25th ANNIVERSARY 1994-2019

traffic TECHNOLOGY INTERNATIONAL

February/March 2019

WWW.TRAFFICTECHNOLOGYTODAY.COM

Emissions crisis
How Europe is fighting pollution with advanced traffic control

Workzone safety
Do autonomous vehicles protect or endanger workers?

Traffex '19
PART OF TRANSPORT NETWORK
The speaker highlights and product launches not to be missed at the UK's leading traffic show

MILLION-DOLLAR SAVINGS!

Will phones replace lidar?

Asset managers could make huge savings on survey costs as new algorithms enhance smartphone video

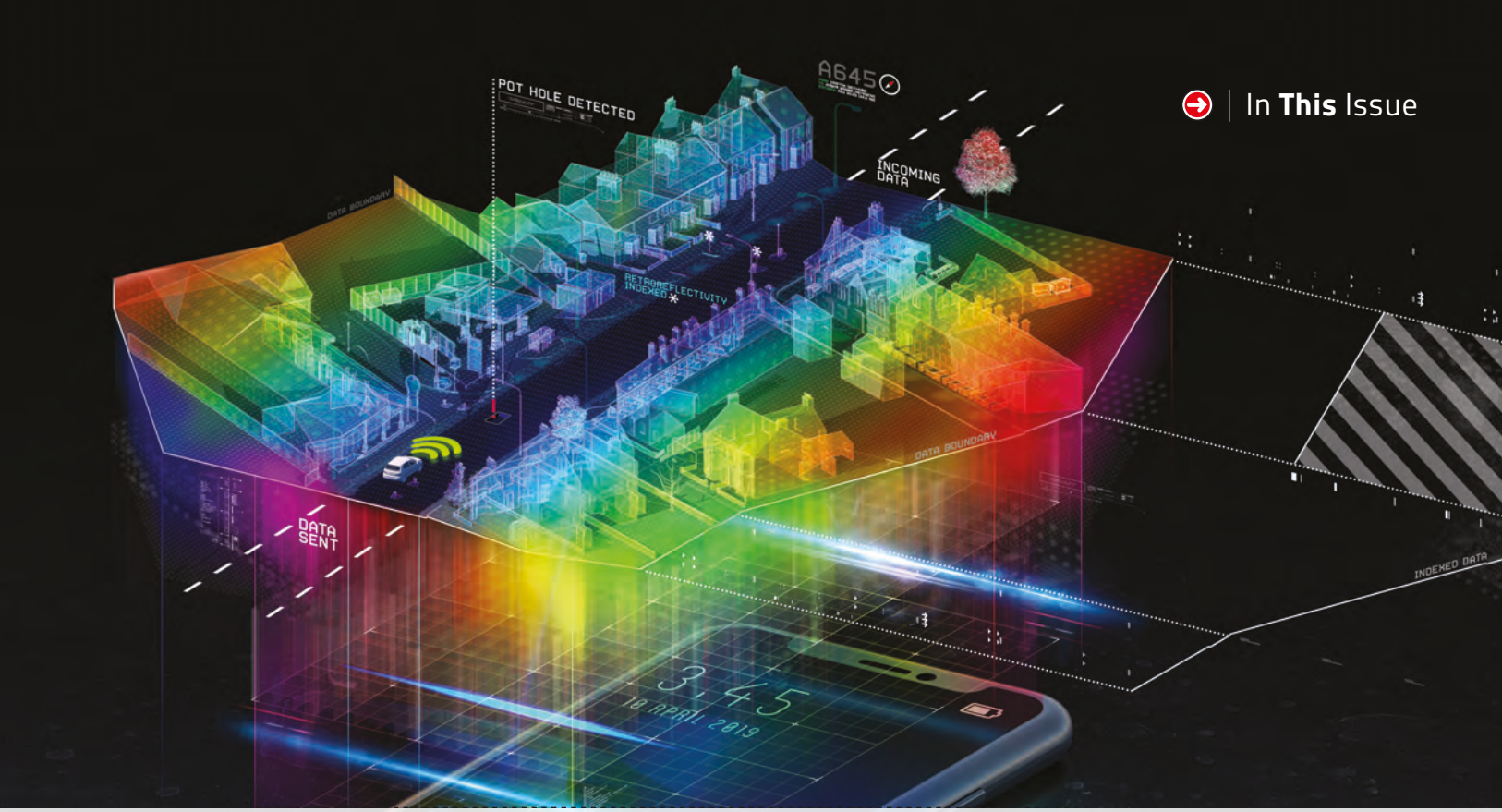
FEATURING

comtrans
Your essential guide to the future of transportation communications

CAV trials in the UK
A new pilot project is connecting vehicles in Kent. But could Brexit pull the plug on progress?

USDOT pilot success
In Tampa, Florida, USDOT's Connected Vehicle Pilot has reached a major communication milestone


SIEMENS
Ingenuity for life
Enhance city life
Cities across the UK are joining the green revolution. Will yours be next?
Clean air zones can transform your city centre into an attractive, greener space for healthier and happier citizens. But finding ways to hit low emissions targets can be tough. Every city has its own unique challenges.
Make your infrastructure intelligent. Choose a partner with the right credentials and expertise. Our end-to-end, proven solutions are already making a real difference, reducing congestion and improving the air we breathe and the lives of city dwellers.
Make now the time. Talk to us. Transform your city.
www.siemens.co.uk/green-revolution



Cover story

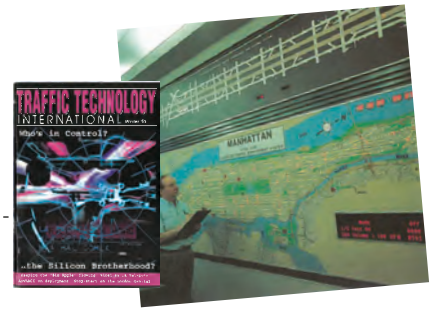
36 Smart views

Lidar creates highly detailed asset surveys, but are there now cheaper solutions?

The ubiquitous smartphone is delivering impressive results for US state DOTs planning road maintenance, as Tom Stone discovers

Cover illustration: Sean Rodwell

Technology Profiles



Editor's letter

Welcome to *Traffic Technology International*'s 25th year! This summer we'll be celebrating in earnest when we publish our special August/September anniversary issue in time for the ITS World Congress in Singapore. But before we get to that auspicious day, we'll be taking some time to reflect on how far the industry has come, starting right here in this foreword.

I was 18 in 1994, when this magazine was first published, which was also the year I passed my driving test. My car was a late-1970s Renault 12, which I picked up for £400 (US$600). Even by early 1990s standards these vehicles were considered pretty unsafe. By today's standards it was a deathtrap: bad road holding, no crumple zones, no ABS, no airbags, and of course no cruise control, lane keeping, collision warning, automatic braking or connected vehicle systems… it did have front seatbelts, though.

The advances in automotive technology in the past 25 years are fairly obvious to anyone who has been driving that long. However, what might be less obvious to the average road user is how much has changed behind the scenes for traffic managers. This is where a flick back through the *Traffic* archives can be an illuminating experience, particularly for someone like me who, in 1994, was more intent on working out how to rig a cheap car radio (complete with old hi-fi speakers balanced dangerously on the rear parcel shelf) than thinking about what kind of communication techniques might be available for managing traffic at the time.

One of my favorite images from the archives is the one above of Manhattan's VTCS 2000 Advanced Traffic Management System display wall, which we published in our Winter 1995 edition. Clearly at the time (much like my Renault 12), this legacy system was in need of updating. Indeed, the article stated NYCDOT was nearing its target of bringing all its 10,000 signals under computer control. But for me, it's the picture that leaves the most lasting impression, being an instant illustration of how far we've come. Where once there were flashing lights on a painted map, it's now almost unthinkable to display any traffic management information without high-definition screens, backed up by AI algorithms to aid decision making (more on those on page 44).

Looking back is a valuable exercise. It helps to give us perspective and to learn lessons from the past (our very own Larry Yermack does some more of it in his regular column on page 71, which includes further memories of early-1990s New York City). It also helps to make informed decisions and predict the future. And, of course, just like any other issue of this magazine, we do plenty of that in the pages that follow.

In our cover story on page 36 we look at how futuristic lidar asset surveys might soon be edged out by cheaper, smartphone solutions; on page 28 there's insight into the technology that aims to make workzones safer; and, of course, there's all the latest advances in connected systems in our regular Comtrans section (page 51).

We must always look to the future and strive for better, but there's value in remembering the past – a fact clearly not lost on the last few Renault 12 owners left in the world. A good-condition example is now considered a 'classic' and will set you back at least £3,500 (US$4,560), while a 1972 Portuguese Gordini version is currently listed online for €28,500 (US$32,300). If only I hadn't scrapped mine in 1996!

Tom Stone, editor

traffic TECHNOLOGY INTERNATIONAL comtrans
25th ANNIVERSARY 1994-2019

Editor
Tom Stone (tom.stone@ukimediaevents.com)
Deputy editor
Rachelle Harry
(rachelle.harry@ukimediaevents.com)
Assistant editor
James Allen (james.allen@ukimediaevents.com)
Production editor
Alex Bradley
Chief sub editor
Andrew Pickering
Deputy production editor
Nick Shepherd
Senior sub editor
Christine Velarde
Sub editor
Alasdair Morton
Design team
Andy Bass, Anna Davie, Louise Green, Patrick MacKenzie, Craig Marshall, James Sutcliffe, Nicola Turner, Julie Welby, Ben White
Head of production and logistics
Ian Donovan
Deputy production manager
Robyn Murrell
Production team
Carole Doran, Bethany Gill, Frank Millard, George Spreckley

Subscription updates
datachanges@ukimediaevents.com

Circulation
Adam Frost
Publication manager
Godfrey Hooper
(godfrey.hooper@ukimediaevents.com)

CEO
Tony Robinson
Managing director
Graham Johnson

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

Traffic Technology International USPS 012-893 is published bi-monthly – in January, March, May, July, September, and November – by UKi Media & Events, Abinger House, Church Street, Dorking, Surrey, RH4 1DF, UK. 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 UKi Media & Events, Abinger House, Church Street, Dorking, Surrey, RH4 1DF, UK. Air Business is acting as our mailing agent. UKi Media & Events is a division of UKIP Media & Events Ltd.

If you wish to cancel your subscription to this magazine please email datachanges@ukimediaevents.com. For more information about our GDPR-compliant privacy policy, please visit www.ukimediaevents.com/policies.php#privacy. You can also write to UKi Media & Events, Abinger House, Church Street, Dorking, RH4 1DF, UK to cancel your subscription or request a copy of our privacy policy.

UKi MEDIA & EVENTS

Published by UKi Media & Events, a division of UKIP Media & Events Ltd

Member of the Audit Bureau of Circulations

Average net circulation per issue for the period January 1 to December 31, 2018, was 17,413
Annual subscription US$120/£90
USPS Periodicals Registered Number **012-893**
ISSN 1356-9252 (Print)
ISSN 2397-5970 (Online)
Traffic Technology International

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

SAFER ROADS FOR A SAFER FUTURE

SEE HOW FLIR INTELLIGENT TRAFFIC SYSTEMS KEEP TRAFFIC MOVING, PEDESTRIANS SAFE AND PROTECT INFRASTRUCTURE

FLIR ITS is changing how traffic flows on the world's cities and highways. FLIR's proven systems are currently deployed throughout the world, and are essential elements to a modern, effective traffic management system.

To learn how FLIR ITS keeps traffic flowing safely around the globe, go to *FLIR.eu/ITS*

FLIR®

Traffex leads the way

Rachelle Harry reveals the highlights of the forthcoming Traffex event in Birmingham, UK, which include an opening speech from Highways England's Jim O'Sullivan and the new, fully immersive Future Mobility experience

Above: **Traffex 2019 will take place at the NEC, Birmingham**

Traffex 2019, which is taking place from April 2, 3 and 4, 2019 at the NEC, Birmingham, UK, is set to bring together professionals and organizations from the transportation industry, as well as members of the UK government, and provide them with business, networking and knowledge-sharing opportunities.

"The transport and highways sectors, although at times stifled by a lack of funding for local roads, have become incredibly resilient," says Adrian Tatum, head of events at Transport Network, the company that organizes Traffex. "It has learned to be better at adapting to change, as well as embracing new innovation and technologies.

"There has been a lot of discussion in recent years around future mobility and of course connected and autonomous vehicles. How can we successfully integrate emerging technologies like this with our existing transport and highways infrastructure? On one hand, the

Traffex | FLIR Stand No. D036

V2X camera

EXHIBITION HIGHLIGHT

FLIR will demonstrate vehicle-to-everything communications at Traffex 2019, as evinced by its ThermiCam V2X – a thermal sensor for urban traffic that allows vehicles and traffic infrastructure to communicate and share data. The goal is to improve motorist, pedestrian and cyclist safety, and overall network efficiency.

V2X technology relies on the communication of information between nearby vehicles and traffic infrastructure to warn drivers about potentially dangerous situations. In a V2X system, both the vehicles and infrastructure have communication units installed to transmit information. The FLIR ThermiCam V2X mounts on existing traffic signals and detects vehicles, pedestrians and cyclists at intersections.

ThermiCam V2X uses a multicore processor architecture to support both thermal detection and V2X message processing at the same time. ThermiCam V2X can distinguish between vehicles and cyclists, which allows traffic signal controllers to adapt green times according to the specific road user type. ThermiCam V2X can also detect pedestrians and it is capable of collecting traffic data, including volume, speed, occupancy, headway, gap time and vehicle classification.

Other FLIR product highlights at Traffex include the ThermiCam2 dual-vision sensor for intersection control and safety, the TrafiBot2 AID camera and the ThermiBot2 thermal AID camera.

Traffex '19 PREVIEW

Traffex | Videalert Stand No. C025

EXHIBITION HIGHLIGHT

Intelligent detection

Videalert will be demonstrating the latest electric mobile enforcement vehicles at Traffex. On show will be two unique vehicles, a fully electric car and a fully electric scooter, both of which will shortly be going into service. These multipurpose vehicles have the latest ONVIF-compliant digital HD cameras that deliver superior capture rates of up to 98% with just a single pass at normal road speeds. They are also equipped with a complete suite of traffic management and enforcement software applications.

Left: **A conventionally fueled Videalert enforcement vehicle currently in use in the UK**

industry is really focused on efficiency, which is crucial not only to its long-term survival but also immediate productivity gains. On the other, the industry is also focusing on investing in innovation and technology. Traffex serves as a central meeting place for those in the highways and transport sectors to get together and discuss these challenges."

Traffex will also address core traditional elements of the sector, such as highway maintenance and funding, intelligent transportation systems and traffic management.

Theater discussions

To allow visitors to listen to presentations on these topics and debate issues surrounding them, Traffex is running a conference program.

"I always look forward to the content presented by speakers in the theaters," says Tatum. "It gives a really detailed view on what is important right now in the industry, as well as providing a chance for everyone to debate and discuss the key challenges and opportunities."

Sessions will be run in two theaters during the three days of the event and each day will be themed. Day 1 (April 2) will center on funding; Day 2 (April 3) will focus on changing the way we travel; and Day 3 (April 4) will look to the future.

"Jim O'Sullivan, chief executive of Highways England, will kick off discussions in our Traffex Theatre on Day 1," says Tatum. On the same day, the Chartered Institute of Highways and Transport will discuss training and skills in the Highways and Transport Theatre.

The discussion about changing the way we travel in the Traffex Theatre on Day 2 is another not-to-be-missed highlight. The debate will involve road safety, mobility and environmental experts arguing why maintaining the current transportation status quo is not an option.

Day 3 is set to be equally captivating. "What Does the Future of Travel Look Like? will feature a debate on driverless cars, and we will also be exploring new concepts that we all need to be aware of," says Tatum. "Blockchain is an example. How will it help us change the way data is transferred and best used in the sector?

Traffex | Aimsun Stand No. K025

Advanced models

Aimsun's international team of technologists, scientists and transportation engineers with a singular focus on solving the world's most complex mobility problems will be on hand to advise visitors to Traffex. The team brings its experience to projects as diverse as testing the impact of connected and autonomous vehicles, training artificial intelligence and machine learning to forecast and manage traffic, modeling the interaction of public and private vehicles, and offering insights into smarter multimodal transportation choices. Thousands of mobility professionals worldwide in government, research institutions and private companies are successfully using Aimsun tools and services to model tomorrow's smart mobility networks, today.

"In addition, discussions will explore how the industry needs to better understand the changing behaviors of the traveling public and how they can be influenced in the right way to help create a more effective and efficient transport network."

Highways England will play an ongoing role at the event. "The executive director for strategy and planning will present an interesting session on roads of the future and the organization's digital roads agenda," says Tatum.

350
Companies will be exhibiting their latest innovations

> "How can we successfully integrate emerging technologies with our existing transport and highways infrastructure?"
>
> ***Adrian Tatum, head of events, Transport Network***

Traffex '19 PREVIEW

Above: **Attendees at Traffex 2019 will get to see the industry's latest innovations first hand, as well as being able to take part in the growing conference program**

> We will use video screens on the walls and floor to present a series of scenarios to visitors as they walk through the Future Mobility feature
>
> ***Adrian Tatum, head of events, Transport Network***

"The company's support in the content and direction of Traffex, as well as providing access to its senior team, has been invaluable in developing the event."

Leading contractors and consultancies such as Kier, Colas, Costain, Mott MacDonald and WJ Group will also take part in the event's conference sessions, highlighting the growing importance of their roles in supporting and developing the UK's highways and transportation sectors.

All-new hall features

"This year, there is a lot more for visitors to see and do at the event," says Tatum. "We are trying to keep Traffex even more in line with the rapidly changing sector by covering current and emerging technologies that present challenges and opportunities for the sector."

Attendees will certainly want to block out a significant amount of time to explore the show floor, where more than 350 organizations will be showcasing new products, alongside an all-new feature called Future Mobility.

"Future Mobility is our new conceptual road feature that will be located in the middle of the show floor," says Tatum. "It will add a strong interactive element to Traffex that we have never had before.

"The idea here, having worked with our sponsors Costain and Mott MacDonald, is to take visitors on a journey into the future of mobility. We will use video screens on the walls and floor to present a series of scenarios to visitors as they walk through the feature. Visitors will be able to experience the technologies they might be using in the future when managing their networks."

An example of such technology is automation. "The five levels of SAE automation – and the impact that they will have on vehicles and road networks – will be explained," says Tatum. The concept feature will use current projects and schemes to support and depict the information it is delivering.

Traffex will also host its Data Discovery Centre for the second year running. "It will use data to solve specific challenges on road networks – thereby taking the traditional 'hackathon' to another level." Visitors will be able to see and interact with organizations working in this area.

With more than 10,000 visitors expected to attend, Traffex is set to be a memorable event that will drive change and progression in the industry.

For more details about Traffex 2019 and to register for FREE entry, just visit www.traffex.com

Traffex | Kapsch Stand No. H030

Smarter connections

Kapsch TrafficCom is a provider of intelligent transportation systems in the fields of tolling, traffic management, smart urban mobility, traffic safety and security, and connected vehicles. As a one-stop provider, it offers end-to-end solutions covering the entire value-creation chain of its customers, from components and design to the implementation and operation of systems. Its mobility solutions help make road traffic safer and more reliable, efficient and comfortable in urban areas and on highways alike, while helping to reduce pollution.

As one of the global experts in Intelligent Mobility Solutions (IMS), Kapsch focuses on integrated traffic and mobility services combining traffic, transit and parking data under one umbrella system. At Traffex in Birmingham, UK, on April 2, 3 and 4, experts from Kapsch will be presenting how modern mobility solutions contribute to improving quality of life. It will also be possible for visitors to experience its integrated Advanced Traffic Management Systems for highways and cities and the new comprehensive in-vehicle V2X platform.

Traffex | Jenoptik Stand No. C020

EXHIBITION HIGHLIGHT

Enforcement solutions

Jenoptik's Light & Safety division makes roads better – its experts use ALPR-based technologies to reduce casualties, improve traffic flows and enhance the environment. With a global presence and more than 100 UK-based staff, its services support projects from initial consultation, design and manufacture through to installation and ongoing maintenance.

Jenoptik is a global leader in enforcement, including HOTA for SPECS3 Vector – the most popular and widely used average-speed enforcement technology. Over 500 SPECS installations operate in the UK, covering every road type and speed limit. In 2019, SPECS is joined by Vector SR, an entirely new Spot Speed and Red Light enforcement solution, which will be on display at Traffex.

Jenoptik products and services have continually evolved to provide best of breed solutions, through ongoing innovations with patented firsts such as synchronized IR illumination and deep learning artificial intelligence software.

If you have a project that could benefit from this industry experience, visit the Jenoptik stand at Traffex to learn how the company's unique solutions could improve the performance of your roads.

Midland moves

Traffex, the biggest show serving the traffic industry in the UK, is approaching. As visitors prepare to head to the event at the NEC in Birmingham, here is a variety of travel-related facts about the English city

29 minutes

The average extra time that congestion adds to a journey on the city's roads

1.8 million

Cars on West Midlands roads in 2017

179,280,523 miles

(288,524,123km)

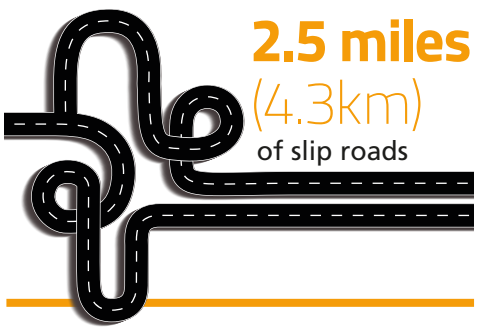
Cumulative distance traveled by vehicles in the city in a year

The date that MaaS Global launched multimodal transport app Whim in Birmingham – its first UK location

APRIL 2018

05

Gravelly Hill, more commonly known as Spaghetti Junction, is the most complex interchange in the British road system. Split across five levels, it covers 121,406m² (30 acres), serves 18 routes and includes

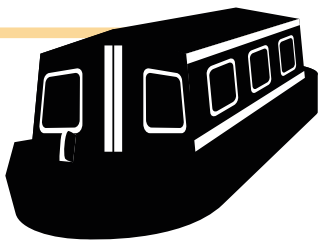


2.5 miles (4.3km) of slip roads

11,169 miles (17,975km)

The city's total road network

Birmingham has more canals than Venice, with



35 miles (56km) of waterways

210,000

Average daily flow of vehicles at Spaghetti Junction, which has its own weather station, **46** traffic signals, three electronic message signs and **25** emergency roadside telephones

Birmingham attracts

34 million

visitors a year. Almost one million are international visitors

kapsch >>>
challenging limits

Kapsch TrafficCom

Everything is connected.

There is a lot to be said for the interaction between vehicles and infrastructure: Intelligent Mobility Solutions refine your journeys, meaning shorter travel times. They identify risky situations ahead of you and also lower emissions by reducing congestion on our roads. In a nutshell, they protect people's lives and the environment at the same time.

>>> www.kapsch.net

Traffex
2 – 4 April 2019
Booth # H030

Road care reports

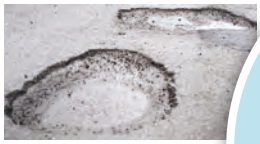
Highway maintenance is often the unsung hero of the traffic world. **James Allen** highlights some of the most important recent stories from around the world

Spend, spend, spend

Study shows good road maintenance leads to wide-ranging long-term benefits

A Rutgers University study indicates that highway pavement maintenance saves money, energy and reduces greenhouse gas (GHG) emissions, which more than offsets the pollution generated during road construction.

The study was led by researchers at the Rutgers School of Engineering in New Brunswick, New Jersey, with collaboration from North Dakota State University and Al-Mustansiriyah University in Iraq.



Extending the life of pavement through preventive maintenance can reduce GHGs by up to 2%; transportation agencies can cut spending by 10-30%; and drivers can save 2-5% in fuel consumption, tire wear, and vehicle repair and maintenance costs because of smoother pavement surfaces.

1.5 million

The number of road excavations taking place every year in the UK

Robots are coming

Pipe repairing robots to minimize workzone disruption to traffic

The UK government has announced £26.6m (US$33.8m) in new investment that will be used to develop and build micro-robots that can help repair the country's vast underground pipe network, preventing the disruption caused by the 1.5 million road excavations that take place every year, and can be used in hazardous workplace environments.

The traffic closures and disruption to businesses of these road works is estimated

to amount to more than £5bn (US$6.3bn) annually.

Scientists from four UK universities (Sheffield, Birmingham, Bristol and Leeds) will use £7m (US$8.9m) of government investment to develop 10mm long robotic devices that will use sensors and navigation systems to find and mend cracks in pipes.

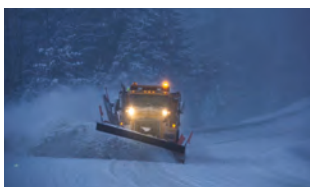
Maintenance predictions

Hyperlocal weather data to support Colorado road maintenance decision making

Informatics supplier Iteris Inc. is helping with critical maintenance decisions during Colorado's largest ever transportation project.

Iteris's ClearPath Weather system has been selected to provide pavement and weather forecasting services for improved winter road maintenance response in support of the Colorado Department of Transportation's (CDOT) US$1.2bn Central 70 Project.

The software-as-a-service (SaaS) platform will provide



access to high-resolution pavement weather forecasting and treatment alternatives and maintenance decision-support system (MDSS) services during the reconstruction of key snowplow routes on I-70 in the Denver region.

Rapid response repairs

Risk-based approach to road fixing increasingly adopted by road authorities in the UK

Research by the UK's RAC Foundation has revealed that local highway authorities are increasingly adopting a risk-based approach to fixing road defects, with some councils aiming to repair the most severe potholes within minutes.

The risk-based approach means that not only will the size (width and depth) of a pothole be taken into account, but also the type of road, the volume of traffic, and the mix of road users. Intervention times will also depend on the size of the local authority area and the length and makeup of its road network, with urban authorities tending to have smaller and more geographically

confined networks than their rural counterparts.

The RAC Foundation study was based on data received from 190 of the 207 local highway authorities in the UK, which revealed that 75% (142) had already moved to a risk-based approach by autumn 2018, with a further 15 (8%) saying they were about to move or were reviewing their existing practices.

Driving progress

With the countdown underway to the doors opening on the biennial event, **James Allen** reports on why excitement is building around Intertraffic Istanbul

10.11.12 APR 2019 Intertraffic ISTANBUL

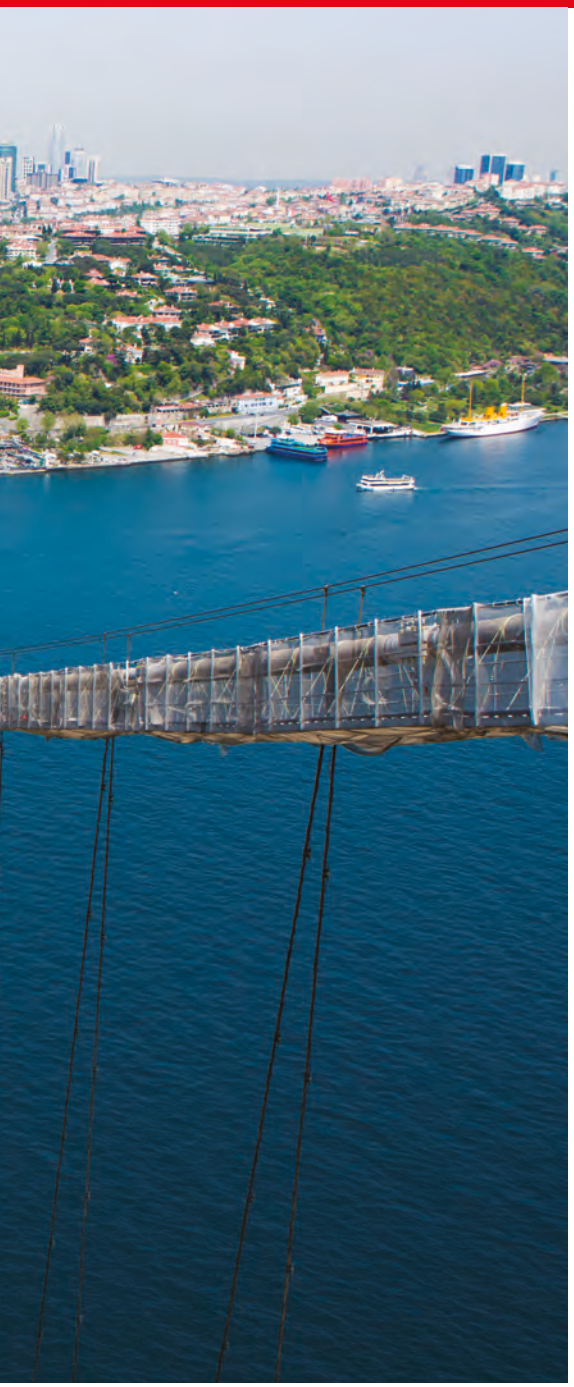
The eyes of the traffic technology world are turning eastward as Intertraffic Istanbul fast approaches.

Kicking off on April 10, 2019, the Istanbul Expo Center will once again bring together the industry's leading lights within the borders of Turkey's sprawling, transcontinental city.

With only a short time left, last-minute preparations are underway, but anticipation is building around what is gearing up to be a packed show.

Much has changed in the industry since the last Intertraffic Istanbul two years ago, according to Joyce de Winter, exhibition manager at RAI Amsterdam and host for the Istanbul event alongside Turkish company UBM: "The industry is clearly in transition; the traveler – the end user – is now in the lead, looking for seamless means of sustainable mobility. Whereas the focus globally in 2017 was on the autonomous car, we now see a shift toward cooperative and connected mobility. Big data is key in the whole process and traditional players will need to come up with new business models to reclaim their role in this altered ecosystem."

As organizers of Intertraffic events across the world, de Winter and her team are acutely aware



Left: **The Bosphorus Bridge, now known officially as the 15 July Martyrs Bridge**

Above: **The Istanbul event is important for the MENA region**

of the topics foremost in the minds of the industry's movers and shakers.

Harnessing this knowledge, the three-day conference program in Istanbul will include, among others, sessions on sustainable smart mobility, the influence of big data in the traffic technology industry, and whether Mobility as a Service (MaaS) can benefit Turkey and the MENA (Middle East and North Africa) region.

"For international exhibitors, we have introduced an exclusive government matchmaking program. Based on their specific requirements, we have a government liaison team in place that will bring exhibitors in direct contact with relevant officials," says de Winter.

Continental crossroads

Turkish co-host UBM is well aware of the historic importance its country has for global commerce.

"Since ancient times, and due to its geographic location, Anatolia has been a bridge between the East and the West, while also being one of the most important turning points of the Silk Road," explains UBM account manager Buket Soyturk. "Today, Turkey's road authorities are carrying out many different projects, with the aim of strengthening the links that the Silk Road created so many years ago."

67,119
Total length (in km) of Turkish roads under control of the General Directorate of Highway (41,706 miles)

The most populous city in Turkey, Istanbul is rich in history and culture, as well as being the country's economic center. It means that in addition to the networking and educational opportunities for industry professionals available within the halls of the show, the city itself presents an array of arresting experiences for attendants.

However, Soyturk is keen for people to understand that Istanbul itself serves as

> "The industry is clearly in transition; the traveler – the end user – is now in the lead looking for seamless means of sustainable mobility
>
> ***Joyce de Winter, exhibition manager, Intertraffic Istanbul***

Main: **The Yavuz Sultan Selim Bridge, opened in 2016, is the second tallest bridge in the world**

Right: **The new Kuzey Marmara Otoyolu building project, which is part of Turkey's Kurtköy to Liman route**

Below: **When completed, the Grand Istanbul Tunnel will be the world's first three-story tunnel**

> Today, Turkey's road authorities are carrying out many different projects, with the aim of strengthening the links that the Silk Road created
>
> ***Buket Soyturk, account manager, UBM***

10.11.12 APR 2019 Intertraffic ISTANBUL

a showcase for some of the smart mobility challenges faced by other megacities.

"Turkey's Ministry of Transport and Infrastructure is overseeing a number of mega-projects. For instance, it has been continuing the work on the massive Kanal Istanbul and there at least 18 major road building schemes planned for completion by 2023 [the 100th anniversary of the foundation of the Turkish Republic]," says Soyturk. "Intertraffic Istanbul exhibitors – such as Aselsan, Ortana, Intetra, Siemens, Ekaldes and Asya Trafik – are part of these new projects at all levels. Since it is the region's only international traffic and infrastructure exhibition it is the meeting point of all leading companies of the sector.

Your time to shine

Alongside the exhibition and conference, Intertraffic Istanbul is once again giving the most innovative products a chance to have the attention of the international media. Open to all participants of this year's event, the Intertraffic Istanbul Awards is divided into four categories: smart transportation, municipality, parking and road safety. It will be judged by Turkey-based university academics, members of AUSDER (the independent Turkish association of intelligent transport systems) and civil authorities, with winners announced during the opening ceremony of the 2019 show. Submissions must be made prior to March 15, with nominees announced on the Intertraffic Istanbul website on March 29, where further information can also be found.

Another mega-transportation ventures currently underway in the country is the Grand Istanbul Tunnel, which intends to provide a route for road traffic, as well as for trains to travel between Asian and European Turkey underneath the Bosphorus river. Once completed, it is expected to be the world's first three-story tunnel.

With such significant investment being pumped into improving Turkey's transportation infrastructure, the forthcoming show is well timed. "We know Turkish organizations in this industry are looking for international expertise to jointly work on large infrastructure and ITS projects," says de Winter. "We truly believe the business opportunities are there and those who are willing to invest their time and energy will reap the benefits."

For more details about Intertraffic Istanbul 2019, visit www.intertraffic.com/en/istanbul

SWARCO

The Better Way. Every Day.

1969 – ANNIVERSARY – 2019
50
swarco
1969 – ANNIVERSARY – 2019

You encounter us every day on the roads of our planet. At the traffic light, on the motorway, in a car park, at the charging station or on board public transport.

Our products, systems, services and turnkey solutions offer direction, information, safety and convenient travelling, and all this as environmentally sound as possible.

We improve quality of life for all people on the move. SWARCO's over 3,700 traffic experts are looking forward to providing you with the solutions that really meet your individual needs.

What can we do for you today?

Meet us at

Traffex '19

The NEC, Birmingham
Stand C010
2 – 4 April 2019

www.swarco.com

swarco

The European Commission's new coordinator for road safety, **Matthew Baldwin**, is passionate about reducing road deaths by means of technology and education

Interviewed by Jack Roper

On European road safety, Matthew Baldwin is far-reaching and authoritative, but what galvanizes him most keenly is our apparent acceptance of 25,000 annual fatalities. "Deaths and serious injuries don't have to be an inevitable price for our mobility," he maintains. "What does transport cost society? Economists have measured the unfunded external costs of transport at around €1tn [US$1.14tn] for the European Union: €400bn [US$ 454bn] on environmental costs, €270bn [US$307bn] on congestion – and just under €300bn [US$341bn] on road accidents." It is this last sum that most exercises Baldwin at present, but giving it a monetary value was no easy task.

"You must factor in the cost of emergency services as well as the congestion costs of closing a motorway," he says. "There's also a complicated calculation, tendentious in its quantum, on grief, pain and suffering, plus the loss of that individual's economic output. Forty percent of road deaths are people who are commuting, so they don't show up at work or don't come home – I find that particularly heartbreaking." He commends aviation in preventing deaths through multiple failsafe systems, pointing out that if 25,000 people were dying annually in Europe's airspace, governments would topple.

Though road accidents seldom make headlines, they do kill this many, and they are people's loved ones.

Baldwin, 55, is deputy director-general at DG Move (see *Making a Move*), the department responsible for shaping European transport policy. A graduate of Oxford and Harvard, the former British civil servant joined the European Commission in 1996, serving in the cabinets of three commissioners, before assuming his current post in 2014.

In October 2018 Baldwin was further appointed as European coordinator for road safety, and applauds the progress already made under transport commissioner Violeta Bulc. "She's really led from the front, bringing a passion and moral sense to the debate," he says.

But Europe will fall short of a 50% death-rate reduction target for the decade to 2020, with decrease now on a plateau. There's regional divergence, with 20 road deaths per million in well-performing nations compared with 100 in some member states, making collaboration imperative.

"We must exchange learning to get on a sharp downward path, especially in those countries with higher death rates," says Baldwin. "But Sweden, the Netherlands, the UK and Denmark [where death

Making a Move

The Directorate-General for Mobility and Transport (DG Move) is the arm of the European Commission responsible for developing and implementing transportation policies across the EU's (at time of writing) 28 member states. DG Move became a separate entity from the Directorate-General for Energy (DG Ener) in 2010. It is headquartered in Brussels, reports to Violeta Bulc, the European Commissioner for Transport, and aims to promote efficient, safe, secure and environmentally friendly transportation, creating well-connected and competitive economies. DG Move manages the Connecting Europe Facility funding program, worth €26.2bn (US$29.9bn) from 2014-2020.

Deputy director-general since 2014, Matthew Baldwin holds responsibilities for aviation, land transportation, maritime areas and ports. His new role as European coordinator for road safety was created as part of the European Commission's third Mobility Package, intended to modernize Europe's road transportation. "The Commission is determined to cut deaths and serious injuries by half by 2030 and reach our Vision Zero (i.e. zero deaths) by 2050," said Commissioner Bulc. "The latest road safety figures show progress stagnating. The new role aims to put road safety back on the agenda of decision-makers and key EU organizations."Road crashes cause a staggering 99% of all transportation deaths. There are currently 25,000 road deaths per annum in the EU, compared with 250,000 in both China and Africa, 200,000 in India, 33,000 in the USA and 27,000 in Russia. Of EU fatalities, 46% occur in cars and 17% on motorcycles or mopeds; 21% of victims are pedestrians and 8% cyclists. Fifty-five percent of deaths occur on rural roads and 37% in urban areas, while 20% happen at junctions. A disproportionate 76% of victims are male, with road crashes representing the most common cause of death in young European men.

Above: **Violeta Bulc is the European Commission's Transport Commissioner**

76%
The proportion of road death victims that are male

rates are at the lowest in the EU] are also scratching their heads, looking for the next reduction."

A safer system

Central to Baldwin's strategy is pan-European implementation of a Safe System approach. "The Safe System is about applying core scientific principles," he explains. "What kinetic forces can the human body withstand before serious injury or death occurs? You have a multilayered approach with multiple failsafe systems: if one part fails, another kicks in. It's like a checklist: roads, infrastructure, vehicles, speed, protective equipment and post-crash care. If infrastructure is insufficiently safe, the car must be safe to protect the people inside. If the car isn't safe, you must reduce its speed to prevent the human body colliding with hard surfaces, inside or outside the car. Humans are humans, so we're building a system that protects people against their mistakes."

Now, Baldwin will traverse Europe, persuading member states to buy into DG Move's ambitious new proposals. He expects key Safe System performance indicators to be established in 2019, including indicators for speed. "Police data from France, Spain and Switzerland identifies excessive speed as a factor in a quarter to one-third of serious accidents," he says. "A pedestrian or cyclist hit by a car at 50km/h [31mph] has a mere 10% chance of survival; at 30km/h [18mph], that rises to around 90% survival. It's a 90-10 flip." He praises the French government's initiative to reduce the speed limit on two-lane *route nationale* highways from 90km/h to 80km/h (56mph to 50mph) and the growing UK movement saying 'Twenty's Plenty' (in mph) vis-à-vis default urban limits. In workzones, he sees good use of VMS as crucial, along with the ability to measure average speed along road works and levy a fine or take enforcement action on that basis.

99%
The proportion of transportation-related deaths that happen on roads

Connected future

Baldwin foresees a future of connected and autonomous vehicles

> Forty percent of road deaths are people who are commuting, so they don't show up at work or don't come home – I find that particularly heart-breaking

Autonomous challenges ahead

Baldwin suspects that, by eliminating human error, CAVs may ultimately help us achieve Vision Zero. Yet he disagrees with commentators who suggest we can flick some magic switch to make all driving autonomous, abolishing road accidents at a stroke.

Indeed, he anticipates significant new challenges arising in a transitional phase with cars at differing stages of autonomy.

"There are dangerous pints going through the so-called five levels of automation," he says. "For example, at Level 3, where the car handles most driving functions, if you come across an atypical motorway maintenance lane, it might suddenly say, 'OK, take back control!' – so the driver must remain fully alert and in charge. It's a crazy concept. We have issues with distraction already and risk some nasty accidents if we assume drivers will be in a state to resume control.

"You'll have a lot of human-machine and machine-machine interfaces at junctions," he predicts. "At a four-way stop you could have two cars at different automation levels and two human drivers. How will they interpret the situation – do that eyeball-to-eyeball stuff?"

Only time will tell how such scenarios can be standardized, but Baldwin is delighted by current projects developing potential puzzle-pieces, including Barcelona's Prospect initiative, which benefited from EU Horizon 2020 funds.

"This involved a Mercedes car with specific radar and sonar sensors, aiming to pick up not just hand signals but even the body inclination of a cyclist who might be just about to cut in front of a car," he explains.

With vulnerable road users accounting for 40% of all road deaths and a staggering 80% in urban areas, Baldwin says such mechanisms will be essential – until we can properly protect cyclists and pedestrians from cars through a fully segregated infrastructure.

Below: **The Berlaymont in Brussels, Belgium, houses the headquarters of the European Commission**

1.35m
The annual number of road deaths worldwide (25,000 in the EU, 33,000 in the USA)

(CAVs) wherein drivers will no longer be able to exceed safe limits, with CAVs automatically limited to the posted limits, so they not are advisory, but fixed.

"Manufacturers are still selling cars that can be flung around bends at 180km/h [112mph]," says Baldwin. "Well, you won't be able to drive like that on Europe's public roads in a connected and autonomous future." For the first time, DG Move's proposals encompass automated active safety functions such as automated emergency braking (AEB) and lane sensing. Central to the package is intelligent speed assistance (ISA) that is dynamically responsive to both speed limits and driving conditions. When a limit is reached the accelerator pedal starts to lift, providing a haptic signal to the driver. The ISA system being proposed allows drivers to override it, because the European public is not yet ready to accept non-overridable speed assistance, even though such systems could save 1,300 additional lives per annum.

There is frustration that the European Car Manufacturers' Association (ACEA) has publicly resisted the introduction of potentially life-saving ISA technology. "Though Ford is responsibly installing ISA systems across its range of vehicles, it's hard to escape the conclusion that some ACEA members don't yet want these systems mandated because they'll find it harder to sell cars to people as speed machines," Baldwin surmises.

Global picture

Globally 1.35 million annual road deaths constitute a World Health Organisation (WHO) epidemic, and 90% of fatalities occur in low- or middle-income countries – where Baldwin believes manufacturers could do more to save lives. "Some European manufacturers are still selling cars to the developing world with some safety standards stripped out to save costs," he says. "It's unacceptable."

Though Europe's 25,000 road deaths are only a small proportion of the 1.35 million worldwide, one needless death has a collateral cost and is always one death too many. Through applying the Safe System, sharing best practices and looking at cost-effective ways for technology to drive down fatalities, Europe can lead by example, establishing standards, through the UN, for others to follow.

"People in the developing world sometimes see road safety as a rich country's problem, but I hope we can get past that view," says Baldwin.

"Disproportionately it's young people who die on roads and they are the future, so we need to do better. All international learning, whether within the EU or from our neighbors, is valuable. We absolutely need to learn from each other."

> Some European manufacturers are still selling cars to the developing world with safety standards stripped out… It's unacceptable

Traffex 2019

2-4 APRIL 2019
THE NEC | BIRMINGHAM

Free registration at
www.traffex.com

Co-located with:
Parkex

- New Interactive conceptual road feature
- The Traffex 'Trading Floor'
- Live Data Hackathon
- Directors' Briefings
- Round Table Debates
- Networking Social Events
- CPD Accredited Seminars
- Futures Day – the next generation

Event Partners:

KIER

SIEMENS

Future Mobility Partners:

MOTT MACDONALD

COSTAIN

Supporting Partners:

ADEPT

Department for Transport

ITS United Kingdom

CIHT

htma

highways england

IHE INSTITUTE OF HIGHWAY ENGINEERS

In Association Partners:

iAL

REMA

lcrig

therichworks.co.uk

TMCA

JAG United Kingdom

artsm

ROAD SAFETY FOUNDATION

FROM THE PUBLISHER OF *TRAFFIC TECHNOLOGY INTERNATIONAL* MAGAZINE

the FUTURE of TRANSPORTATION World Conference

26 - 28 November 2019

VIENNA, AUSTRIA

Multiple streams, over 200 speakers,
***PLUS** meet the companies shaping the future of transportation in our exhibitor zone!*

www.thefutureoftransport.com

2020-2030

AND BEYOND...

CHANGING THE WAY PEOPLE THINK ABOUT TRANSPORTATION & URBAN MOBILITY!

STREAMS & SESSIONS INCLUDE:

PATHWAYS FOR AUTONOMOUS VEHICLES

CHANGING LANDSCAPE FOR THE AUTOMOTIVE INDUSTRY

5G – THE ESSENTIAL BUILDING BLOCKS

MOBILITY AS A SERVICE

URBAN CITY AND INTERCITY AIR MOBILITY

WHY RAIL IS DEAD IN THE WATER

VISIT THE WEBSITE FOR MORE DETAILS AND TO REGISTER!

www.thefutureoftransport.com

Pollution alert!

Russia is preparing for an introduction of low emission zones en masse. But despite rising pollution levels, not everyone is convinced they are the right solution. **Eugene Gerden** reports

70%
The approximate contribution transportation makes to harmful air pollution in Russian cities

Source: Russian Ministry of Energy

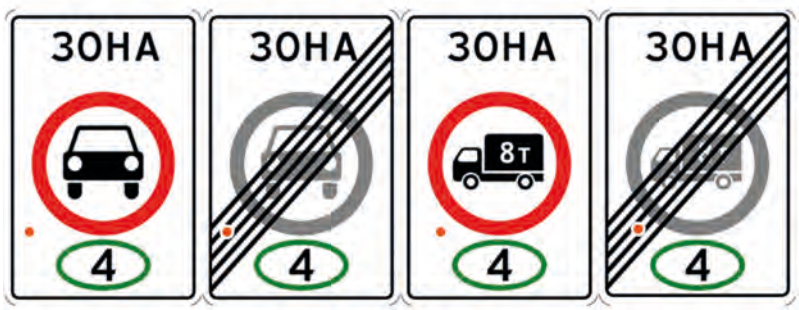
In order to tackle decreasing air quality, Russia is ready to introduce low emission zones in its major cities this year, with the backing of the country's minister of transport Yevgeny Ditrich and other senior officials in the Russian government.

According to calculations by the Russian Ministry of Energy, in Russia's large cities, transportation is responsible for 70% of harmful air pollution, and the problem continues to grow.

In 2018, the annual average concentration of polluting substances (NO_x, formaldehyde) in the majority of Russian cities was almost double the average worldwide, which sparked serious concern from the government.

The initiative for the establishment of such zones in Russia was first put forward by the Russian Ministry of Transport in 2014, which was when a special state resolution, regulating the establishment of such zones, was approved. Sanction wars between Russia and the West, and the financial crisis in Russia, resulted in the suspension of these plans until recently.

The establishment of these zones will be regulated by the Highway Code legislation, which came into force on July 1, 2018. The code provides an opportunity for regional



Right: **The proposed low emission zone signs that will be used in Russia, with circled numbers referring to the minimum Eco Class of vehicles allowed**

authorities to introduce movement restrictions on vehicles that do not match certain emissions requirements, based on their engine type. In Russia this is known as the engine's Eco Class and is given a number, roughly equivalent to similar engine standards in the EU, numbered up to Euro 6, representing the least-polluting engine type.

"The region or municipality will determine in exactly what area restrictions should apply," says Yevgeny Ditrich, official spokesperson for the Russian Ministry of Transport. "That will probably include areas where there are historic buildings, recreation areas, nature reserves and other pollution-sensitive areas, depending on the city's region and its geographic location."

To identify vehicles entering them, the newly established zones will be equipped with ALPR cameras to determine the Eco Class of a vehicle by checking its license plate against a national database.

The first zones will be established in Moscow and St Petersburg, as they have the highest emission levels and biggest congestion problems. Highly polluting vehicles will be banned but an exception will be made for the cars of Russian special services, military, mail, motorcycles and vintage cars.

The Russian Parliament has already approved the imposition of penalties for violation of low emission zone rules. Fines will vary between RUB 10,000-15,000 (US$150-200) and will be significantly higher in the case of repeat violations.

Dissenting voices

The new state initiative has already been criticized by some representatives of Russian public and local experts in the field of traffic.

7.7 million

Number of road vehicles in Russia 10 to 15 years old

Right: **Smog hangs over Moscow as the city prepares for the implementation of its first low emission zone**

Fighting pollution in London

The UK's capital will see the introduction of its first Ultra Low Emission Zone in April 2019, with even more stringent regulations to come

London, UK, introduced its Low Emission Zone (LEZ) in 2008. The ALPR-enforced area covers most of the greater urban area. Charges do not apply to cars and motorcycles, but larger vehicle owners are advised to check to see if they need to pay the charge (between £100 and £200 a day). Since October 2017 older, more polluting cars have also been subject to restrictions – the so-called T-Charge (toxicity charge) is only applicable in the central Congestion Charge Zone, 7:00am-6:00pm Monday to Friday.

Now residents and businesses are preparing for the introduction of the Ultra Low Emission Zone (ULEZ), which will apply 24/7 in the Congestion Charge Zone from April 9, 2019, and across the whole of the original LEZ area by October 25, 2021. Broadly speaking it means that any gasoline cars registered before 2005, and diesels before September 2015, are likely to need to pay a charge. With even stricter rules for larger vehicles.

Recycling firm First Mile released this image of what London's Oxford Street could look like if emissions continue to rise unchecked

For many, the rules can't come soon enough – the capital repeatedly surpasses its air pollution quotas, and air pollution is estimated to be directly responsible for 9,000 deaths a year in London.

Small business, like recycling firm First Mile, are taking action early. It currently fulfills 150 zero-emission deliveries a day using electric vans and a cargo bike, and says its HGVs are 10 times cleaner today than a decade ago. Through cooperation with the local council it has also managed to reduce the total number of HGVs operating. Meanwhile route optimization systems are helping to determine the most fuel-efficient routes for the collection and delivery vehicles. Additionally all vehicles are fitted with telematics to deter heavy breaking, fast acceleration and idling, all of which increase emissions.

"First Mile is using innovation to make its routes shorter and emissions lower with high-spec vehicles," says First Mile CEO Bruce Bratley.

14.7 million

Number of road vehicles in Russia that are over 15 years old

Left and right: **Road signs are tested ahead of the implementation of Moscow's ALPR-enforced low emission zone**

Alex Dozorov, chairman of the Moscow Committee for the Protection of the Rights of Drivers, believes that the introduction of low emission zones is an excessive measure for Russia and its traffic system at present.

"The establishment of such zones is too early for Russia," he says. "At present, the number of low-emission vehicles in the country remains insufficient to enable the smooth functioning of such regulations. This is also reflected in the fact that even drivers themselves do not always remember the Eco Class of their own cars. The situation is aggravated by the fact that very often vehicles said to be low-emission are in reality much more polluting."

Dozorov and some other Russian analysts in the field of traffic technology believe the new rules will have a negative effect on domestic drivers, taking into account that a significant proportion of them still use old cars that do not comply with any modern emission requirements.

According to the Russian Federal Authority for Road Traffic Safety, at present, out of a total of around 42.4 million passenger cars registered in Russia, there are 7.7 million vehicles aged 10 to 15 years and 14.5 million over 15 years old. Virtually all of these will be banned from low emission zones. Only 40% of the Russian fleet is equipped with the new Euro 5 and Euro 4 equivalent engines.

> The establishment of such zones is too early for Russia. At present the number of low-emission vehicles in the country remains insufficient to enable the smooth functioning of such regulations
>
> **Alex Dozorov, chairman of the Moscow Committee for the Protection of the Rights of Drivers**

Olympic inspiration

To date, low emission zones have only been established in Russia on a pilot basis. For example, during the Sochi Winter Olympics in 2014 only electric cars were allowed to enter the Olympic Park. The management of this zone was carried by the city authorities. The area was deemed to be a suitable test area for such a concept due to the large number of pedestrians visiting the event, who could have been adversely affected by excessive vehicle fumes. The project contributed to the status of Sochi as one of the most eco-friendly cities in Russia, and provided inspiration to those pushing for

Zero-emission debate

In Oxford, UK, officials want to ban all but zero-emission vehicles from stopping on city streets. Logistics companies are concerned

The historic university town of Oxford, just over 50 miles (80km) northwest of London, has long been a leader in curbing car use on its narrow city center streets. It introduced the UK's first permanent park-and-ride scheme in 1973, and today only has very limited city parking options available.

Now a new Zero Emission Zone is planned, which, in 2020, will ban all but zero-emission capable vehicles from parking or loading on city center streets at peak times. However, there are still many details to be finalized, and logistics companies are already concerned that the definition of 'zero-emission capable ultra-low-emission vehicles' does not extend far enough.

The proposal defines them as any vehicle that emits less than 75g of CO_2/km from the tailpipe and is capable of at least 10 miles (16km) of zero-emission driving. This will exclude most vans and trucks.

Rebecca Kite, environment policy manager for the UK's Freight Transport Association (FTA), says, "Vans are over twice as heavy as cars, and midsized trucks are 20 times heavier. One car usually carries just one person; a van can carry a ton of goods and a medium-sized truck can carry 10 tons. They cannot be judged in the same way. Currently the car definition is the only definition available of an ultra-low-emission vehicle. But there is an array of hybrid vans and lorries becoming available that will be zero-emission capable while in this urban environment. There needs to be a vehicle appropriate ULEV standard, which is agreed nationally before local authorities implement any ultra-low-emission requirements."

low emission zones on a much larger scale around the country. It's a dream that looks soon to become reality.

A cleaner future

Most Russian analysts seem to agree that the establishment of such low emission zones will be very important for Russia, especially for the country's largest cities.

"A priority plan is creating low emission zones in the downtown areas of the largest cities," says Dmitry Enin, director of the Russian Institute of Applied Transport Research, one of Russia's leading research institutions in the field of traffic and transport control. "This is mainly due to their high levels of congestion. During the second stage, these zones will have to be established in residential areas of cities, particularly those close to hospitals, schools and other social facilities. This should help to greatly improve pollution levels in these areas."

While concerns clearly still exist surrounding the proportion of low-emission vehicles in the Russian fleet, the winds of change look set to finally begin blowing the clouds of pollution away from Russia's largest cities.

> A priority plan is creating low emission zones in the downtown areas of the country's largest cities
>
> **Dmitry Enin, director, Russian Institute of Applied Transport Research**

40%

The proportion of the Russian national car fleet equipped with Euro 4 equivalent engines, or better

Right: **Road traffic may be the biggest source of air pollution in Moscow, but it's far from being the only one**


NATION'S FIRST
AUTONOMOUS
IMPACT PROTECTION VEHICLE
ROADX
ACCELERATING TECHNOLOGY
KRATOS

Tech that protects workzones

From autonomous vehicles to advanced traffic data systems, a wealth of new technology is currently being deployed to combat the ongoing problem of workzone injuries and fatalities. **Paul Willis** examines how effective the new solutions are, and finds out what road authorities need to do now to prepare for the future

Left: **Colorado DOT is pioneering the use of autonomous attenuator trucks during line-painting operations**

There's no getting away from the fact that highway workzones are dangerous places. According to the US Federal Highway Administration (FHWA), there were nearly 100,000 crashes in workzones in 2015 alone, with 640 of them leading to fatalities.

In the UK, 12 road workers have lost their lives in the past 10 years and in 2017 there were on average 150 incidents per month of vehicles encroaching into workzones illegally.

Until now, one of the most dangerous jobs in the workzone has been driving attenuator trucks. These specially equipped machines, known as impact protection vehicles in the UK, help to shelter work crews by driving behind them during mobile road work operations such as cone setting or line painting.

The trucks are mounted with crash cushions that can absorb the impact of a head-on collision. They are designed to be hit, in other words.

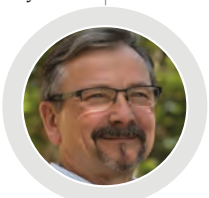
"Up to now, you've had to have a driver in that truck and he is put at severe risk if that truck is hit by a tanker truck or another large vehicle," says Fred Bergstresser, government account manager at US truck manufacturer Royal Truck & Equipment. To counter this risk, Royal Truck has developed technology that can be retrofitted to attenuators, meaning they can be operated completely autonomously.

The technology was developed in collaboration with US defense contractor Kratos, which initially designed it to create autonomous targets for military training. Bergstresser explains how it

Above: **Royal Truck's Fred Bergstresser with one of his company's retrofitted autonomous attenuator trucks**

works: "The lead vehicle is equipped with antennas and computer hardware that send signals back to the following truck – they call them e-crumbs – with GPS position data. So the attenuator follows – plus or minus a couple of inches – the route of the lead truck."

Royal Truck's system is already in use in Colorado, where CDOT has installed it onto a line-painting truck; and in the UK, where the contractor Colas is using it in its road work operations for Highways England.



> The lead vehicle is equipped with antennas and computer hardware that send signals back to the following truck
>
> **Fred Bergstresser, government account manager, Royal Truck**

Legal implications

Meanwhile, another driverless attenuator system that reacts to a worker's hand signals is being developed by the Southwest Research Institute in San Antonio, Texas.

The introduction of autonomous vehicles has legal ramifications and in Pennsylvania a law was signed on to the statute last November specifically permitting their use in workzones. Under the new law, the trucks can be switched to driverless once they enter the worksite, but must be manned at other times, says Dan Farley, chief of the traffic signal and arterial management section of PennDOT.

"We are trying to do this in a more controlled way," says Farley. "We're not going to Level 5 automation straight out of the gate. The technology is moving at a rapid pace, but the people in the field need to get comfortable with it."

Highlighting the need for the technology, he says, "Annually, we have about 15 attenuators that are hit during mobile operations. In a lot of cases the driver is seriously injured, because when you have a tractor truck traveling at you at 70mph [112km/h], that's serious."

Autonomous challenges

In the era of self-driving vehicles, could workzone safety actually get worse before it gets better?

There have been several fatal crashes involving autonomous vehicles. Last March, a Tesla driver was killed on a stretch of road in California. It was the second confirmed fatality on US roads in which the car maker's Autopilot self-driving system was engaged. In the same month, an Uber self-driving car killed a pedestrian in Arizona.

So far, none of the accidents have occurred in workzones, but with autonomous vehicle use on the rise, a workzone crash seems inevitable, especially given the non-standard road layouts highway maintenance demands. Such a scenario will raise the thorny question of liability, says Gerald Ullman, of the Texas A&M Transportation Institute.

"Workzones are already hotbeds of litigation," he says. "If a fatality occurs, then lawyers are often looking at the incident carefully to see if there are grounds for litigation."

Self-driving systems will only complicate such litigation further, says Ullman, making his point with the following potential scenario:

"One of the key navigational tools self-driving systems rely on are lane markings. But if you've got a line-painting operation going on, and the contractor working the job doesn't fully erase the old markings, this could potentially lead the autonomous vehicle into a closed lane.

"If that happens, who's liable? Is it the car manufacturer's fault? Is it the contractor? The highway agency?"

He foresees similar gray areas over liability with the use of driverless attenuator trucks.

"For example, if the contractor lays out plans and the vehicle doesn't interpret them correctly, whose fault is that?"

He says the situation is made worse because "right now, the industry hasn't defined what it needs to function safely".

He blames this on the makers of the driverless systems, who have so far refused to reveal how their detection systems work for fear of having their intellectual property infringed upon. As a result, he says, "Things are going to be all over the place once courts get involved."

Left: **The autonomous attenuator truck relies partly on GPS data from the vehicle ahead of it for navigation**

In spite of the dangers, workzones have generally been getting safer. According to workzonesafety.org US workzone fatalities hit a low of 533 in 2010, and though they crept back up to 710 in 2017, this figure is still below the 732 recorded in 2007.

Smarter workzones

Gerald Ullman, a senior research engineer at the Texas A&M Transportation Institute, considers the widespread adoption of smart workzone technology to have had a positive effect. Indeed, a study published in 2014 by Illinois DOT found that after deployment of such systems on the I-55 interstate the incidence of rear-end crashes went down 14%.

In the USA, technology take-up has been helped by initiatives such as Every Day Counts, an FHWA program that helps fast track innovations in workzone safety.

Ullman defines smart workzone technology as any system that uses condition-monitoring sensors and algorithms to relay usable data to a dissemination mechanism, which could be anything from variable messaging boards to social media alerts. Some of the smart workzone systems currently in use include queue-warning systems and average drive-time alerts.

"If you incorporate these systems into your operations, the data suggests that more drivers will seek alternative routes," says Ullman, "thereby reducing congestion and crash risk."

> We need to communicate detailed real-time data, right down to which lanes will be affected
>
> **Gerald Ullman, senior research engineer, Texas A&M Transportation Institute**

Despite its success, smart workzone technology is nowhere near to fulfilling its potential, says Ullman. "Up to now, there has only ever been limited data communicated to the public about workzone activities: on current travel times

MOVING **PEOPLE**
MOVING **DATA**
MOVING **FREIGHT**

ATTENDEE REGISTRATION
OPEN NOW

ITS America's 2019 Annual Meeting in Washington, D.C. will highlight seamless mobility around the movement of people, data and freight. Innovative business models can flourish in the new age of mobility. Be a part of the conversation that will shape an environment for safe deployment of connected and automated mobility.

28TH ITS AMERICA ANNUAL MEETING

JUNE 4-7, 2019 | WALTER E. WASHINGTON CONVENTION CENTER

and upcoming planned work." The goal, however, is to be able to "communicate detailed real-time data, right down to which lanes will be affected", he says. "If we can do that, it has all kinds of ramifications for safety and mobility situations."

For that to happen, the process of data collection by state DOTs needs to be radically improved.

Workzone Data Initiative

It is with the goal of improving the quantity and quality of information available about workzones in mind that the FHWA has launched the Workzone Data Initiative (WZDI), an effort to promote a standardized approach to data collection across the USA.

Right now, data collection is at best "ad hoc", says Todd Peterson, WZDI project manager: "There is information out there, but it's inconsistent," he says. "It's also geared more to a lane closure process rather than an impact assessment process. The focus is on giving out permits for lane closures so that their contractors can get out to the field.

"So the DOT will know that a lane is closed, but they won't necessarily know the status of the work scheduled to be going on. It's like trying to book an appointment for the doctor and being told that you can be seen between this time and this time. We want to get more specific: What time was the first cone laid down? When was the last one taken up?"

Left: **DOTs are switching on to the safety benefits of smart, connected roadside infrastructure**

> There's information out there, but it's inconsistent… We also want to get more specific: What time was the first cone laid down? When was the last one taken up?
>
> **Todd Peterson, project manager, Workzone Data Initiative, FHWA**

The FHWA is looking to the private sector to lead the standardization process, with Peterson suggesting it could be taken up by a standards agency such as the International Organization for Standardization (ISO).

Ullman says, "The other piece to this is that once the process is complete, there's an opportunity for a third-party data provider to step in and act as a repository for all this

Wear it well

After a false start for proximity detection devices, does wearable technology still have the potential to revolutionize workzone safety?

Following on from last year's protests in France, high visibility vests have become something of a political symbol. In workzones, however, they mean the difference between life and death.

Efforts are underway to make the high-vis vest an even more essential safety asset by fitting it with an intrusion alarm system, which tells the worker that a vehicle has deviated into the work lane.

The technology, currently under development at Virginia Tech, is known as the InZoneAlert vest and uses GPS to track a worker's movement, and short-wave radio sensors that can communicate with the car's connected vehicle technology.

"This communication would be two-way," says Gerald Ullman, of the Texas A&M Transportation Institute. "So that connected vehicle drivers would also get an alert from a worker's vest warning them of the worker's location."

Another wearable technology with the potential to improve workzone safety is the proximity detection device. Initially developed for the mining industry, the devices use GPS and Bluetooth to warn operators and workers when they get too close to other machines or people on-site.

The devices are fitted to machinery and also worn by workers on their clothing. They are already being used in workzones but, according to Ullman, take-up has been limited, mainly because of the problem of false positives.

"When you're in a work environment where you are in close proximity to heavy machines this can happen a lot, and it slows down the workflow," he says. "So they are still working on developing the intelligence of these systems."

Left: **DSRC roadside units are being installed in Wyoming to transmit workzone warnings to connected vehicles**

data and make money on it by selling it to the public."

The safety benefits are clear – the more you can inform motorists about a workzone's status, the better equipped they will be to navigate it safely. But, the question remains how best to relay that information.

Connected Wyoming

One answer is via connected vehicles. With this purpose in mind, a pilot program currently underway in Wyoming is testing a workzone warning system.

Wyoming DOT has fitted about 400 vehicles, with onboard units that include an antenna capable of picking up DSRC and a chipset capable of picking up broadcasts from the Sirius XM satellite radio network.

> We're trying to improve the situational awareness for drivers so that they can be more prepared as they approach a workzone
>
> **Ali Ragan, ITS project manager, Wyoming DOT**

Workzone alerts will then be sent by DSRC via roadside units deployed on the I-80 interstate. The same data will be simultaneously broadcast on Sirius XM.

The onboard units will transmit the alerts wirelessly to Samsung smartphones and tablets – provided to the owners of the vehicles involved.

"What we're trying to do is improve the situational awareness for drivers so that they can be more prepared as they approach a workzone," says Ali Ragan, project manager for Wyoming DOT's ITS program, who recently won an AASHTO Vanguard Award for her work.

Updating motorists is not the only way workzone data can be used to improve safety, however. For the FHWA, the key driver behind WZDI is the need to improve strategic planning around safety.

"We have good traffic data from probe data providers and good data on crashes," says Peterson. "But what we need is a complementary map that shows us where the workzones are and when they are active. With these three pieces of information, we will be able to fully understand the true relationships." With the new drive toward improving workzone safety, it can only be a matter of time before this goal is reached.

13th ITS EUROPEAN CONGRESS

FULFILLING ITS PROMISES

Brainport Eindhoven, the Netherlands | 3-6 June 2019

SAVE THE DATE

The 13th ITS European Congress 2019

Brainport Region - The Netherlands
3-6 June 2019

A unique opportunity to

- Exchange information with 3000 industry stakeholders and influencers
- Discover the latest mobility solutions
- Share experiences and lessons learned
- Monitor progress and measure results of implementation and deployment
- Exhibit and experience cutting-edge technologies and innovative products and services
- Enter business and partnership opportunities
- Experience the latest technology first hand through demonstrations

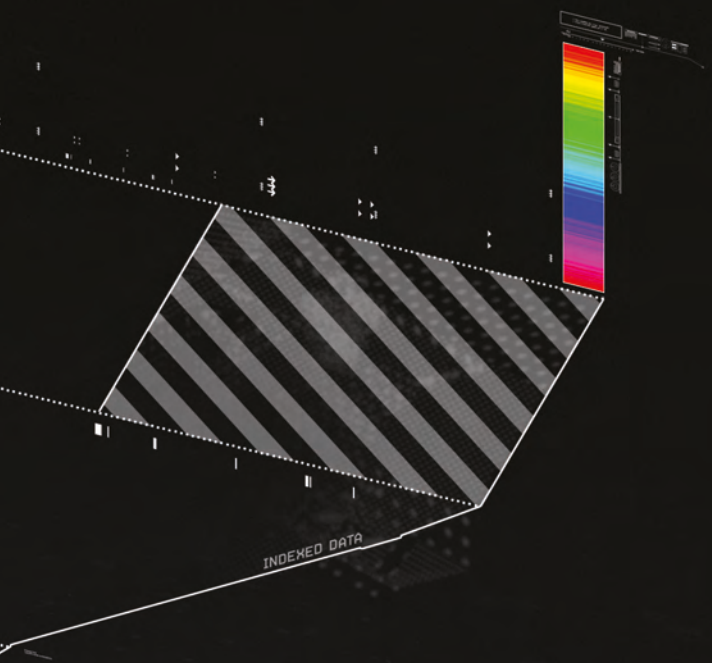
Visit **www.2019.itsineurope.com** for information on Call for Contributions and Commercial Partnership & Exhibition opportunities.

Organised by: ERTICO ITS EUROPE

Hosted by: EINDHOVEN, Gemeente Helmond

Supported by: Connekt ITS Netherlands, Ministerie van Infrastructuur en Waterstaat, Brainport Development, Provincie Noord-Brabant


POT HOLE DETECTED
A645
INCOMING DATA
DATA BOUNDARY
RETROREFLECTIVITY INDEMED
DATA BOUNDARY
DATA SENT
3:45
10 APRIL 2019



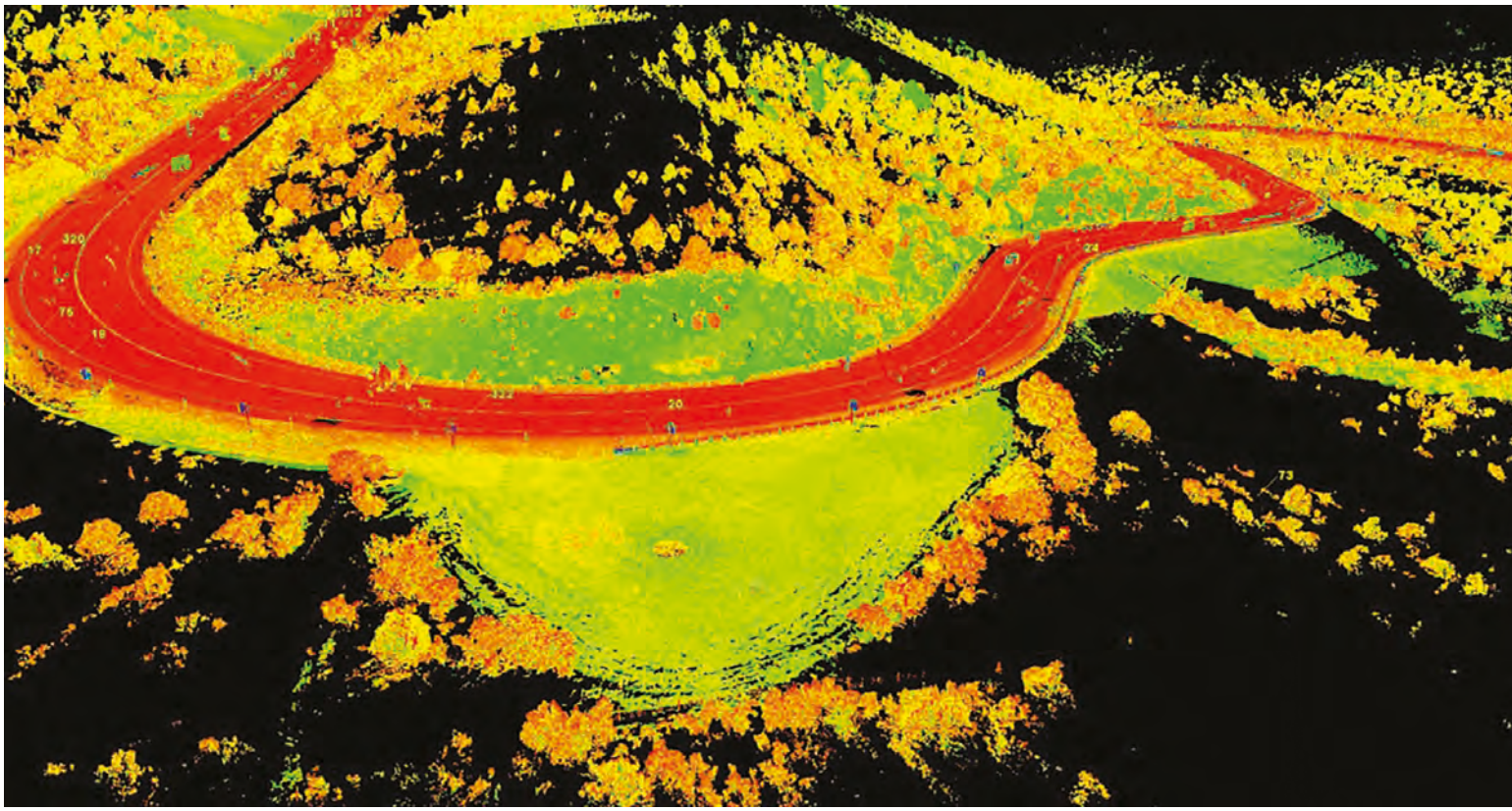
Smart views

The state of Utah has long been famed for having some of the best-quality roads in the whole of the USA. But that's not because its DOT is especially well funded, or due to incredibly unusual ground that is immune to subsidence. Instead, it can be largely attributed to its world-class asset management program, which has long been defined by one key principle – 'Good roads cost less'.

Decades ago far-sighted DOT chiefs make the decision that they would spend more in the short term to maintain roads in a good state of repair, in the hope that in the long term it would reduce the need for even more costly wholesale road rebuilding. And it has paid off. "At a time when construction costs are increasing, we've been able to maintain or slightly decrease the amount of money we need to invest on our pavements, while still keeping them in the condition

Over the past few years, forward-looking agencies, such as Utah DOT, have revolutionized their asset surveys with lidar. How have they done it? What are the limitations of the technology? And could cheaper, smartphone-based survey methods be about to take over? **Tom Stone** investigates

Illustration: Sean Rodwell



we're seeking," says Utah DOT's director of technology and innovation, Nathan Lee.

The theory behind Utah's asset management success is simple enough, but the practices and technology are more complex and warrant further explanation. Extensive road surveys have always been a key part of UDOT's successful asset management program, and in the past decade they have been helped by one technology above all others – lidar.

"We started with 'good roads cost less' and then went to electronic data to improve consistency and decision making," says Lee. "Lidar was the biggest step in that. We love lidar; we've been using it for about seven years. It's been a great help to our organization."

> When we moved into lidar it was fantastic because we doubled the number of assets we could gather data on. It was a whole new world
>
> **Nathan Lee, director of technology and innovation, UDOT**

Lidar cameras, attached to a moving vehicle, are able to rapidly build highly accurate 3D representations of the world around them by creating 'point clouds', which can be enhanced further with video images to create realistic color and texture on objects.

"I'll give you an idea of some of the things we've done with it," continues Lee. "First we started looking at the condition of assets. We found that we could extract data from 26 different assets using lidar imaging [see *The Hit List* overleaf]. We have roughly 16,000 lane miles here in Utah that we collect data on. To cover all that once with lidar costs about a million dollars. Then it's about half a million to process the data for those 26 assets."

US$1m

The approximate cost of surveying all of Utah's 16,000 lane miles once using lidar

But despite these high costs, Lee believes the investment is well worth it. Not only does this work out much cheaper per mile than manual data collection, but the data is now comprehensive. Lee remembers that in the old days of manual collection, only one-tenth of each mile could be surveyed. The condition of the road on the rest of the mile had to be extrapolated from that small data set. After manual data collection came IRI (international roughness index) cameras, which are still used today. This was the start of electronic data collection and began to create a more

Left: **Lidar drone mapping can clearly reveal ground and pavement weaknesses**

complete picture. "When we moved into lidar it was fantastic because we doubled the number of assets we could gather data on," says Lee. "And we not only had consistent data, but imagery with it, and that was a whole new world."

Putting it on the map

Collecting huge amounts of data is one thing, but it's no use unless you have a system to make sense of it all. In Utah they do this using maps. Public services across the state are unified by the Automated Geographic Reference Center (AGRC) – the State of Utah's map technology coordination office. It's no surprise, then, that GIS (geographical information systems) are an important tool for public officials to understand data and communicate information.

For UDOT, getting data onto maps meant turning to the experts at Esri, which makes GIS software. Esri's ArcGIS Pro suite enables not only traditional 2D representations of the world, but 3D digital twins, which are built using the type of lidar data UDOT is now collecting. "You can use lidar from ground vehicles or drones in Esri," says Lee. "So lidar

Right: **A landslip on Highway 12 in Utah was the perfect opportunity to test the effectiveness of lidar drone surveys**

Taking to the skies

Lidar started as a ground-based survey technique, but now, with the advent of drones the cameras can get a bird's-eye view

Some of the high costs involved in lidar have been mitigated for UDOT by outsourcing the collection duties, with Mandli being its biggest contractor for the task. However, that picture is beginning to change with the advent of UAS (unmanned aerial systems), otherwise known as drones.

"We weren't buying lidar cameras ourselves, but now we own half a dozen drones and have started collecting lidar imaging from the drones ourselves," says Lee. "The first thing we started using them for is bridges, which can be very dangerous to do manually."

Another advantage of lidar drone surveys that UDOT has discovered is when assessing culverts – the drainage ditches that run alongside highways. "We get great pavement data from the ground lidar, probably the best you can get," says Lee, "but culvert data is difficult because of the shadows. But if you introduce some of the other methods in the point cloud, like drones, you can do analysis from the side view, so you can look at data and assets in a different way. Our drones can complete a culvert survey in a matter of minutes, whereas a survey crew would take a few days to get the same information."

Drone surveys were particularly useful for UDOT recently when there was a landslide that closed Highway 12 on the route into Bryce Canyon National Park.

"With the failure of that road they lost access to the National Park and a small town of people, so it was urgent to have a quick solution," says Lee. "So we used drone lidar and gave the model to the contractor to start working on a solution. That was something we were able to do in a day, whereas if you were to do that with any other method it probably would take a week just to get all the imagery needed to make decisions."

Left and above: **Lidar drone surveys can help to get vital information to repair teams more quickly than ever before**

gives us a couple of key benefits. First there's information about asset condition, and second there's great value in being able to have GIS files," says Lee.

Maps derived from ArcGIS Pro are now displayed on the web-based UDOT Data Portal information service (also called U-plan) (http://data-uplan.opendata.arcgis.com), which is a highly detailed snapshot of all of UDOT's assets. It has impressed Esri's global transportation industry director Terry Bills. "I can go on the website and pull up any single asset anywhere in the state with a precision of 2cm," says Bills. "UDOT has done this by conflating digital video, which has the visual representation, with lidar, which has the accuracy. So UDOT can take precise measurements and can dissolve the video and see the lidar behind it. They can look at any of the assets for the first time. They used to know there were somewhere between 80,000 and 120,000 signs. Now they know precisely how many there are. Maintaining the condition is the next challenge."

> We are spending a great deal of time on AI and applying it to transportation questions, such as how to build better degradation curves to prolong asset management
>
> **Terry Bills, global transportation industry director, Esri**

Calculating the future

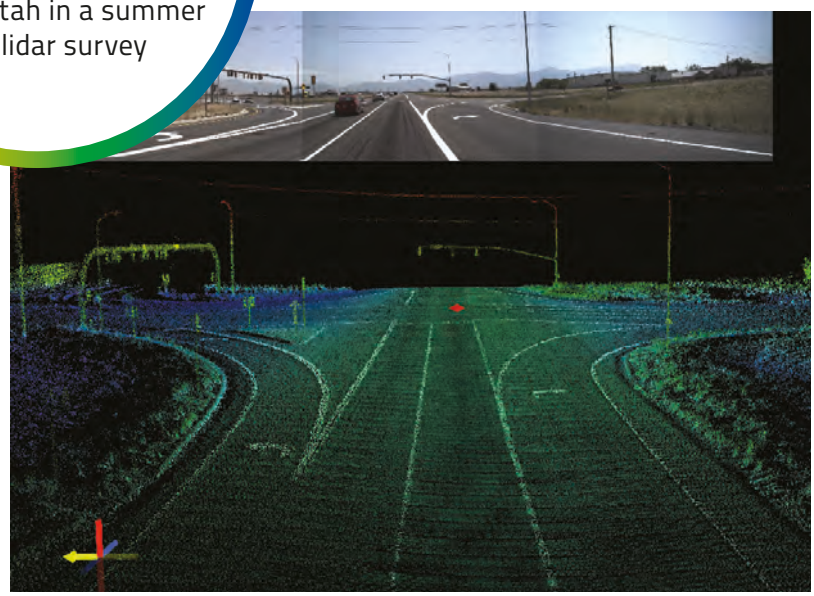
"When we first started lidar surveys, we intended to collect the data every two years," says Lee. "We were collecting on all the routes and directions. But we found that some assets needed to be surveyed every year and others much more infrequently. For instance, walls. Their risk of damage is so low, and their deterioration rate is so small, that we said, 'After two years of collection we don't need to do that for another five or six years.'"

Such rich data sets mean that UDOT no longer has to rely only on the simple 'good roads cost less' mantra because now its asset managers can make ongoing risk assessments and predictions of exactly where damage is likely to occur. "We've added a risk index to our asset management program," says Lee. "Now we can see the probability of failure and define what the consequence will be if we don't address that probability. We could never do that before, so that's really

Left: **Utah's Eagle Canyon Bridge is ideal for lidar drone surveys, as collecting data in other ways is dangerous and time-consuming. "We flew it with a drone. Not only did it take a fraction of the time, but we got information we never had before," says Nathan Lee**

106,636

The number of sign faces recorded across the entire state of Utah in a summer 2015 lidar survey



The hit list

The 26 assets that UDOT is able to assess using lidar

1. Billboards
2. Billboard assemblies
3. Barriers
4. Bridge decks
5. Drainage
6. Intersections
7. Medians/traffic islands
8. Signs
9. Sign assemblies
10. Walls
11. Paint striping
12. Surface areas
13. Travel lanes/bike lanes
14. Shoulders
15. Pavement messages
16. Rumble strips
17. ATMS devices
18. Driveways
19. usRAP
20. Roadway utilities
21. Power pedestals
22. Signal cabinets
23. Signal poles
24. Retroreflectivity (partial)
25. Cattle guards
26. Cross sections

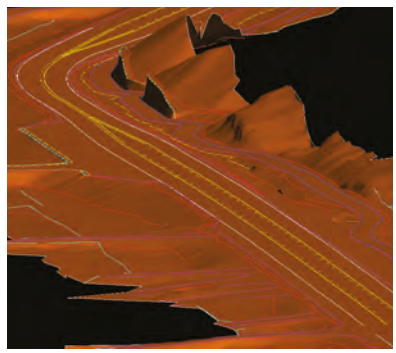
helping our asset management. We can target repairs more quickly because we can start to see trends that we couldn't see before." It's not yet a perfect system, but leaps in the accuracy of such predictions could be just around the corner.

"They have a calculated degradation curve so they know when they need to get out there to do repairs," says Bills. "But one of the things we've talked about is to work out how do we use AI machine learning to take asset management to the next level. We are spending a great deal of time on AI and applying it to transportation problems, such as how to build better degradation curves to prolong asset management. There's a whole load of ways AI can contribute to that."

Smartphone solution

But lidar isn't the only high-tech solution at the disposal of asset managers today. In recent months a new, cheaper way of surveying road condition has been gaining popularity. RoadBotics is a spin-off from a Carnegie Mellon University research project that uses windshield-mounted smartphones to gather video of roads that can then be analyzed to accurately assess condition. RoadBotics says its AI can identify every useful aspect of the

Below: **GIS software can help to build 3D models, based on accurate lidar surveys**



Right: **Detroit, where the condition of streets is now being assessed with a much cheaper alternative to lidar: smartphones attached to vehicle windshields**

road surface as well as a human can, from potholes to less obvious features such as bumps, depressions and cracks.

Since launching in December 2016, RoadBotics has assessed roads for more than 90 cities, towns and counties around the USA, with Detroit recently becoming the latest city to use the technology to inspect its 2,600-mile long (4,200km) network. "It's providing us with data and insights about our road conditions that will help our engineers determine where to objectively allocate our resources and maximize investment in maintaining our residential streets in the best condition," says Oladayo Akinyemi, deputy director of Detroit's Department of Public Works. "We will use this data to expand our road asset database as part of our broader data-driven asset management and investment strategy for the City's Right of Way."

> We will use this smartphone data to expand our road asset database as part of our broader data-driven asset management and investment strategy
>
> **Oladayo Akinyemi, deputy director, Detroit Department of Public Works**

2,600 miles

The length of Detroit's road network, currently being surveyed by smartphone-based technology (4,200km)

Back in Utah, smartphone video is also being tested for asset management purposes. Despite the huge benefits that lidar has brought, it does have certain limitations. "With lidar we can record the presence of paint striping," says Lee, "but can't do more than that accurately. We do have devices that measure retroreflectivity, but lidar can give false reflectivity readings. The same goes for road signs."

Now UDOT is hoping that a smartphone-based service similar to the RoadBotics one, offered by a company called Blyncsy, will help to plug this gap in lidar data.

"With paint striping we found that smartphones could capture the data just as well as lidar," says Lee. "And it's much cheaper and easier. Now Blyncsy is seeing if can it develop an algorithm that will allow us to index paint condition and reflectivity. Lidar is just not very good at that. It can't tell, for instance, if a sign is going black or if the words on it are starting

The entire world in digital?

Lidar drones enable swift building of 3D models. Could such techniques one day replicate the entire world in digital? One UK company believes so

Building information modeling (BIM) is another key use for lidar drone surveys. Creating digital twins of existing buildings can help architects formulate designs and communicate their plans direct to construction companies. Now UK company Sensat is taking the process to the next level, creating digital twins not just of individual buildings, but of entire cities.

It's latest creation – a simulation of the city of Cambridge – has already been used to plan the locations of new cellular communications masts, and Uber has expressed an interest in using it to test its driverless car technology. The model even includes virtual traffic and pedestrians.

But Sensat's ambitions don't end there. It's cofounder and CEO James Dean wants to continue digitizing whole cities and dreams of one day linking them up to create a seamless virtual world.

"We have a big vision – AI to help computers understand the physical world in the same way we do. That would be as big a development as the internet," Dean told *The Times* recently. "It will connect all human knowledge online and in our computers with the places we live and the industries that touch them. That would create massive value. But it's incredibly difficult."

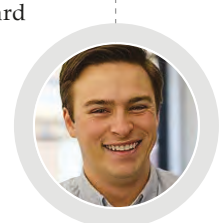
Sensat's digital model of York, UK

to fade. So we're looking at these phone surveys and other methods. One, to be complementary. And two, to see if we can collect that data for three or four years in between lidar collections, which will reduce costs but still give us accurate feeds.

"It's a new world and we're certainly testing it. If Blyncsy can make these algorithms work, that will be a huge step forward for the industry.

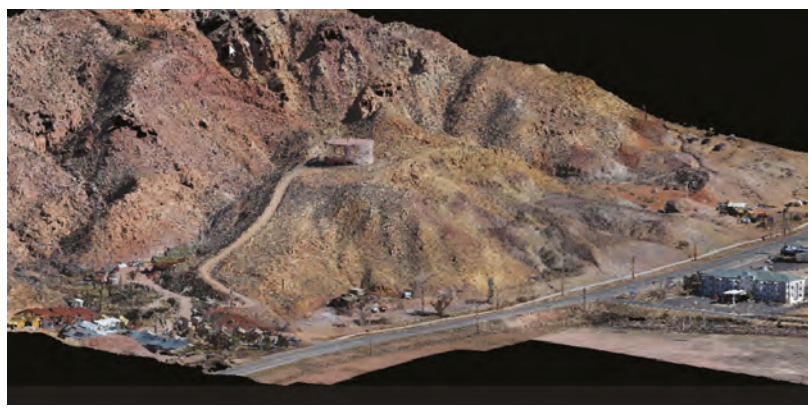
"The other good thing about video is that there are so many devices on the road right now that can capture it. There might be people with their windshield-mounted cameras collecting video for liability reasons and they can sell that data to use for other things. And in the future cars themselves will capture this type of video. If all that can be aggregated at a high level from multiple sources, it should really be able to give you pretty cheap solutions pretty quickly."

> We have a big vision – artificial intelligence to help computers understand the physical world in the same way we do. That would be as big a development as the internet
>
> **James Dean, cofounder and CEO, Sensat**



With cheap video feeds poised to fill in the gaps in lidar data, and reduce the need for so many expensive lidar surveys, could there come a day when video analysis becomes so good at assessing the condition of pavements and other assets that it takes over from lidar completely? "You could easily see that being the case," says Lee. "But then lidar might continue to improve in the way it can be used, as well."

The technology race to provide the best value, most detailed road surveys, is on.



Right: **Lidar opens up the possibility not just of creating 3D models of roads, but of entire regions**

When predictions fail...

Many of the UK's new homes are being built on the edges of existing towns. But some reports suggest the traffic modeling techniques being used to predict the extra strain on infrastructure are falling short. Is this really the case? **James Gordon** investigates

How do you travel to work? How do you take your children to school? How do you take them to their swimming lesson or football training? In many big European cities, the answer lies in highly developed public transit. But spare a thought for young couples who live in new, edge-of-town housing developments. A recent report published by Transport for New Homes says that many of them are heavily car dependent. The study, which saw researchers visit 20 housing developments in England, three in the Netherlands and one in Sweden, found that many new housing estates are so far away from city centers that it is challenging for residents to cycle, much less walk, into town. Researchers also discovered that many developments have poor public transit links. The combination of these factors is resulting in an unusually high level of car dependency.

Over-reliance on cars is causing additional congestion on already crowded local streets. But the finger

77%

The proportion of new homes in England that were houses (23% were apartments) in the financial year 2017-2018. This is the highest proportion of houses built since 2002 (in 2009 it was 50/50).

Source: UK Ministry of Housing Communities and Local Government

of blame cannot be pointed at government, at least not in the UK, as there are already regulations in place that are supposed to avoid car dependency in new housing.

"Every new development in the UK is subject to Section 106 of the Town and Country Planning Act 1990, which requires the developer to show that there is a plan in place to encourage modal shift away from the car," explains Dr Anan Allos, a transport planner for Atkins, who specializes in multimodal modeling and has collaborated with a host of local and central authorities. "If there's isn't such a strategy in place, or if it's seen as not robust enough, a local authority should not grant planning permission."

So if there isn't a problem with the regulations, could traffic modeling techniques be to blame? Dr Allos doesn't think so: "It's usually the fault of the developer or the local authority rather than the traffic modeler. A traffic model can provide an accurate forecast of traffic flow around a proposed development. To do that, we evaluate existing traffic patterns around the potential site. We then use mathematical models to forecast the total number of trips likely to be generated by the new development and how many of these journeys will be made by public transport, where they go, and what routes they take if they use a car." But if these models are being applied to streets that have been built without consulting the correct guidance, it's possible that the results could be skewed (see *Streets Behind*).

> A traffic model can provide an accurate forecast of traffic flow around a proposed development
>
> **Dr Anan Allos, transport planner, Atkins**

Nevertheless, when applied to standard road layouts, modeling techniques are already impressive and they're about to get even better with the help of big data, which will give traffic managers a much more detailed and accurate picture of how people travel.

Dr Allos has had two papers published on the subject of big data, and explains, "If used in the right way, both big data and AI have the potential to open up a whole new world of possibilities – especially for forecasting. We now have access to data that we have never had before. For example, it will allow us to take into account not just the standard metrics such as current traffic levels and the number of journeys made, but also factor in more arcane data sets such as GDP or income per capita, which can also have an effect on car ownership and trip rate levels."

A continuing journey

Dr Allos remembers traffic modeling a decade ago when data was less plentiful and much more expensive and labor intensive to source.

"In the past, whenever we wanted to collect data measuring mobility, we either spent a lot of money purchasing it from National Traffic Surveys or we went out and did the necessary field tests ourselves (such as roadside interviews), which was equally expensive not to mention potentially obstructive to road users," he says.

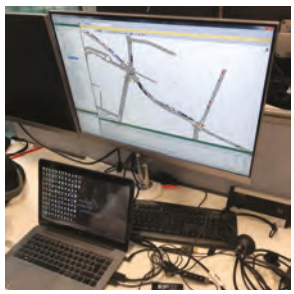
Data is now relatively inexpensive and some software is free. But it is

Streets behind

Could outdated street planning be to blame for some of the congestion experienced near new housing developments in the UK?

Findings from a study by the Urban Design Group conducted last year revealed that only 18% of authorities interviewed were using the latest government guidance – the *Manual for the Streets*. Alarmingly it found that "36% of authorities were still using policies and practices based on *Design Bulletin 32 (DB32)*" – despite the government withdrawing it over 10 years ago. The study also reveals that the remainder were said to have adopted *Manual for Streets*, but in practice were still using *DB32*.

Robert Huxford, who wrote the report, says, "Those highway authorities that are continuing to apply *DB32* and the earlier 1960s street design standards when creating or improving streets and highways are doing great damage. *DB32* was replaced by government as it was based on outdated or questionable principles. Continued use could make the role of traffic modelers more difficult in the future and ultimately poorly designed roads mean more congestion, less active travel and harm to public health."



Above left: **New housing in the UK is typically being built in edge-of-town locations, which are picturesque, but create transportation challenges**

Above: **Traffic modeling software will soon be enhanced with artificial intelligence**

floating car data from cell phones that Dr Allos says is "opening up exciting new vistas".

"TfL and Highways England have used anonymized and aggregated cell phone data to get movement data that can be used to underpin the building and improvement of passenger and traffic models. I think this will become invaluable for traffic modelers like me in the future. It allows us to create much more precise real-time journey information, which will in turn help us to create even more accurate traffic models."

And data from phones and smart devices is just the beginning. "Currently data gleaned from cell phones is changing the landscape, but that's just the tip of the iceberg," says James Gleave, director of the Mobility Lab, which provides strategic advice to the transport sector. "Data from connected vehicles will give traffic modelers even more real-time intelligence."

AI future

It will probably be some years yet before AI makes a deep impression on traffic modeling systems. But when it does, this disruptive technology has the potential to further transform the landscape.

"The vast and diverse application of AI has proved its effectiveness in so many fields, and there's no reason why this cannot be applied to modeling travel behavior," says Dr Allos. "Machine learning tools can enable computer algorithms to 'learn' how to arrive at an outcome, with another independent set of data used for validation."

Dr Allos says that Atkins has already embarked on some initial research in using neural networks to predict which destination people will choose, by providing a plethora of factors such as "traveler attributes, level of attraction of the destinations, and cost and time of travel to those destinations".

Gleave agrees that AI is the next stage of the revolution and is looking forward to a future when all cameras will be able to count not just cars, trucks and buses, but bikes and pedestrians, too. "This will mean that traffic modelers will get a much clearer and fuller data picture to feed into their models," he says.

But Gleave, who spent 10 years working as a strategic transport officer for Bedfordshire Council and three years at the UK's Transport Systems Catapult doesn't think these powerful technologies will necessarily do away with the need to have human experts overseeing the process.

250,000

The minimum number of new homes it is estimated England needs each year to curb extreme house price rises

Source: Fullfact.org

Software advances

Using the very latest software, traffic managers will be able to test the impact of virtually any connected or autonomous vehicle application

The latest release of Aimsun Next mobility modeling software focuses on more powerful and flexible modeling for connected and autonomous vehicles (CAVs), with new features that can be extended to add technologies and messages as they emerge.

Not only are there parameters that allow modelers to control vehicle behavior by vehicle type, there is also a new, easy-to-use interface for external control agents, and a technical preview of the V2X Software Development Kit (V2X SDK).

The V2X SDK features the most common V2X message protocols and allows the adjustment of transmission range and probability of successful transmission that simulates the physical and network layers of a Vehicle Ad-hoc Network (VANet).

This makes it possible to test virtually any connected vehicle application, implementing the resulting actions at the level of a single vehicle, the immediate vicinity, or the whole network.

In one scenario, a modeler may want close-up detail for a single intersection to test how fast driverless vehicles can pass through. Then, in another scenario, the modeler may want to test pollution levels using data aggregation across a large network.

"Modeling at an appropriate scale, from a single junction to a city-wide road network, is an important part of what Aimsun Next is able to do with integrated macro-, meso- and micro-models," says Gavin Jackman, director of Aimsun's UK branch. "The design of the V2X SDK in Aimsun Next, with its inherent extensibility and flexibility, is just a part of the same philosophy."

"Traffic modeling will always depend on the ability of skilled and experienced modelers and designers to understand the factors most likely to trigger congestion in years to come," he says. "However, it can provide them with a much better insight than is currently possible. For example, data-driven weather forecasting tools that can predict the impact of flooding could make a big difference to road designs. For instance, if modelers know that a particular region or city in the UK is going to suffer more heavy rain and flooding in the future, they can factor in more resilient and more robust roads, with storm drains, into their designs. This is one way that real-time data sets can add true value to models."

> Traffic modeling will always depend on the ability of skilled and experienced modelers and designers to understand the factors most likely to trigger congestion
>
> **James Gleave, director, Mobility Lab**

And there's further scope for AI to assist with planning new roads and developments. Dr Allos adds, "Another application that Atkins is involved in is to apply AI to modal choice, by predicting the choice of mode given personal attributes and levels of service provided by public transport and car."

Such advances should make it much clearer when new housing risks driving residents into their private cars rather than to alternative modes. And with such powerful tools at the fingertips of traffic modelers, there will be nowhere for unscrupulous housing developers to hide in the future, and we can hope that modal choice will increasingly be seen as a right, not a privilege.

aimsun.

Move Brilliantly.

Aimsun software helps thousands of international users model tomorrow's smart mobility networks, today.

Join the movement at aimsun.com

We're at stand K025!

Traffex '19
PART OF TRANSPORT NETWORK

comtrans

Your essential guide to the future of transportation communications

The pilot took place in Washington DC's Chinatown district

Smart parking success in DC

A new variable-pricing parking pilot, which made use of connected technologies, proves to be a success in US capital

Washington DC's app-reliant, variable-pricing parking pilot has been hailed a success, in a recent report to the Transportation Research Board.

The US capital's District Department of Transportation (DDOT) said that the demand-based parkDC project had kept individuals better informed as to the availability of spaces, reducing traffic congestion and incidents of illegal parking in the process.

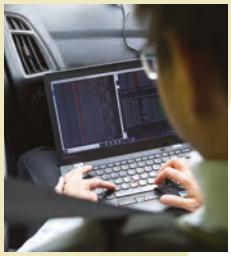
Additionally, the report confirmed that local businesses were not negatively affected and use of non-driving transportation modes remained at a high level.

DDOT director Jeff Marootian said, "This innovative pilot advanced a cost-effective approach for managing our curbside space. We leveraged technology, data and real-time information to enable more effective use of curbside space by residents, visitors and commercial vehicles over the past four years.

"Such a data-driven and technology-enabled approach is increasingly important as we work to meet Mayor Bowser's goal of making the District a truly multimodal city."

Members of the public were kept informed as to the availability of spaces in the Penn Quarter/Chinatown area of DC via two smartphone apps and by the end of the project, demand matched supply for 72% of parking spaces – a 10% improvement for the area.

The amount of time vehicles spent cruising for a spot decreased by as much as 15% during all time periods, while weekday congestion decreased by 5% and travel time reliability improved by 5% in the pilot area.




AIRBAG
Lenovo
Type here to search

Corridor of connection

A new connected vehicle testbed in Kent, UK, is pointing the way toward better traffic flow, greater safety and the future of driverless cars. **Saul Wordsworth** reports

Monitoring in-car connected vehicle data during the test project in Kent, UK

An exciting testbed on the roads of Kent, a county in southeast England, is offering drivers a wealth of new connected vehicle data to help them make better-informed decisions, in an attempt to reduce congestion and improve safety.

The project is a collaboration between the Department for Transport (DfT), Highways England, Transport for London (TfL) and Kent County Council. It has led to the creation of a high-tech corridor on the A2/M2, which is testing how effectively information about road conditions, workzones and traffic light timings can be transmitted to test vehicles via a wireless network. Initial stages have proved successful and it is now hoped that in the future the technology could run all the way from London to Dover on the southeast coast.

"Connecting vehicles to each other, to the road, and the infrastructure can improve journeys, make them safer and give drivers reliable, real-time personalized information," says Joanne White, head of Intelligent Transport Systems Group, Highways England. The project feeds indirectly into the government's long-term aim to be a world leader in the development of connected and autonomous vehicles.

"Safety is woven into everything we do and every journey should be safe," says Anthony Ferguson, divisional director for traffic

Above: **Traffic light phase and timing information can be sent directly to vehicles to aid smoother driving**

Above: **One goal of the project is to reduce the chance of drivers missing vital roadside information**

and technology, DfT. "This is also about ensuring the infrastructure we have is used as efficiently as possible as that has a big pay-off for the taxpayer. However it is the connected part that will underpin what we need for driverless cars in the future, so it's all part of a continuum."

How is it done?

The scheme comprises four elements: an in-vehicle screen showing what would normally be displayed on gantries, workzone warnings to increase safety, Green Light Optimal Speed Advice (GLOSA) giving drivers advanced warning about traffic lights, and the opportunity to mine vehicle data to help plan journeys. It is hoped that displaying information inside vehicles will reduce the chance of drivers missing vital information displayed by the roadside. The project is part of InterCor, an EU scheme testing services across borders, connecting the UK to the Netherlands, France and Belgium. The project began in 2016 and is nearly complete.

"One of the future benefits is hopefully crossing a border and not noticing the difference," says Ferguson.

The technology is led by smart infrastructure solutions firm Costain. The company has brought together industry leaders from across Europe to deliver an integrated end-to-end hybrid system that was exhaustively tested at the TESTFEST event in Kent in October 2018. The success of the event is expected to lead to a full-scale pilot project that should receive the green light in 2019.

> This is about ensuring the infrastructure we have is used as efficiently as possible as that has a big pay-off for the taxpayer
>
> **Anthony Ferguson, divisional director for traffic and technology, Department for Transport**

Pilot process ahead

"It's been a lot of work to get to this stage, but the test event was a milestone," says Ferguson.

Brexit roadblocks?

Despite uncertainty surrounding Brexit, Highways England remains committed to transcontinental connected vehicle projects

At the time of going to press, the exact nature of the UK's departure from the EU is still uncertain. Is now the time for a project that allows British vehicles a better, smoother transition when traveling across continental Europe? Highways England's Joanna White believes it is.

"We said we'd do this project back in 2015 when we launched the First Road Investment Strategy. It is a European project and it's really important that what we learn from this feeds into common standards, but this project won't be affected by Brexit due to pre-existing arrangements we have with our partners."

Left: **The Kent-based project caught the attention of local TV crews**

"Following the test operation on the A2/M2 and assuming we get the green light on the pilot, the process will be the same as any project involving public money. We test, evaluate, see what we learn and consider the business case for the next stage. Any data would be shared through Highways England and InterCor before long-term decisions are reached. This is merely part of the ecosystem of projects."

Despite talk of autonomous vehicles, Highways England's policy objective remains to operate road networks more efficiently and safely.

"Talk of driverless vehicles is for another day," says White. "If the pilot goes ahead, other services will come out of it quite naturally and that's when the consumer benefits will start to increase. From a Highways England perspective, long-term ambitions are about using existing infrastructure and reducing the risk to road workers. In addition, we are capturing data from vehicles. Part of the project is examining vehicle data to help create congestion algorithms. In future, we hope to provide tailored information to vehicles based on knowing where they've come from and where they want to go."

> Part of the project is examining vehicle data to help create congestion algorithms
>
> **Joanne White, head of Intelligent Transport Systems Group, Highways England**

According to White, it's "pretty likely" that drivers will need new technology in their cars for this scheme to go live and this will cost an "unknown" amount of money. Such information is not part of the trial. Some of the app developers present during TESTFEST are currently developing onboard units for future use. White predicts that the road investment period of 2025 to 2030 will most likely see this technology go live on UK roads, though it remains dependent on the outcome of all trials taking place across the UK and abroad.

It's good to talk

With vehicles now communicating with each other, a milestone has been reached in the USDOT Connected Vehicle Pilot in Florida. **James Allen** reports on the latest developments

The journey toward real-world connected vehicle (CV) technology is gathering pace in Tampa, Florida. Of the three Connected Vehicle Pilots overseen by USDOT, the one occurring in the Sunshine State is the only one involving privately owned vehicles and is arguably the most ambitious.

After two years of design, installation and deployment, the pilot on the Lee Roy Selmon Expressway is now entering the testing phase, meaning that there are 44 roadside units (RSUs) and more than 1,000 vehicles equipped with onboard units (OBUs) able to send and receive traffic-related information.

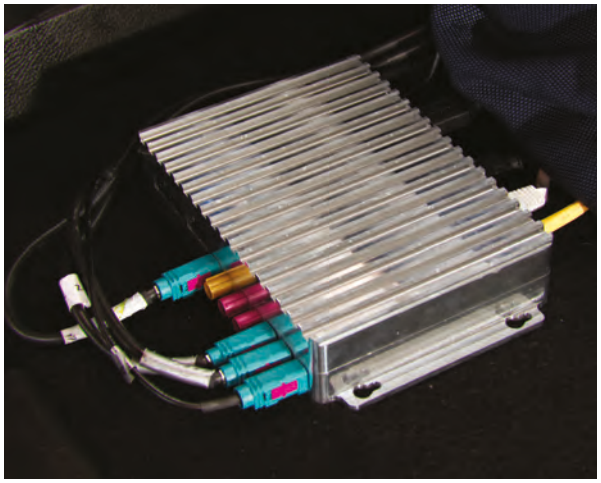
The expressway is operated by Tampa Hillsborough Expressway Authority (THEA). Its status as a toll road has provided opportunities to incentivize public involvement in the CV project.

"Monday through to Friday, every morning we are seeing between 505 and 580 of the connected vehicles, so over 50% are involved in the study area – which is great," says THEA director of planning and innovations Bob Frey. "That involvement is what we hoped to see based on us using the toll facility as leverage, giving discounts for users to take part and allow us to collect data from their vehicles in return."

It is premature to make definitive conclusions about whether the connected vehicle technology being tested can deliver all of its promised benefits, but a significant milestone has been reached – vehicle-to-vehicle (V2V) communication is occurring.

Even as project manager of the Tampa pilot, Frey isn't in a position to be certain of what the final findings will be, but he is already aware of some anecdotal positives: "We have actually received impromptu emails from customers who have said that the V2V communication has saved them from crashes.

Above: **Observant motorists on the Lee Roy Selmon Expressway might spot gantry-mounted DSRC roadside units**



Left: **One of the vehicle OBUs used in the Connected Vehicle Pilot in Tampa, Florida. Some volunteers have complained they are unsightly**

"Even THEA's communications director came into my office one day and told me she was traveling outside of our study area, but her car received a forward collision warning anyway. She assumed it must have been a bug in the system and was planning on letting us know about it so we could fix it.

"She then realized the car ahead had a Tampa CV project sticker on it and that it was communicating a warning to her vehicle – that was interesting, and we've had several similar stories of V2V communication occurring well outside the pilot's testing area. When you hear positives like that, it shows the technology is working."

For all the good things observed in the pilot, not all the drivers signed up have warmed to the project. Some have complained about the aesthetics of the OBU equipped on their privately owned vehicles, while a few individuals have found the safety messages distracting. But, for the most part, Frey has been surprised at how little negative feedback has been received.

That is not to say the project has been plain sailing, and while external participants are generally supportive and positive, there's one particularly big problem that has been giving the project's manager a headache.

> At a high, we are seeing 15 vehicles per second connect, amounting to about 1TB of data a week. That's a lot of data to process and move back to the server
>
> **Bob Frey, director of planning and innovations, THEA**

"A typical CV deployment in the future wouldn't have to do this, but being part of a pilot focused on gathering data, we do. It is making our job a lot more difficult and is our biggest challenge," Frey explains.

Technology partners involved in the pilot have stepped in to unblock the data logjam, with four RSUs now dedicated to exclusively stripping data from the OBUs and sending it to the University of South Florida and USDOT for evaluation. It is such experiences that have left an indelible, positive impression on Frey.

"The climb we've made from October to now in terms of data downloads has been staggering; it really is doing much better. One of the most impressive things for me from this whole project has been the ability of business to react and solve problems," he says. "When the private sector is made aware of a problem and can bring its own people in, it is amazing how quickly we've been able to overcome issues."

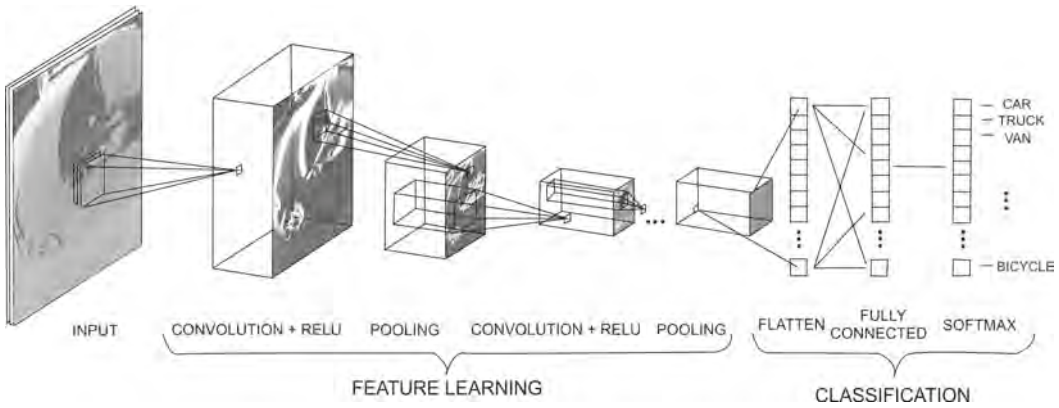
The pilot isn't due for completion until next year, but already Frey is unequivocal about the Tampa CV project being one of the most rewarding of his career in terms of lessons learned and the variety of organizations worked with.

As the findings of the program become clearer and more certain, the most rewarding part could be yet to come.

Parking systems that harness artificial intelligence

The demands placed on modern parking lots are growing in complexity. They need not only to be bright and friendly – and offer larger parking spaces for today's larger vehicles – but the best facilities must also guide drivers intelligently to available spaces. Moreover developments in autonomous parking are running at full speed. However, any parking guidance system is only as good as the information it is given. Reliable data requires a high level of accuracy in capturing the current parking situation.

Left: **The Nosco is a hybrid camera that relies on two sensors**



Below: **Neural networks assist parking systems with object tracking**

Two ways to go

There are essentially two approaches used today – single-space sensors and the balancing method.

Single-space sensors offer a very accurate picture of the current occupancy situation and also support intelligent parking guidance systems inside the parking lot to guide drivers to open spaces. However, this type of detection system involves equipping each parking space with a sensor, and for parking facilities with a large number of spaces, the installation investment is high.

A balancing system is an economical alternative that uses sensors only at the entrances and exits of the parking lot. However, the system must be extremely accurate in detecting incoming and outgoing vehicles, since detection errors will gradually add up.

RTB offers solutions for both approaches, which can be combined flexibly with one another.

The Lobo single-space detection system uses modern sensors to capture the current occupancy situation of each parking space. For parking lot operators that cannot afford the time or expense for such an installation, RTB also offers a balancing parking system. Nosco is a hybrid camera system that works with a neural network to provide excellent detection rates, even when driving situations are very complex.

Need to know

Comparing the advantages of single-space and balancing parking information solutions

- Single-space solutions are more accurate
- Single-space solutions can interface with car guidance systems
- Balancing solutions are quick to install
- Balancing solutions cost less

Balancing system

The Nosco hybrid camera consolidates data recorded by two sensors (camera and radar) located at the entrances, exits and ramps of the parking lot. With the help of a neural network, a heat map is first generated for each of the hybrid camera's images. This shows where vehicles are most likely located and a position map shows the position of any object that has been detected. Using this data, object tracking creates a tracking profile for each moving object. This profile contains data on the position and size of the tracked object, which is collected throughout the entire time the object is tracked. If the object leaves the hybrid camera's field-of-view, the tracked object is displayed and compiled with the radar data and possibly data from another hybrid camera. A plausibility check is then

performed. Objects that are too small, were not tracked long enough or have an implausible movement profile are no longer analyzed.

A balancing method then determines the occupancy status of the parking lot with an accuracy of 99.8% and transfers the data to the parking guidance server, which controls the displays accordingly.

Environmental or weather-related disruptions, such as fog and dust, do not affect the results thanks to data fusion. Even if the first sensor fails, the second continues to deliver accurate data.

Single space system

Artificial intelligence is a buzzword that will surely make greater inroads into the traffic industry over time. The first step in this direction in the parking sector has been made by the Nosco system and its implementation of a neural network. Major advantages include very robust signal processing with a high degree of detection quality thanks to the learned mining of complex patterns and characteristics.

By using a neural network, parking lot operators no longer incur development expenditure in adapting the system to local conditions. They only need to expand the training data and train the system, which means enormous savings in time and cost. The challenge for the future of parking will now be to build on these innovations and exploit their potential. ○

by **J J Eden**

Toll payment options must continue to evolve

Tolling has been the tool with which our nation built the infrastructure needed to develop and expand our economy.

The first major toll road in the USA was the Philadelphia and Lancaster Turnpike, built in the 1790s. The owners of this road included stagecoach companies, miners and ranchers, who relied on the road to protect their investments and attract business to grow economic activity. But generally the growth of tolling has been precipitated by the need to pay for needed infrastructure.

The development of major infrastructure has always been popular. Tolling? Not so much. To improve public acceptability, toll operators have often been the first to try new business rules, methods, procedures and technologies to keep pace with changing consumer tastes. Toll road providers know how to keep traffic moving while ensuring that everyone pays their fair share.

In 1959, when we were still forcing vehicles to stop in the middle of highways to collect coins in baskets or cash in toll booths, Nobel Prize recipient William Vickrey proposed a system of electronic tolling for the Washington Metropolitan area. This was then followed by the first RFID electronic toll collection system in the USA on the Dallas North Tollway in 1989 and the first fully automated toll highway in the world was in Ontario on the 407 ETR in 1997. These advances were extremely popular and have been broadly adopted across North America over the past 20 years.

Today, with free-flowing traffic under our gantries, tolling is providing an even easier way for payments to be collected and has become ever more popular.

However, 'tolling' is now part of a broader mobile payments framework. We are moving into a world where electronic toll infrastructure can be part of in-vehicle payment systems used for other things such as parking and fast food. Large private companies want to participate.

In recent months several large companies have announced investments in in-car payment systems – some are already automotive players, while others are outsiders keen to enter this lucrative market (Waze/Google, Apple).

These companies are following consumer preferences in retail payment services and technologies. Even big retail

"We are moving into a world where electronic toll infrastructure can be part of in-vehicle payment systems"

stores are eliminating cashiers in favor of mobile apps to pay for purchases. Toll operators, as part of this larger consumer payments framework, will have to follow suit. We will have to accept multiple payment systems provided by multiple private companies' back offices and payment services. Toll facilities will become another guaranteed payment point-of-sale, not unlike most retail establishments, where payment and collection are handled through an outside company.

The toll industry can leverage this pool of payment channels to reduce fixed operations costs and offer customers more. These changes offer the chance for more retail services, more autonomous and connected vehicles, and other prospects not yet envisioned.

The toll industry does not have a choice whether or not to jump into this pool, only whether to jump in the shallow end now or wait and get pushed into the deep end.

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

How to win the battle against rising vehicle emissions

Air pollution is one of the most significant challenges that faces major cities around the world, and London is a prime example, where around half of all particulate matter and nitrous oxide emissions come from road transportation.

As part of a series of initiatives to clean up London's toxic air, on April 8, 2019, Transport for London (TfL) is to introduce an Ultra Low Emission Zone (ULEZ) in central London. From then, most vehicles, including cars and vans, will have to either meet new, tighter exhaust emission standards, or pay a daily charge to travel within the ULEZ area. From October 2021, this area will be expanded to include the whole of inner-London, bounded by the city's North and South circular roads.

At the heart of the ULEZ will be a software solution developed and installed by Siemens Mobility. The software will be integrated with existing roadside sensors and automatic license plate recognition (ALPR) cameras, which already form part of TfL's congestion charging scheme. For more than 10 years, Siemens Mobility has been responsible for this system, the world's largest congestion charging scheme, with the company having designed, built, operated and maintained it.

The ULEZ and congestion charging systems will both use Siemens Mobility's advanced, multi-lane, free-flow tolling technology, which extends throughout London. The system offers the highest level of performance and operates at greater than 99% reliability.

During the first 10 years of the congestion charging scheme's operation, more than two billion vehicle detection records have been processed, all with industry-leading security and transactional integrity.

New technology

The new ULEZ software solution will monitor and control the passing of highly polluting vehicles through designated geographical areas, creating a comprehensive set of data and enabling reliable and rapid identification of vehicles that do not meet the emission standards.

Left: **The emissions levels of an electric vehicle fleet (above) compared with that of a standard fleet (below) modeled in Aimsun Next**

Need to know

A range of solutions are available to traffic managers to help them improve air quality

- Low emission zones, enforced using ALPR, linked to a vehicle database
- Traffic emissions modeling, which can help to inform signal timings to optimize flow
- Traffic optimization and bus prioritization to reduce stop/start emissions

Noel Frost, head of global enforcement at Siemens Mobility, explains, "The congestion charge system infrastructure will be used with ALPR to identify and register every vehicle that enters the ULEZ – 24 hours a day, seven days a week, 365 days a year. This information will then be transmitted to a data center, where our software will determine the compliance of the vehicle based on its emissions profile.

"The system has to process an immense volume of data," says Frost. "The data also has to be processed and stored in such a way that it can be used as a basis for notifications of fees. Drivers of high-polluting vehicles on streets within the

Left: **Software in the camera can quickly identify vehicles**

ULEZ will face very high penalties for non-payment and so some drivers will inevitably attempt to take legal action to avoid payment. The information the system gathers and holds therefore has to constitute a strong basis of evidence."

Modeling emissions

In 2018, Siemens acquired Aimsun, an expert in transport modeling and simulation, and a similar innovator and market leader, also working closely with TfL to help London achieve its low-carbon goals.

Among the company's portfolio of software solutions is Aimsun Next, which allows transport planners to build a digital twin of transportation networks of any size and then simulate the trips that people want to make. The latest release of Aimsun Next mobility modeling software includes a London Emissions Model (LEM), which was developed by the Institute of Transport Studies, University of Leeds, for TfL, and then integrated into Aimsun Next in order to enhance the accuracy of emissions predictions.

The LEM measures pollutants in both microscopic and mesoscopic simulations and includes options for modeling CO_2 and NO_x emissions from configurable fleets of vehicles. Whereas traditional average-speed models tend to under-predict emissions at low speeds, the LEM derives the emissions for individual vehicles using their average speed in a set of micro trips, which, when combined, form their whole journey.

Traffic emission simulation also demands a detailed understanding of the composition of the fleet, including vehicle and engine types, age and (in Europe) the Euro emissions standard proportions. Consequently, an interface has been established to specify the vehicle and powertrain type (petrol and diesel ICE, hybrid, EV) for all vehicles, with the LEM configured to reflect driving conditions in central, inner and outer London.

"The addition of the London Emissions Model to our modeling suite means we can offer far more accurate measurement and prediction of the type of emissions typically encountered in urban situations," says Gavin Jackman, director of Aimsun Ltd. "This is something that was previously very difficult to represent realistically, and which allows traffic authorities to use our software to address emission hot spots around the UK."

Holistic approach

The model could be used to inform the urban traffic control system, enabling environmental considerations to form a part of the overall traffic management strategy; for example, signal timings could be adjusted to strategically adjust the flow of traffic when pollution levels rise.

Although London is the first ULEZ scheme to be introduced in the UK, a number of other authorities are adopting their own methods of tackling the issue of vehicle emissions in their cities, while still many others are showing interest in exploring the options available.

"A ULEZ is one of a number of solutions we can provide to local authorities that will help to manage and bring under control the issue of emissions, providing a proven enforcement solution," says Frost. "In the longer term though, as emission levels are brought under control, Siemens Mobility can provide a range of additional controls and management tools that will help a city to operate its traffic system in a safe, clean and efficient manner.

"Of course, the enforcement of clean air zones is an obvious tool to reduce pollution and make our cities healthier places. But having a portfolio of tools to understand and manage traffic efficiently helps significantly. With digitalization, we are helping mobility operators worldwide make their networks and infrastructure more intelligent and ultimately to enhance the road-user's experience; for example, through efficient bus prioritization, increasing use of electric vehicles and even upgrading traditional traffic signals to LED units. All these elements combine to deliver a more efficient transport network and a cleaner, healthier and more attractive environment."

Minimizing workzone disruption with a traffic control radar solution

Refurbishing a busy junction in the center of Hastings, UK, presented several challenges for road providers Costain and Jacobs, and public authority East Sussex Highways. Street lighting and traffic signals supervisor Nick Killick was keen to avoid further intrusive workzone, as well as being aware that the site's topography could create difficulties for above-ground detection. The solution, AGD's 318 Traffic Control Radar, far exceeded his expectations.

The junction of Blackman Avenue with Marline Road in Hastings is one of the busiest in the town, and running it smoothly is a priority for East Sussex Highways. The decision to switch from loop-based to above-ground detection was taken as part of a refurbishment and improvement program that was completed in September 2018.

"We've had a lot of success with the AGD 318 in other locations and we wanted to try it here – partly because of the already high level of works that have taken place on underground services in the area," says Killick. "These tend to create problems with loop detection and we knew that if we stayed with this method the new loops would only be a short-term solution." To make matters worse, speed humps in the road meant that loops couldn't be placed precisely where they were needed.

However, the layout of the road presented some obstacles for an above-ground solution. "Historically this hasn't been a good site for above-ground detection because we couldn't get a clear view of approaching traffic," explains Killick. "There's a bend leading up to it, but it's also on the side of a hill. There are also lots of trees and bus stops that can get in the sight line of radar."

Need to know

Key features of the AGD 318 radar include:

- Accurate virtual-loop technology
- Approach and recede detection of vehicles
- Stationary/queued vehicle detection
- MOVA compatible
- Low installation and maintenance costs
- Comes with wi-fi AGD Touch-setup

Killick and his team wanted a solution that would be discriminatory, to minimize false detections – for example, from waving trees. "Telent helped us do some site tests using the AGD 318, which provided an excellent solution," says Killick. "In fact it has turned what used to be a problematic area into a very efficient site."

Hard problem, easy solution

"The result has really impressed us," says Killick. "The site is also running MOVA [microprocessor optimized vehicle actuation] and it's working really well – particularly with the recent enhancements that allow for monitoring of stationary and queuing traffic."

Reliable and cost-effective, the 318 was developed from enforcement-grade technology and provides accurate virtual loop detection with speed discrimination, emulating two inductive loops to a range of 150m (492ft) or lane-specific detection up to 40m (131ft).

Because it is pole-mounted, the 318 is simple to install and maintain, requiring no ducting or intrusive works, and no traffic management or associated disruption to road users. It is also quick to set up, thanks to AGD's wi-fi Touch-setup and enhanced user setup graphical user interface (GUI), which allows engineers to configure the radar from their vehicle. Detection zones can be changed or moved just as easily.

Able to detect vehicle types based on range, speed and direction of travel, the AGD 318 offers flexibility for MOVA schemes, speed discrimination,

Left: **The AGD 318 enables detection zones to be easily selected and changed**

bus priority and single turning movements.

Killick is delighted with its performance. "We were not expecting such reliable detection, due to the bus stops and trees near this junction, and the added complication of the junction approaches," he says. "Any problems we've experienced with this site have been overcome and the junction is operating far better than it had done previously. I would consider this solution in similar circumstances, and I'm looking forward to using the AGD 318 to solve future detection challenges." ○

by **Don Hunt**

Are we putting enough C into CAV?

"While the connected vehicle technology debate – DSRC or cellular – continues to slow down government officials' and auto makers' direction for connected vehicles (CVs), highway operators are moving ahead with DSRC-based vehicle-to-infrastructure (V2I) demonstrations projects. The objective is to gain technical and operating experience with V2I and produce some immediate benefits from the projects.

In the latest AV 3.0 policy document, the US Department of Transportation (USDOT) addressed the current relationship between connected and automated vehicles. "Communication both between vehicles [V2V] and with the surrounding environment [V2X] is an important complementary technology that is expected to enhance the benefits of automation at all levels, but should not be – and realistically cannot be – a precondition to the deployment of automated vehicles."

The USDOT had no choice but to take this position given that its 2016 rule-making for light vehicles to include V2V communications no longer has a completion date. Meanwhile Level 4 autonomous vehicle (AV) testing continues in cities across the US.

In the US there are more than 70 V2X pilot project deployments using DSRC wi-fi for connectivity. A few of these are supported by USDOT grants, but many more are funded by state DOTs or cities. In most cases, roadway agencies control the installation of roadside devices, but struggle to outfit a meaningful number of connected vehicles. State and locally funded projects focus on installing DSRC radios in fleet vehicles to gain operational experience, but also to provide immediate benefits to functions such as bus and snowplow signal priority.

Two major federally funded connected vehicle projects in New York City and Tampa, Florida, have greater connected vehicle scale, anticipating almost 10,000 connected vehicles between the two deployments. At this scale, the CV information gained by roadway operators will be much greater, and both city deployments anticipate larger scale roadway safety and operational benefits created by the real-time data transmitted by vehicles.

"AVs will be dependent on onboard sensors for at least a decade after their introduction"

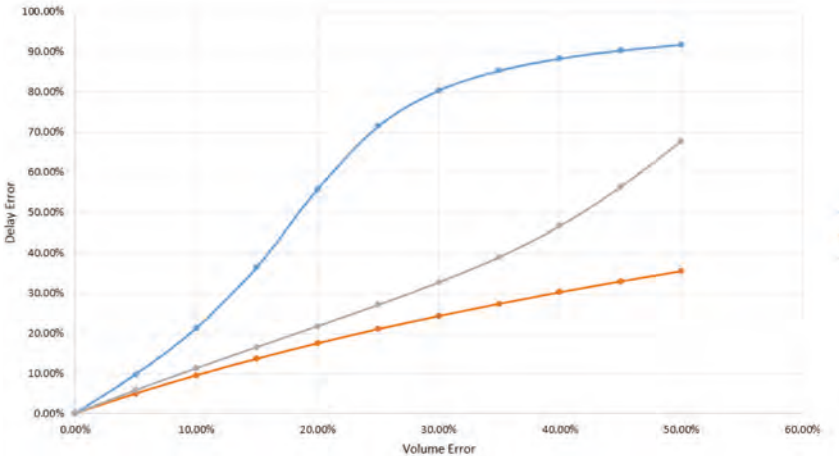
Cellular communications companies are beginning to roll out 5G service. 5G promises 10 times faster data speed, less processing delay and greater connectivity. Moreover, early tests of cellular V2V and V2I have shown that this new technology can connect vehicles and infrastructure locally without depending on the cellular network. At the same time, data can be uploaded to the cellular cloud without the use of roadside units and construction of a new fiber backhaul system required by DSRC.

There are possible benefits as AVs are connected, for example a bigger picture look down the road to alert a vehicle to congestion or safety problems, and the platooning of vehicles to improve lane capacity. But given the CV technology dilemma, the reluctance of the federal government to mandate installation of connectivity on new vehicles, the slow US fleet uptake of connectivity and unresolved cybersecurity concerns, AVs will likely be dependent on onboard sensors for at least a decade after their introduction.

Don Hunt is a transportation consultant and former director of Colorado DOT; ***dhunt@anteronet.com***

When guessing works better than tube data

Traffic data specialists at Miovision are big advocates of using video over pneumatic road tubes to collect traffic data. They recently presented a webinar comparing the use of pneumatic tubes and video data collected using Miovision Scout, proving video to be superior from an accuracy standpoint. Here, some analysis backs up the importance of using the most accurate data available, and shows the difference data can make in traffic engineering analysis. Spoiler alert: the results were surprising – even to Miovision!



Left: **The effect of volume when counting error on average delay calculations using the HCM method**

Below left: **Collecting the tube data in New York City**

Data collection

Miovision completed a study in New York City during a 72-hour period. Working alongside its partners at Traffic Databank, both road tubes and Miovision Scout units were deployed in two locations within the city. The objective was simple: gather data using both methods, and compare results.

Video data collected in both locations was verified by Miovision using manual observation. And, despite areas of undercounting due to blockages or breakage, road tubes still counted an average of 13% more vehicles than were observed in video. It's also interesting to note that in one of the two locations, equipment failures (due to breakage and blockages) resulted in tubes reporting 35% fewer vehicles on average compared with the video. So, there was anywhere from a 13-35% loss in accuracy when using road tubes.

To illustrate the impact of this, Miovision modeled a typical four-way intersection in a peak-hour scenario and assumed a 15% overcounting on all volumes at the intersection. This resulted in a 50% increase in average estimated delay (from 27.8 seconds to 41.8 seconds).

The chart above expands on the results. The bottom axis refers to volume over estimation error. Sensitivity analysis showed how overestimation of the volumes affected the intersection's average delay estimation using a Highway Capacity Manual (HCM) formula. The analysis was conducted in three different levels of saturation (under-, over- and near-saturated).

For all three levels of saturation, there is a strong relationship between volume error and delay error, but as the level of saturation increases, the effect of error is much more significant.

Results

There may be some situations in which the low-cost benefit of road tubes outweighs the skewed results – for instance, in a very undersaturated environment with low counts. In this situation, agencies may be willing to live with the results for the low cost of tubes.

However, at the low end of the scale at about 15% loss of accuracy, you will average about a 40% error in the delay estimation – and it only gets worse. As you get up to the 35% loss, you see a staggering 85% error in your delay estimation. In truth, one could argue that at that point, an educated guess using already available data may work better than road tube data for this type of analysis.

Agencies use traffic data to plan, build, monitor and operate their infrastructure.

The outcomes of these traffic projects directly affect cities and their citizens, and they are indicative of how tax dollars are spent on cities themselves.

One could imagine the negative impacts on the economy and driver experience, when completing traffic projects based on faulty data. That's why it's imperative to work with data that truly represents real-world circumstances when completing a traffic project. ○

Need to know

A comparison of road tube data versus video provided the following takeaways:

- Video is a good source of ground-truth data
- As saturation on roadways increases, road tube data begins to fall apart
- Road tubes may work in areas of low saturation

Using CCTV to keep cycle lanes clear

On average, every week, from 2011 and 2016, two people lost their lives and a further 62 were seriously injured while cycling on UK roads, according to the UK's Department for Transport (DfT).

Improving road safety can help increase the number of people taking up cycling and this can help to reduce congestion and emissions, ultimately improving air quality.

Local authorities in the UK are already starting to take action against illegal parking on cycle lanes and pavements to remove obstructions that often force cyclists to ride on main roads. According to the DfT, such obstructions currently account for 15% of UK cyclist casualties.

CCTV enforcement

Duncan Dollimore, head of campaigns at Cycling UK, believes changes need to be made to save lives on the roads. "Although it's already an offense to park in a mandatory cycle lane, the reality is that as a result of the decline in police traffic numbers, this has been widely ignored and rarely enforced," he says. "Giving local authorities the power to enforce this offense with CCTV cameras is one of the simple solutions Cycling UK has proposed in its response to the government's cycling and walking safety review."

CCTV cameras provide a cost-effective way of enforcing cycle lane contraventions, either fixed on a nearby lighting column or deployed on a mobile enforcement vehicle (MEV). Significantly, Videalert's unique digital video platform supports multiple traffic management and enforcement activities simultaneously, often with the same camera assets. This means that the capability of MEVs – whether they be cars or bikes – that are already in use to enforce illegally parked vehicles in schools' marked 'keep clear' zones, bus stops, bus lanes and red routes, can quickly and easily be extended to capture the license plates of vehicles parked in cycle lanes.

This highly flexible mobile system integrates with all back-office penalty charge notice processing systems to ensure timely enforcement, as well as with police systems for the identification of blacklisted vehicles for improved community safety.

With the introduction of clean air and low emission zones in some of the UK's worst polluting cities, perhaps some of the revenue generated should be reinvested in encouraging active transport. This belief is supported by Sustrans, a walking and cycling charity that states that clean air zones will not solve air pollution on their own – a behavioral shift away from vehicles is needed. What is now clear is that improving air quality requires a variety of approaches, including encouraging people to see cycling as a real alternative to their cars, particularly when traveling to and from the workplace.

"Investments that are being made in promoting cycling and installing the infrastructure are just the start, and significant change will only happen when roads are safer for cyclists," says Tim Daniels, sales and marketing director at Videalert. "A behavioral change from motorists is required to achieve this, whether it's by them getting on their bikes or adopting a more considerate approach when parking. Simultaneously, to increase compliance, enforcement technologies such as those provided by Videalert will enable councils [local authorities] to play their part in further reducing the unacceptably high level of accidents involving cyclists."

Left: **CCTV is in place at many cycle lanes in the UK to improve safety for cyclists**

Below: **Videlaert's digital video platform integrates with penalty charge notice systems**

Need to know

Videalert offers automatic license plate recognition (ALPR) solutions for traffic applications, including:

- Traffic management and enforcement
- School safety
- Parking management
- Data-sharing for smart cities
- Clean air zones/low emission zones

Average speed enforcement gets impressive results in Scotland

Authorities across Europe are now embracing the proven benefits of average speed enforcement, understanding that not only does it bring down casualty rates, but it can also improve the flow of traffic, limit the quantity of harmful emissions and be seen as fairer and more acceptable by the traveling public. Scotland in particular has taken advantage of this technology, covering a huge variety of carriageway and environment types.

There are now more than 220 miles (350km) of Scottish roads under the benevolent, watchful eye of Jenoptik's SPECS. These routes demonstrate clearly that the benefits can be seen on all carriageway types, rather than just rural roads or motorways, for example. From Europe's longest enforcement scheme on the A9 – with around 140 miles (220km) of enforcement – down to quarter-mile (400m) long urban schemes in Glasgow, these installations have demonstrated that driver behavior changes and greatly improves wherever SPECS cameras are operated.

Urban success

There has been a considerable improvement in driver behavior and speed limit compliance since Scotland's first urban average speed camera (ASC) system went live on Old Dalkeith Road, Edinburgh, in 2017. Jenoptik's SPECS3 Vector system was introduced to improve road safety on the route, reduce the number of collisions and encourage motorists to drive within the speed limit. Since the cameras went live there have been on average only two offenses recorded per day. This is a major improvement in driver behavior, considering three in every five vehicles were speeding prior to the installation of ASC. In addition, during the past year there have been no injury collisions reported on Old Dalkeith Road within the monitored area.

Another example is the recent installation on Mill Street in Rutherglen, Glasgow. This site has already seen clear improvements in driver behavior despite the cameras being in place only a few weeks. One of the most promising statistics is the continued fall in offenses on a month-to-month basis. Another added benefit of average speed cameras is their ability to improve journey times, and this has been apparent despite the Mill Street installation being only 0.6 miles (1km) long. Traffic flow has improved due to the consistent lower speeds, with an improved journey time of 10-15 seconds over this short distance.

A final example of the benefits seen from average speed enforcement is the A90 between the central belt of Scotland and the northeast of the country. Covering 50 miles (80km), this section of the A90 typically carries around 23,000 vehicles a day. The road had a high casualty history, which had previously been addressed using spot speed cameras and mobile enforcement. But while this approach delivered good levels of speed limit compliance at the camera locations, camera 'surfing' occurred, involving cars speeding up and slowing down between locations.

It is sometimes said that driver behavior is extremely difficult to change, taking many months or years to influence. However, the A90 system provides a perfect example of how ASC technology has encouraged a rapid change

Scotland's first urban average speed cameras were introduced in 2017

Need to know

Compliance rates since the average speed system was installed on the A90 in Scotland

- 99 out of every 100 vehicles are now driving at or below the 70mph (113km/h) speed limit. Prior to installation, only 40 out of every 100 vehicles were at or below 70mph
- Only one in every 5,000 vehicles is now driving at more than 10mph (16km/h) over the speed limit. Prior to ASC installation one in five vehicles was driving at this excessive speed
- Speed surfing has been eliminated, with 85th percentile speeds below 70mph at all locations. Prior to installation the 85th percentile speeds were between 80mph and 90mph (129-145km/h) at most locations

in driving behavior. Since the system launched in October 2017 the trend has been extremely encouraging (see *Need to know*, left).

The Scottish experience is in no way unique. A well-designed average speed enforcement scheme will always deliver a better, safer, road environment. As technology progresses, a number of innovative concepts are enabling these benefits to become more accessible and achievable, allowing those responsible for road and public safety to make ever greater improvements. ○

Richard Butter

To meet today's traffic challenges, we must collaborate

At the end of October last year I arrived at Jakarta International Airport for Intertraffic's first ever Indonesia show.

It's always fun to travel by taxi in a vibrant city such as Jakarta. Using Google Maps, I showed my driver the location of my hotel, and while doing so I immediately noticed a new feature in the app. Normally, when planning routes, you can select a travel mode – car, public transport, bicycle or walking. I noticed that in Jakarta a motorcycle had been added. This made sense because motorcycles are so commonly used in Southeast Asia.

And yet, such is the popularity of two-wheeled motorized transport, that some cities in the region are moving to ban motorcycles in a bid to curb pollution and congestion. Even Jakarta is trialling such a ban on three major streets. But many believe this isn't the solution."Motorcycles shouldn't be banned because the current public transportation system is far from integrated," Nursal Ramadhan, coordinator at the newly formed Anti Motorcycle Restriction Movement, recently told the *South China Morning Post*.

As I sat in my taxi on the way to the hotel, going nowhere fast, I got first-hand evidence of the fact that Jakarta is one of the most congested cities in the world. Solving this seems impossible. Where do you start? We live in a technological era, but as a starting point, technology isn't what this city needs. It needs better infrastructure and more modal choices.

The other thing I observed as the taxi edged slowly along was the multitude of motorcycles driving alongside each other, as well as weaving in and out between cars. They appeared to be driving in harmony – like a school of fish – almost as if they had special radar to avoid collisions. However, appearances are sometimes deceptive – statistics show that traffic safety in Indonesia is another cause for concern.

The World Health Organization Global Status Report on Road Safety shows that motorcyclists account for over 61% of road fatalities, so added to congestion and pollution concerns, tackling the country's safety issues is another key challenge for traffic managers and politicians.

Addressing key risk factors such as helmet-wearing has been identified as pivotal to reducing road traffic deaths. As such, motorcycle helmet laws for both drivers and passengers have been implemented in the country. Yet despite this legislation being in place, only 52% of passengers currently wear helmets.

> "Public authorities and businesses are seeking ways in which they can work together"

Around the world there is a collective effort to reduce road deaths and injuries and mitigate the social and financial burden they place on society. In a bid to move toward achieving this goal, governments, public authorities and businesses are seeking ways in which they can work together to support the improvement of traffic enforcement, and increase public education on road safety.

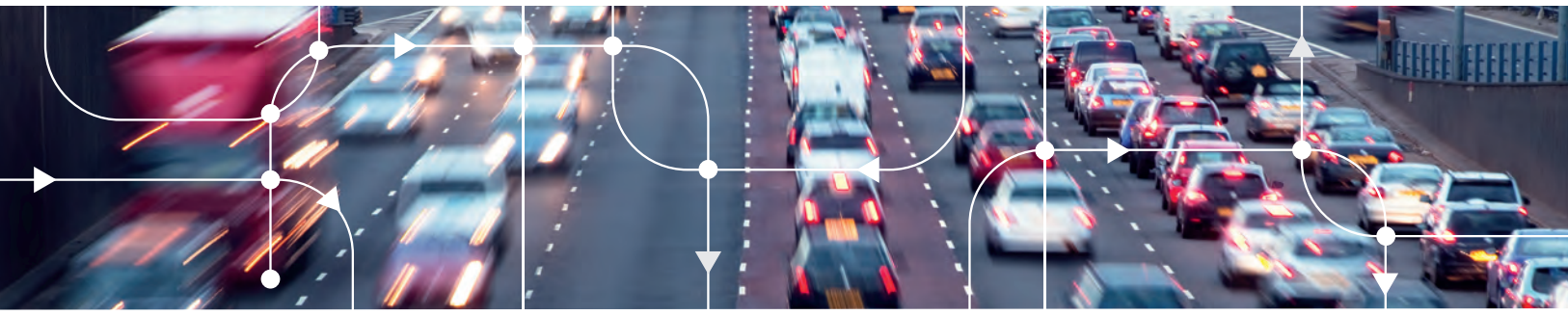
And so, as my hotel finally came into sight, I could reflect with a sense of hope, that while I was undoubtedly one more person using the congested road system, the reason for my visit – Intertraffic Indonesia, which enables greater collaboration within the industry – may be part of the solution to Jakarta's transportation challenges.

Richard Butter is director of traffic technology at RAI Amsterdam and is responsible for Intertraffic worldwide events, ***www.intertraffic.com***

Intertraffic

The leading traffic technology events connecting traffic professionals worldwide

INFRASTRUCTURE • TRAFFIC MANAGEMENT • SMART MOBILITY • SAFETY • PARKING



Save the dates for our upcoming events

ISTANBUL - TR
10 - 12 APR **2019**

SHANGHAI - CN
27 - 29 MAY **2019**

JAKARTA - ID
6 - 8 NOV **2019**

MEXICO CITY - MX
12 - 14 NOV **2019**

AMSTERDAM - NL
21 - 24 APR **2020**

Organised by: rai AMSTERDAM

In partnership with: TTEC, ITS China 中国智能交通协会, UBM, Tarsus MEXICO, Tarsus INDONESIA

www.intertraffic.com

Improving traffic flow with real-time software

The main transport corridors of the Taiwanese city of Taichung are suffering from heavy congestion. Especially during peak hours, but also at holiday times, the intersections in the suburban area of the Daya Region, close to the ramps of Freeway 1 and Expressway 74, are packed with traffic.

The highway ramp metering system often leads to oversaturation and congestion, spilling back onto the associated urban roads and junctions, thereby reducing overall network efficiency.

On particularly busy days, motorists driving on Huanzhong Road from east to west experience delays of up to 45 minutes. Cars traveling from south to north on Zhongqing Road are also frequently affected. In total the area covers 535km of roads with 61 signalized intersections.

To improve traffic flow, Taichung City has already implemented some engineering actions, mainly involving adding extra lanes at junctions.

Next-level enhancements

For Taichung City to make the best use of its existing infrastructure and further optimize traffic flow on a strategic level, in October 2017 it joined forces with FarEasTone Telecommunications (FET) and PTV Group to implement an intelligent transportation system consisting of the real-time traffic management software PTV Optima and the traffic-adaptive signal control software PTV Balance. Complete with Traffic Supervisor, a single integrated user interface, the ITS is based on real-time data and gives traffic operators the opportunity to test and evaluate alternative strategies before applying them in the field.

Left: **PTV Optima offers alternative route guidance**

Need to know

Key facts about the PTV Optima traffic management software:

- It works with traffic-adaptive signal control software PTV Balance
- Combining real-time data with a model-based approach, it provides a detailed analysis of current traffic conditions
- It can provide a comprehensive forecast up to an hour ahead

PTV Optima combines real-time data with a model-based approach for a detailed analysis of the current traffic state and a comprehensive forecast for a period of up to an hour.

The system detects incidents at an early stage and helps operators work out a response plan to reduce negative impacts on the traffic flow. PTV Optima evaluates various measures and their effectiveness quickly and objectively.

Based on the analysis and prediction of PTV Optima, Taichung City can now provide motorists at the Daya interchange with alternative route guidance published on variable message signs.

As the real-time traffic management software calculates the effect of rerouting on the entire network area, drivers always receive reliable recommendations and know which alternative path they should take to access Freeway 1 and Expressway 74.

At six intersections in the Daya Region, the city installed the dynamic signal-timing solution PTV Balance to optimize signal control. Based on data input provided by detectors placed along the road network, the software identifies any changes in transport patterns and reacts to what is happening on the road. As a model-based control system, PTV Balance even goes one step further by automatically designing a range of signal control options and sending the optimized signal plans to the local controllers every five minutes. This way, Taichung City coordinates ramp metering in the Daya Region and reduces the overall travel delay for motorists.

Higher traffic throughput

During the five-month project, from October 2017 to February 2018, PTV Optima and PTV Balance enhanced the network capacity to enable a higher traffic throughput, enabling drivers to reach their destinations faster and more conveniently.

In detail, PTV technology reduced the area-wide average travel time by 9.4%, improved average traffic speed by 8.4% and increased throughput by 7.6%.

How to overhaul a traffic control center

The traffic control center in Kozina is one of the four regional control hubs in Slovenia. It covers the southwest part of the country's freeway system including the picturesque A1 freeway, which runs from the coast to the capital, Ljubljana. Operators control a host of assets (see *Need to know*, right) and register and resolve over 5,000 events each year. The A1 is a busy route, particularly in the summer, being a mainland connection to Italy and Croatia.

When Kozina traffic control center began its operations in 2004, only two tunnels and 13 miles (21km) of open road systems were controlled. In the following 12 years, Slovenia completed the majority of its planned freeways, and the number of systems connected to Kozina grew fivefold. The number of computers in the center also increased – each dedicated to a specific job. Every system was operated on its own, interfaces were different, and there was little interaction between them, which made management difficult, time-consuming and error-prone. Slovenian freeway operator DARS decided it was time for a facelift.

But the requirements were stringent. Without jeopardizing traffic safety, Kozina center had to be renovated inside and out. And so, during the renovation, the whole network was controlled from two local traffic centers, one on the A1 freeway (Markovec) and the other on the H4 (Podnanos).

Building a smart center

The project, which was undertaken by experts at Asist Systems, was divided into phases. First the existing systems (particularly the server) were duplicated, while the Kozina center remained in full operation. Also, redundant network systems were built, which could bypass the Kozina optical network completely. Servers in local centers were equipped with workstations and put into operation. SCADA (supervisory control and data acquisition) systems were installed and operation was tested at local centres in Podnanos and Markovec in Slovenia.

In phase two, operators moved from Kozina to local centers. Two groups of operators were needed instead of one, adding some additional stress at the beginning. However, a hope for better working conditions later put the operators and the contractors on the same side and their cooperation was amicable.

Kozina center was then completely renewed and a new server room with all the accessories (AC, sensor systems, fire systems) was set up. New CAT6 cables were installed allowing a 1Gb wired network between server and operator control rooms. A new LCD video wall enabled unified control and mixing of SCADA and video on the same monitors.

Photo: DARS

Need to know

Assets controlled by the Kozina traffic control center, Slovenia

- 117 miles (188km) of roadway
- Eight tunnels totaling 3.7 miles (6km) in length
- Four large bridges, including the 312ft (95m) high Črni Kal viaduct
- 432 detection and supervision cameras
- 71 full-graphic VMS
- 28 weather stations
- 278 SOS terminals
- 4 height-control systems

Above: **The workstations have been designed so that operators can perform all necessary tasks in one place**

With this phase completed, the Kozina center was fully functional, but the most important aspect of the project was still missing – the integration of the control software in a single workstation where an operator would be able to perform all necessary tasks.

The basic idea was to equip every workstation with three large 4K monitors. On the left-hand monitor, the operator can see all the alarms and control all tunnel's info; in the middle, there is a video control and detection system with control over all the cameras; and on the right-hand monitor are all the operator controls for open road systems. This distribution had a reason: it allows drag-and-drop of cameras shown on SCADA system screens to the central video monitor, allowing instant, live-stream video viewing, as well as recorded video management.

Three identical workstations with such software were installed. Two operators are permanently in the center and can choose where they work, and one workstation is spare. This also makes software or hardware upgrades easier.

Some systems, which previously had separate workstations, were integrated into tunnel and open road SCADA systems– namely radio and emergency call systems. The common alarm system now receives alarms from all systems and presents them in a unified user interface. All main applications also use the same login application, allowing a single sign-in point for one workstation.

Disaster management

The new server and network system enables the Markovec and Podnanos local centers to take over in the event of a catastrophic failure in the Kozina center, be it a fire, a power failure, or damage to main optical connections. In such a case, operators would have to move to local centers, but the working environment would be the same as in Kozina.

In each of the centers, a three-to-one redundancy in a virtualized server system is implemented, which aims for 'five nines' availability (99.999%, or five minutes of downtime per year). The database replication takes care that multiple 'live' copies of databases are available in case of database corruption.

The robust and user-friendly technology makes Kozina traffic control center the most advanced freeway traffic control center in the region. Asist is proud to have led the integration of the various ITS systems in the unified Kozina control station.

by **Larry Yermack**

Looking to the past for lessons about the future of transportation

I have been writing this column for several years now and have no idea how many people actually read it. When I mention it to friends in the industry many of them say that they do, but regardless of reader numbers, I enjoy it as an opportunity to opine on the state of the industry. As I approach another post-Medicare birthday, I've been looking back a bit more than usual. In this issue's column and then again next time I'd like to offer some reflections on both my personal story and the industry story over the past few decades. Let me start where my career began in transportation, back in the early days of computerized technology, and take you forward into today's wireless, connected world.

My earliest connection to what would become ITS was in the 1980s when I became the deputy commissioner of NYC DOT. We were, as we said at the time, computerizing NYC's signal system. It was pre-mainstream PCs and the box we had was known as an IBM 'mini'. We were completely dependent on IBM and so repeated discontinuation of lines of equipment led to repeated delays in implementation. I was there for three years and never got to flip a switch.

Another early implementation was the freeway management on two NYC highways. The monitoring was with cameras and the best way we could access them was with hard-wired connections and slow transmissions of video. Full motion video was a dream.

One more seminal event in that period was the LNG tanker truck that sprung a leak on the George Washington Bridge. Very quickly not only was the bridge shut down, but gridlock overtook the entire regional road network. All we had for communication was the telephone and bilateral links between agencies. That led to the creation of Transcom a multi-agency regional transportation information hub.

Fast-forward a decade to the Triborough Bridge and Tunnel Authority, where engineers were starting to test Automatic vehicle detection (AVI), the precursor to electronic toll collection (ETC). The guys in the back room were trying to find a tag and reader that would not interfere with the tags and readers that the Port Authority was planning to install for tolling. My inspiration was that we were asking the wrong question. Rather than 'how do we not interfere', it should have been 'how do we cooperate'? My idea was a single tag for all the toll roads, so I called a regional meeting and created E-ZPass.

> "The best way we could access cameras was with hard-wired connections

It's interesting to see that while I recounted these as seminal moments in my career, they can be seen as paradigmatic for the ITS business as a whole. In the first instance, it was computer power and the connection to the actual signals. In the second, it was video and its transmission back to the control center. In the third, it was regional communication. Finally with E-ZPass it was connectivity and regional standards. These are all of the past issues that we have solved them in ways that were unimaginable to us when we started out.

More next month on the implications of our solutions.

Larry Yermack is strategic advisor to Cubic Transportation Systems, California. He can be reached at ***lyermack@gmail.com***

Express lanes

Your shortcuts to some highlights you will find in this issue – and beyond!

"AutoAir at Millbrook is one of the most ambitious 5G testbeds in the world. We have completed deployment of a hyper-dense small cell network that delivers ultra-high capacities, enabling a range of new CAV use cases to be explored"

***Paul Senior**, CSO, Airspan Networks; CEO, Dense Air*

Read more about the UK's only independent 5G-enabled infrastructure for testing CAVs at **traffictechnologytoday.com/autoair**

"I can go on the website and pull up any single asset anywhere in the state with a precision of 2cm"

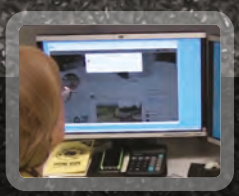
***Terry Bills**, global transportation industry director at Esri, on the ArcGIS Pro maps now displayed on UDOT's website*

Page 36

Page 28

"If you incorporate these systems into your operations, the data suggests that more drivers will seek alternative routes, thereby reducing congestion and crash risk"

***Gerald Ullman**, senior research engineer at the Texas A&M Transportation Institute, on smart workzone systems*



"District 10 has really come to familiarize itself with Facebook and Twitter and you can see that by how often we use it. It has become a tool that drivers have also learned to use"

***Rick Estrada**, public information officer, Caltrans*

Watch this video to learn how Caltrans has embraced social media for the benefit of drivers in the state: **traffictechnologytoday.com/socialmedia**

Index to Advertisers

AGD®

PRODUCT SOLUTIONS FOR
INTELLIGENT TRAFFIC SYSTEMS

Next-generation traffic and pedestrian control solutions

AGD **318**
TRAFFIC CONTROL RADAR

Enhanced Traffic Control Radar

- MOVA IN & X compatible
- New stationary and queuing traffic detection
- Non-intrusive virtual loop technology
- Fast, easy WiFi AGD Touch-setup

AGD **645**
PEDESTRIAN DETECTOR

Smart Optical Pedestrian Detector

- Larger 10x3m detection zone
- IP and real-time video for effective decision-making
- New volumetric capability in wait area
- Fast, easy WiFi AGD Touch-setup

Create integrated traffic and pedestrian control solutions for large-zone crossings with AGD traffic control radar teamed with the AGD 645 Pedestrian Detector. This smart optical kerbside detector, with its large 10 x 3m detection zone, is super-crossing compatible. Volumetric detection provides real-time dynamic adjustment to the pedestrian green phase to cope with fluctuating demand. Advanced optics offer enhanced detect and reject, and IP capability delivers real-time video and cancelled demand data straight to control rooms.

Visit us at Traffex on stand D026

+44 (0) 1452 854212 enquiries@agd-systems.com www.agd-systems.com

safer, greener, more efficient

THE TRAFFIC GROUP


PTV GROUP
the mind of movement
You know the benefits of establishing a smart city. We know how to realise it best.
With our traffic software, we help over 2,500 cities model, simulate, plan, analyse, and predict traffic and transport to optimize the flow of movement.
Take a virtual tour of our PTV Mobility Lab at ptv.to/mobilitylab or join the conversation, #MindofMovement.
www.ptvgroup.com