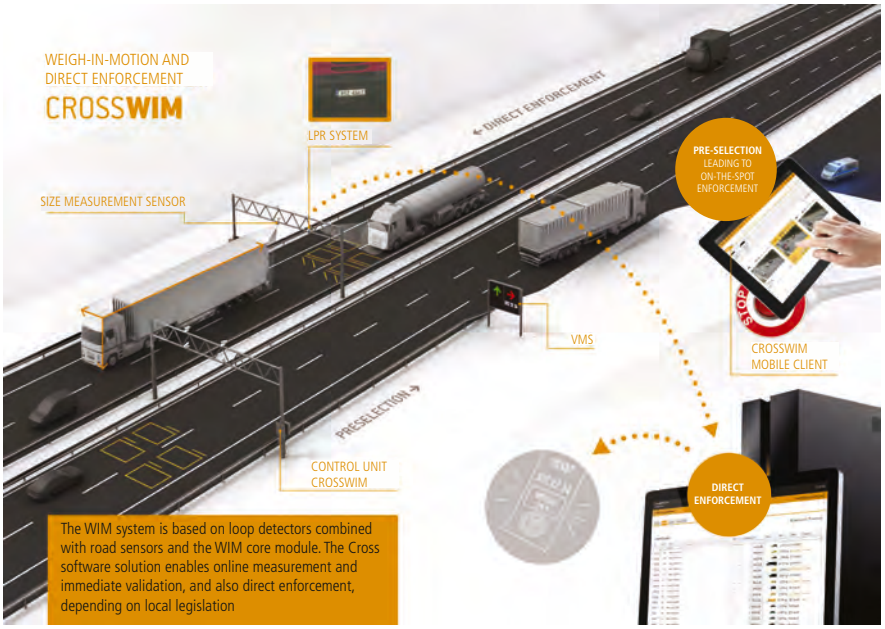
Over the past 15 years, the high-speed WIM system from Cross Zlín has evolved into a complex modular solution that can be used for a variety of applications, not just those that involve weighing. The system has found uses in road infrastructure protection, violation processing, traffic management, pre-selection, direct enforcement and tolling.

In 2011 Cross Zlín became the first company in the world to receive product certification for direct enforcement at its WIM system in Zlín, Czech Republic. The company also has type approval for WIM enforcement technology. There are two WIM gates in the Czech Republic that are equipped for direct enforcement and they are used as pilot projects for the design of other processes. The system generates a record of violations, including a ticket for the driver or vehicle owner, and it starts the fining process.

Need to know

Direct enforcement, pre-selection and traffic statistics can be achieved with a single system

- The CrossWIM system uses sensors embedded in the road (inductive loops and weight detection sensors) and proprietary evaluation electronics
- As an open system, CrossWIM can cooperate with third-party hardware and software, making it possible to customize WIM systems for specific applications and local conditions



(Left) **CrossWIM can be used for both preselection and direct enforcement** (Below left) **A CrossWIM system *in situ* in Korea**

As the Czech Republic is a member of the European Union and the country's legislation is adapted to meet EU standards, similar certification and processes can be implemented in other member states. Other developed countries around the world could also adapt their processes to work with the system. It has proved to be a very useful tool in changing the behavior of drivers and carriers.

Power and versatility

Not every WIM application requires direct enforcement, however. It is common to operate WIM systems for pre-selection, real-time traffic management, and tolling systems, and it is essential to have data online. The CrossWIM system comes with powerful control software, server applications and databases, and web-based client applications. This enables users and cooperating systems

to receive data and measure results in real time.

The system provides a real-time visualization of passing vehicles, including ALPR and overview camera snapshots; detailed information about every recorded vehicle; graphics; detection of overloaded, speeding or oversized vehicles; and it displays the weight protocols. The vehicle database includes search and filtering functions, traffic statistics and reports, which can be viewed on laptops or tablets.

The police do not need any other special equipment, as all the information is accessible via standard IT devices and can be used for routine police procedures. It can also be used to control variable message signs (VMS) and road information panels.

As the CrossWIM system is robust and advanced, it has been possible to install it around the world, with a number of layouts for different uses. The system is also suitable for a range of climatic conditions; from the heat of Africa and the Middle East, to the extremes in Russia, the tropical climate in Asia and Oceania, the deserts in Central America, and, of course, the mild weather in Europe.

Free reader inquiry service

Cross Zlín inquiry no. **509**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

Advances in WIM technology enable efficient, cost-effective enforcement

Today's roadway authorities leverage multiple tools and facilities for weigh-in-motion (WIM) enforcement. Ranging from mainline screening and preselection, to incorporating virtual WIM (V-WIM) locations and software, to using static or portable weigh stations, a myriad of options exist to meet local regulations and requirements.

WIM systems appeal to both authorities and transporters because they minimize the disruptions associated with the static weighing of vehicles. However, static weighing is acknowledged to be the most accurate way to weigh vehicles for citations and enforcement. This has led agencies to develop strategies that employ high-speed WIM (HS-WIM) for screening for probable offenders, and low-speed WIM (LS-WIM) and static scales for measuring highly accurate axle and gross vehicle weights.

Strain gauge load cell-based technology has been widely accepted as the most accurate and reliable means to weigh a vehicle. As such, this technology is widespread in static platform scale and LS-WIM scale systems.

Minnesota-based Intercomp Company has developed this strain gauge technology to work within HS-WIM applications, and has further leveraged its 35 years of experience with portable scales to enhance the user experience for portable LS-WIM and static scales for enforcement.

Reliability and opportunity

The HS-WIM strain gauge strip sensors are installed in a 3in-wide (75mm) channel cut into asphalt or concrete roadways, and can be installed in a single day. With the inherent performance and durability of strain gauge load cells, the sensors are capable of meeting performance requirements for ASTM E1318-09 Type III, or COST 323 A(5) methods. Stability, performance and durability of the sensors in a variety of adverse weather conditions and roadway conditions allows for a wide range of applications and an excellent ROI for users.

These sensors can be paired in existing WIM sites, or within V-WIM systems coupled with cameras and software for vehicle classification, measuring axle weights, axle spacing and gross vehicle weights. Automatic license plate recognition, optical character recognition, and scene view data is matched to WIM data and then transferred to the CPU to be processed further. Data and images can then be flagged for potential violations, and accessed via the web from remote locations for downstream enforcement.

Portable weigh stations

Once a vehicle is flagged for potential violations, it is typically diverted to a temporary or permanent weigh station. Due to the costs associated with construction and operation of permanent weigh stations, temporary stations offer roadway authorities cost-saving options. Portable WIM or static scales provide the tools for agencies to be more flexible with budgets and locations for enforcement.

When placed at temporary weigh stations, portable WIM or static scales enable axle and gross vehicle weight measurements for ticketing violations. Intercomp has several portable scale options using strain gauge technology, with multiple features developed to meet user needs.

Need to know

Strain gauge load cell technology optimizes performance and reliability in HS-WIM

- Intercomp's WIM strip scales can be configured in sets of one, two or three pairs of strips depending on the application
- The sensors can weigh highway vehicles traveling at speeds of up to 80mph (130km/h)
- The system is well suited for weight enforcement screening, monitoring bridge loads, toll roads, traffic data collection and conducting road research

by **Larry Yermack**

Connected vehicles should be a part of an integrated transportation network

We have dreamed of vehicles that could drive themselves for a long time. GM led the way at the 1939 World's Fair with its Futurama exhibit, which presented a futuristic vision of automated vehicles. Then, in 1958 Disney got into the game with an animation called Magic Highway USA. Disney's cars rode on highways with enormous variable message signs and ice-melting coils, and the cars were programmable. You can watch the Disney video here… traffictechnologytoday.com/disney

In the 1990s we had the Automated Highway Consortium where, for the first time, car companies cooperated to develop a national network of autonomous vehicles. There was a press event in San Diego where this experiment ended. It depended on millions of magnets being installed nationwide, so the idea never went beyond demonstration, but that cooperation between the car companies and the government led to the connected vehicles of today.

With the advance notice of proposed rule-making from the NHTSA, we are on the verge of realizing cars with built-in DSRC radios by 2020. These connected vehicles will be able to share information across a network and support active safety. This will give us cars that are much less likely to crash. As a side note, this may be the first time that the automotive industry is promoting safety innovation rather than fighting it. Its track record to this point had not been impressive.

The promised connected vehicles will not only communicate each other, but also with the roadside infrastructure (V2I). Here is where the model is inadequate. Active safety depends upon vehicle-to-vehicle (V2V) communications, but the additional V2I functionality depends on the installation of additional roadside infrastructure and there are no funded plans for this. The hope is that the promise and demonstrations of that functionality will lead to investment. I believe we need to think more broadly.

"While the USDOT has many ideas for V2V applications, it doesn't have funding"

While the USDOT has many ideas for V2V applications, it doesn't have funding. States are constrained these days, so will need a commercial application to attract private investment. The problem is that little thought or attention is being paid to the necessary commercial content. It's sort of 'if we build it, they will come'. Let me suggest that we need to think about it now, so that someone can build it soon.

For me, the 'it' is a payment system built on to the transponder active safety system. Let's use the DSRC network for what people love to do – shop. But in this case let the shopping be inside the transportation network for the rest of the trip. Drivers are not just drivers; they are travelers and will park their car, take a train or bus, order a car service, or perhaps even rent a bicycle. If we can provide complete journey planning as well as ticketing, we can have a complete personal transportation system. Now that might be something to attract investment interest.

Larry Yermack is strategic advisor to Cubic Transportation Systems, USA. ***lyermack@gmail.com***

(Left) **Portable LS630 WIM scale** (Above) **Intercomp's WIM strip sensor**

Portable scales have grown smaller over time, in scale weight and profile height, enabling easier deployment by agency officials and usability for operators. With the integration of wireless weighing technology into the scales, increased safety and convenience is also realized for the operator. One doesn't have to walk around the scales and record the data during weighing operations, as the data can be wirelessly sent to one of several available hardware or software tools. Static vehicle weights can be measured in the same way if the application requires it.

This range of fixed and portable WIM systems provides accuracy, functionality and flexibility in a comprehensive set of enforcement solutions with excellent ROI. Each WIM application presents a unique set of circumstances and customer requirements, but one can configure systems to meet specific application needs.

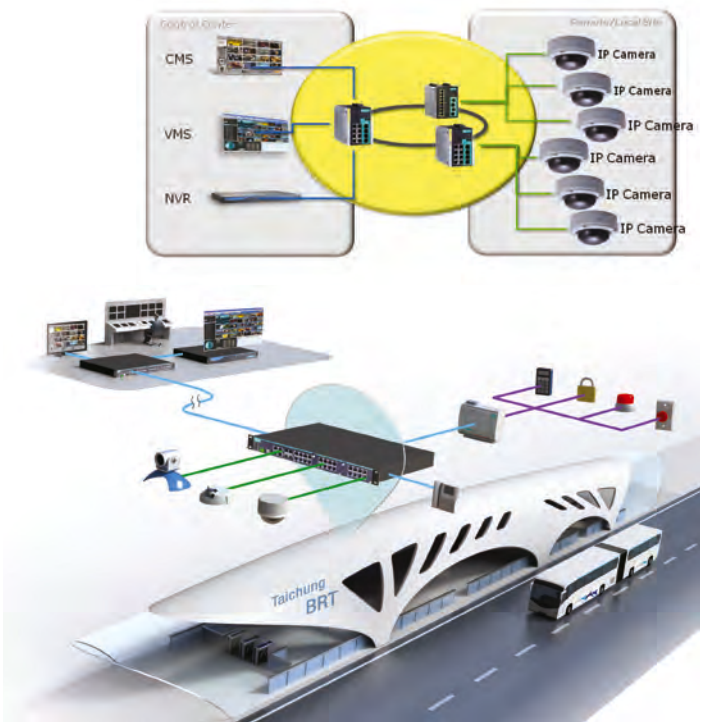
Free reader inquiry service

Intercomp inquiry no. **510**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

Optimizing industrial Ethernet networks for IP video surveillance

Video surveillance systems use images to enable security personnel to monitor an entire facility, or even a collection of facilities, from a central location, 24 hours a day, seven days a week. Surveillance systems are certainly not new, but in recent years there has been a big change in how they are implemented.

A basic system might simply save all of the images onto a hard drive for future analyses. More advanced systems, however, use intelligent cameras that support extremely sophisticated features, including the ability to recognize scene changes in critical areas (e.g. if someone leaves a backpack unattended in an airport), or identify specific types of objects.



(Left) **An advanced network video surveillance system enables real-time event monitoring and provides an image library**
(Left below) **The Taichung BRT video surveillance system encompasses stations, buses and control rooms**

Need to know

Today's critical industrial networks require sophisticated networking solutions

- According to a 2014 IHS White Paper (*Video Surveillance & Storage: Opportunities at the Intersection of IT and Physical Security*), the surveillance market will likely see a CAGR growth of 14.8% between 2013 and 2018
- The forecast for 2018 is that the entire market will generate up to US$25.6bn in revenue
- Network video surveillance equipment is expected to make up the bulk of the market share, compared with traditional analog video surveillance equipment

It goes without saying that a video surveillance system is already a 'must have' for any type of mission-critical facility, both for monitoring events in real time, and for providing a library of images that will be available for future analyses.

Public transportation, for example, has been an important focus for city development in recent years to improve traffic management, quality of life, and city development. Bus rapid transit (BRT) systems are popular as a result of their low cost, high flexibility, high efficiency, and shorter development time compared with railways or mass rapid transits (MRTs), and have already been developed in other regions of the world, including South America and China.

A city in Taiwan has invested in six BRT lines that will operate in 20 sections of the city. An important part of ensuring that the BRT works reliably and efficiently is the video surveillance system, which encompasses stations, buses and control rooms.

Optimized solutions

With video surveillance now standard for industrial mission-critical infrastructures, it is important to choose the best technology for the network. Two of the most important aspects of this problem are the standard protocol and industrial network management.

Although RSTP and IGMP are often used, neither of these protocols are optimized for mission-critical surveillance networks. In fact, the video stream transmission could hang for up to two minutes as the standard protocol responds to network single point of failure events. A better choice is a new proprietary protocol designed to optimize networks for video stream transmission. Moxa's new V-ON technology is an ideal choice, since it takes up where standard protocols leave off, ensuring that a data stream transmission can recover in under 50ms for L2 networks and in under 300ms for L3 networks.

The network management software used can make a big difference in the success or failure of a mission-critical network. Network management software that relies on traditional polling technology to check the status of network devices can delay the reception of important warning messages by several minutes for networks comprised of hundreds or thousands of devices. One can save a lot of time and effort by choosing network management software that supports visualization (enabling the user to see the devices and structure of his network on screen), real-time notification, and easy integration with existing SCADA systems.

Free reader inquiry service

Moxa Europe
inquiry no. **511**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

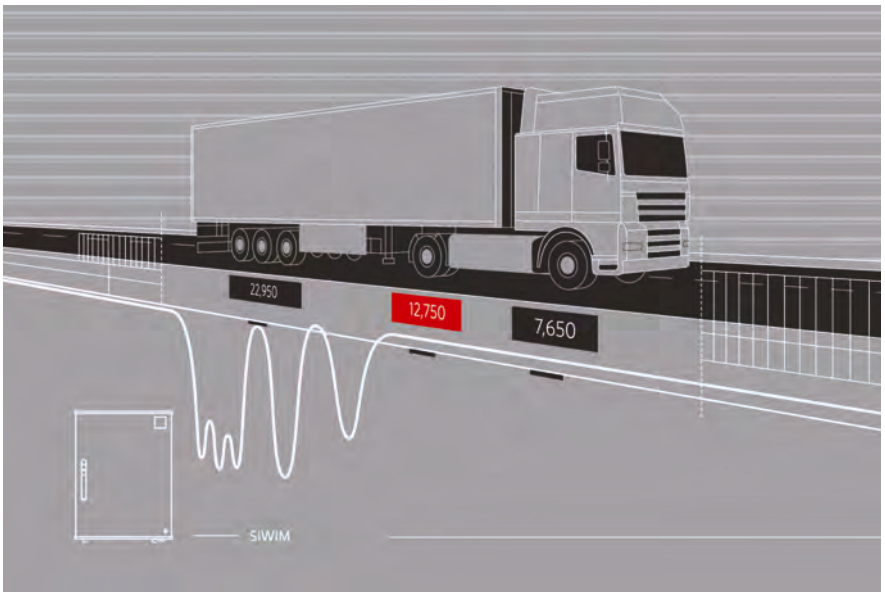
Optimizing the assessment and maintenance of critical infrastructure

In order to achieve efficient road network management, specific types of information are required at different levels of the decision-making process. This is particularly important for critical infrastructure, such as bridges and tunnels, as their failure poses a high safety risk.

To address this requirement, the SiWIM bridge weigh-in-motion (WIM) system has been designed to collect both raw and aggregated data. Road authorities can use this information for a variety of purposes, such as maintenance, planning, preselection for enforcement, WIM data distribution, calculation of damage to the pavement and bridge, supervision of dangerous goods transport, planning special transportation routes, and bridge assessments.

The aggregated data provides detailed information for each vehicle, including: lane of travel, axle load, gross vehicle weight, axle distances, vehicle speed, vehicle class, and axle configuration. The SiWIM format then adds the pavement aggressivity factor of individual vehicles (ESAL – equivalent single axle load) and a quality estimator, i.e. how well the calculated bridge response matches that established by the measurement.

This aggregated data meets the needs of most traffic analysis, pavement and bridge-load applications. If switched on, the outputs from all sensors for selected vehicles – typically heavy ones – are stored. This data is used for fine-tuning the SiWIM setup, re-evaluating dubious measurements, double-checking extreme events, calculating parameters for bridge safety assessment, and post-processing the weighing results.



(Left) **The SiWIM system collects traffic data and identifies the true behavior of bridges – through influence lines and load distributions**

Need to know

Reliable traffic data supports decisions related to bridge maintenance

- The SiWIM data can be used for preselection. An overview camera and a handheld computer can help enforcement units extract potentially overloaded vehicles from the traffic flow, or simply distinguish between loaded and empty vehicles for border control
- Use of the SiWIM system substantially reduces the time required for static or low-speed weight control
- If statistical models of all bridges on a certain road section are systematically updated based on SiWIM measurements, their structural safety can be calculated instantly

Model example

Depending on the length of the measurement, the number of sensors and the additional equipment used, collected data can be used for maintenance and planning, whereby statistical models are used to calculate parameters for pavement, bridge and traffic analysis. Data from the SiWIM system is often combined with information from traffic counters.

Typical results of such models are cumulative ESAL values for a particular road section. These can be directly applied to the design or reconstruction of pavements, and can provide the life expectancy of the road surface.

Aggregated data can also be used for other projects, such as WIM data distribution, whereby the distribution of traffic loads to neighboring road sections is evaluated based on SiWIM data and information from the traffic counters. Filtering the data for specific types of vehicles can establish the extent of damage caused by particular vehicles, users, or companies.

An analysis of dangerous goods transportation can be performed with an overview camera, comparing information from the ADR panel on the vehicle with the gross vehicle weight data from the SiWIM system.

SiWIM data is critical in the assessment of existing bridges. Typical examples include calculating the effects of live loads on the bridges (moments and shear forces), simulation of maximum expected impacts, assessment of dynamic effects due to traffic loading, calculation of safety factors, bridge monitoring, bridge posting, and fatigue of steel bridges.

Free reader inquiry service

Cestel inquiry no. **512**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

Reliable weight-enforcement operations without WIM

What are the benefits of weigh-in-motion (WIM)? Many of the modern and expensive WIM installations are designed to feed into the big data pool, but do road authorities really benefit from this? If the data collected is used for road planning and the screening function is used for pre-selection, then it makes sense to invest in WIM technology. However, these functions are often not used.

Many WIM systems around the world are failing to reduce overloading violations to an acceptable level. Furthermore, the data being collected is not being used effectively. Meanwhile, there are substantial costs associated with the recalibration and maintenance of these systems.

Due to budget restrictions, about 50% of the WIM systems installed in Switzerland have not been recalibrated. This means that they are no longer providing data and are not performing pre-selection for enforcement. They are simply being used to count vehicles – but there are much cheaper solutions for this purpose.

(Top) **Vehicle weigh check in Zambia**
(Above) **Police officers can relax when there is an effective, reliable weigh enforcement application in place**

Need to know

Accurate weight enforcement can be achieved with a cost-effective mobile solution

- Due to union restrictions, officers are not allowed to handle single items weighing more than 20kg. The scales only weigh 17kg
- Due to their small 17mm height, the levelers only weigh 15kg
- The mobile solution is carried in the trunk of a car and has a gross weight of less than 100kg
- The system can set up by one individual and can be be ready to use in less than three minutes, including laptop and printer for the protocol

WIM vs static scales

The first WIM systems were discussed and recognized in the USA some 40 years ago. Despite developments in sensor technology, the physical limits of the application are yet to be overcome and thus WIM systems cannot solely be relied upon for direct enforcement.

In order to effectively and reliably reduce overloading violations, authorities need to use portable static scales. This method of weigh measurement has been accepted as the most accurate since the 1940s.

An experienced team of three officers does not need WIM pre-selection. They know exactly which vehicles to measure and which to let pass – and escaping or bypassing the scales is not possible. Such mobile teams should be included in every weight enforcement application.

In Switzerland, approximately 70 mobile teams have reduced the number of overloaded HGV violations in the country to such a small number, that sometimes the officers only see one violation in a half-day shift.

If vehicles are not stopped and analyzed for their axle weigh limits, they cannot be charged with an overload violation. Furthermore, punishments cannot be enforced without an approved fines catalog. Tolerance deduction measures also need to be in place to avoid drivers taking legal action. For example, if a 40-ton vehicle is found to be carrying 41.2 tons – this is within the +3 % tolerance limit.

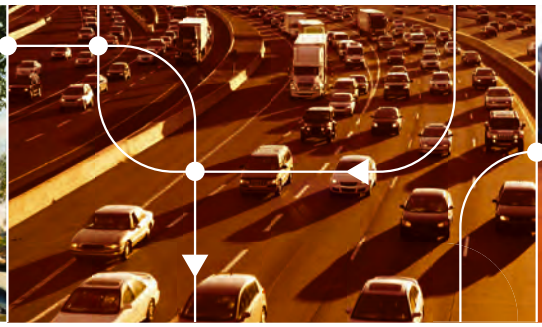
Road authorities need to think carefully about whether they really need to invest a lot of money in installing an expensive WIM system, or whether their needs can be met with a much cheaper, more effective option – a mobile static weigh system.

Free reader inquiry service

Haenni Instruments
inquiry no. **513**
To learn more about this advertiser, please visit: www.ukipme.com/info/tfm

Intertraffic AMSTERDAM

5.6.7.8 APR 2016


International trade fair for **infrastructure, traffic management, safety** and **parking**

Amsterdam RAI
The Netherlands


The world's leading trade event for traffic technology, connecting traffic professionals and businesses worldwide

- 800+ exhibitors from 50 countries
- 25,000+ global traffic professionals
- Latest trends and innovations
- Top notch educational programme
- Dedicated Smart Mobility Center
- Live Experience Hub

Organised by: rai AMSTERDAM

Intertraffic

Express lanes

The best places to find out about groundbreaking technological innovations and ideas – and the people behind them

"I suspect that five years from now, autonomous vehicles will exist in significant numbers – not to the point where everybody uses them, but truly demonstrating that they function"

Oliver Kuttner, founder and CEO of the Edison2 project

Watch the video at
traffictechnologytoday.com/edison2.php

"We can't have wireless devices operating in the same spectrum and interfering with communications from vehicles. It's something that has to be coordinated and we have to get all the stakeholders at the table as soon as possible"

Gregory G Nadeau, acting administrator, Federal Highways Administration (FHWA), USA

Read the full story at
traffictechnologytoday.com/coalition

Page 32

"It's chaos right now when people bale off the system and try to find their way around. It's very difficult. This will be more ordered and will flush the system out"

Joan Sollenberger, Caltrans' Office of Strategic Development, Connected Corridors Program

Page 56

"I think we're all working toward the same common goal, which is to make driving safer. We're just taking different paths to get there"

Chris Urmson, director of Google Self-Driving Car, USA

Index to **Advertisers**

Early bird registration **now OPEN!**

BORDEAUX 2015

22nd

ITS World Congress

Bordeaux, **France**

5 to 9 October

2015

www.itsworldcongress.com
#ITSWC15

TOWARDS INTELLIGENT MOBILITY

Better use of space

Organised by

Co-organised by

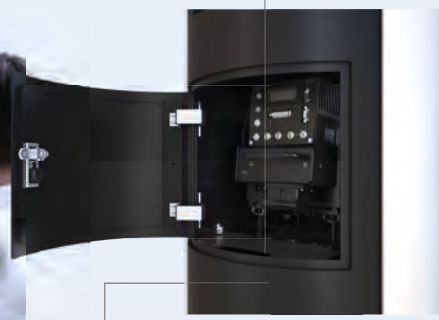
Hosted by

On behalf of

Supported by

Jenoptik Traffic Solutions: Paving your Way to Traffic Safety

Vehicle application



Stationary application in TraffiTower 2.0

Container application

Tripod application

Jenoptik Traffic Solutions offers technological and service-oriented solutions that efficiently increase traffic safety throughout the world. We place great importance on making our systems as flexible as possible to suit your diverse and changing traffic safety needs.

This is why we have developed a completely new solution that allows for the flexible use of a laser scanner or radar sensor plus camera system in all stationary and mobile applications. It can easily be applied in a TraffiTower 2.0, in a TraffiCompact housing, in a vehicle or on a tripod or container. This one-system approach provides you with the highest possible flexibility, cost efficiency and handling ease.

Discover our innovative approach, superior technology and extensive expertise in traffic solutions!

JENOPTIK | Traffic Solutions
info.ts@jenoptik.com
www.jenoptik.com/ts

OPTICAL SYSTEMS
LASERS & MATERIAL PROCESSING
INDUSTRIAL METROLOGY
TRAFFIC SOLUTIONS
DEFENSE & CIVIL SYSTEMS

JENOPTIK