

# traffic

TECHNOLOGY INTERNATIONAL



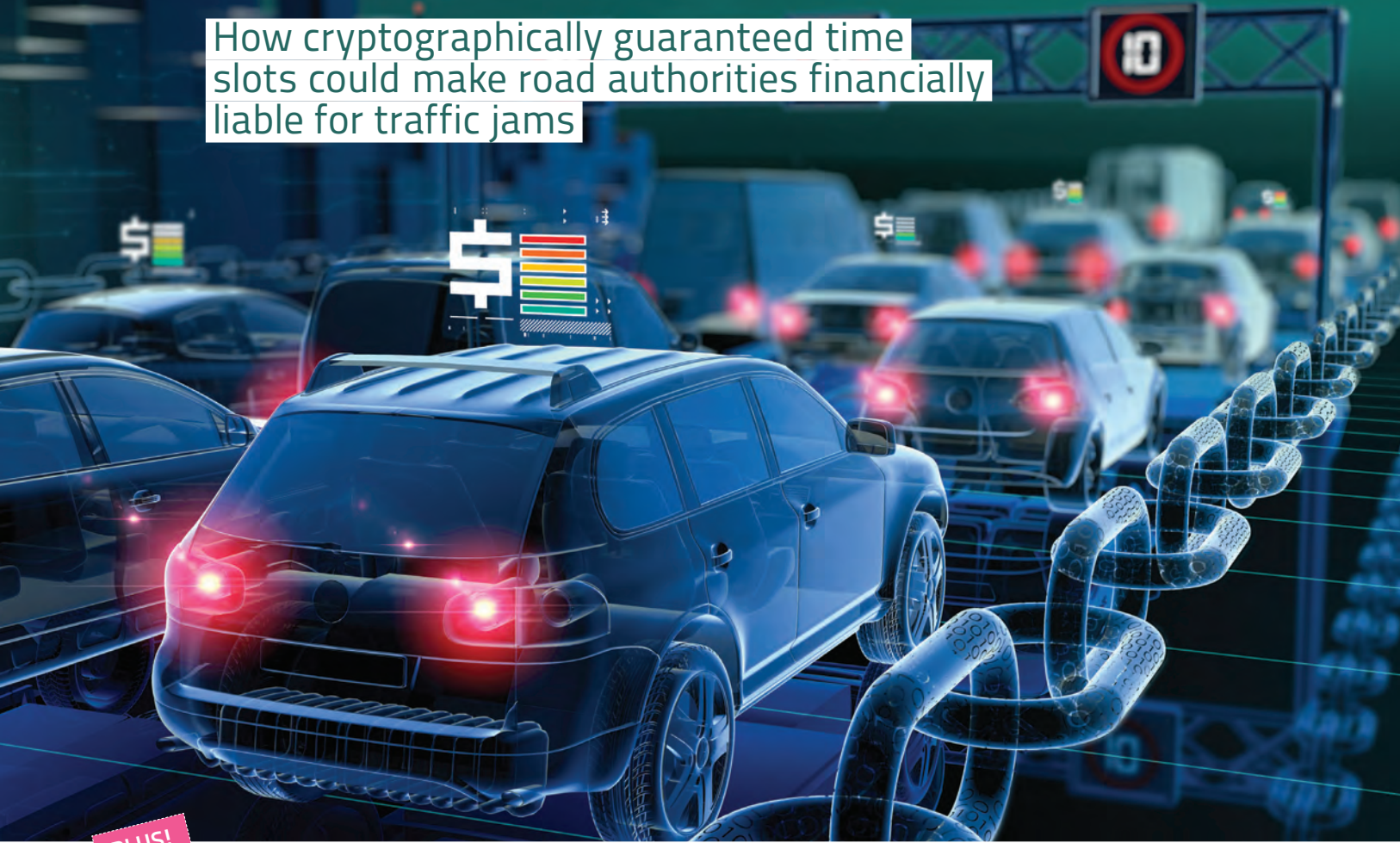
Autonomous Vehicle  
**SAFETY REGULATION**  
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EVENTS SPECIAL

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**Editor's letter**



'Why can't we all just get along?' This was the thought that ran through my head recently, when I found myself stuck in traffic in Central London. Admittedly, my friend in the passenger seat may remember slightly more colorful language, but my thoughts were pure, and about cooperation. Honestly. Why? Well, here's the story.

The plan was simple. Drive from north of London to drop off my friend in Sutton, South London, before continuing home to the south coast. The route, on the face of it, was even simpler – A10, M25, A24, with a minor detour off the M25 London orbital to drop off my friend. Not being completely *au fait* with the South London drop-off route, I set my in-car satnav at the start of the journey... a big mistake.

The midday traffic was light as we approached the M25. But the satnav didn't direct me onto the city's giant ring road as expected, but plowed on into London. This was a choice I never would have made myself, but I noted the estimated arrival time was around 1pm, just over an hour's time. Even if it was half an hour out, I would still have plenty of time to get home for my daughter's swimming lesson. I was sure it couldn't be that wrong. Over two hours (and God knows how many expletive-filled traffic jams) later, we finally reached Sutton

– a full hour after the estimated arrival time. A quick check of Google Maps en route had revealed a free-flowing M25, tantalizingly too far away for it to be worth turning back for by that time.

It's a story that's indicative of the strange, fractured state of the traffic navigation sector. OEMs, tech giants, navigation firms and public agencies are all competing to provide the best advice. And, more often than not, it's OEMs who come bottom of this list for reliability. Nevertheless this hasn't stopped all parties involved jealously guarding their data, refusing to share it for fear of losing out. But wouldn't it be so much better if we all just got along? What if all the parties collecting this data collaborated to build the ultimate traffic management system? If you think this is just an impossible dream, turn to page 70 to find out how a project is underway to make it a reality.

One of the test locations for SOCRATES 2.0, the project in question, is ITS World Congress host city Copenhagen, so you can be sure it will be under discussion there this September, along with a huge range of other key topics that will transform transportation in the coming years. Turn to page 20 for our full preview. Next stop, Denmark (satnav optional).

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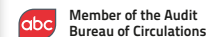
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\*Center for Transportation Research, The University of Texas at Austin.







**PREVIEW**

# Autonomous Vehicle **SAFETY REGULATION**

WORLD CONGRESS

**OCTOBER 23-25, 2018**

THE SUBURBAN COLLECTION SHOWPLACE, NOVI, MICHIGAN, USA

**D**espite the growing excitement surrounding autonomous vehicles, with the race to release fully automated models gathering pace, lawmakers are struggling to keep up. An absence of universal enforcement frameworks has created huge uncertainty about how automated vehicles of the future should be regulated, as well as who should be deemed liable in the event of an accident.

Organized by the publisher of *Traffic Technology International*, the Autonomous Vehicle Safety Regulation World Congress is an annual event that gathers together key industry experts to debate, and help to resolve, these issues.

From October 23-25 the world's only conference dedicated to defining autonomous vehicle regulations will take place in Novi, Michigan, alongside two other major autonomous vehicle symposiums. Here we reveal some of the event highlights

The Congress, which takes place in Novi, Michigan, from October 23-25, 2018, will enable attendees to explore how a regulatory framework can be created to pave the way for full public use of automated vehicles in the future. As well as moderated panel sessions, there will be networking events so that delegates can share ideas with their peers.

Visit the website below to book your place. Your ticket will also give you access to co-located events – the Autonomous Vehicle Test and Development Symposium and the Autonomous Vehicle Interior Design and Technology Symposium.

The next two pages give a taste of what to expect from some of the confirmed speakers at the event...

Discounts for early birds and bookings for two or more visitors!





**Autonomous Vehicle  
SAFETY REGULATION**  
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A not-to-be missed event with more than 60 expert speakers!

**SPEAKER HIGHLIGHT!**

One of the superstar panels at last year's event, left to right: moderator Don Hunt, Shailen Bhatt, Kirk Steudle, Leslie Richards and Malcolm Dougherty

Ahead of the event, we ask key speakers:

**What new legal and insurance frameworks will Level 4 and 5 autonomous vehicles require?**

**Carlos Braceras**

Director of the Utah Department of Transportation and chair of ITS America

“With 94% of vehicle crashes in the USA resulting from human error, the development and deployment of Level 4 and 5 vehicles has the potential to be a transformational element that moves us toward zero fatalities. But as with any

transformational moment in history, this will have ripples across technical and policy arenas, raising new areas of uncertainty: Who is responsible – the car or the driver? If it's the car, who is responsible for maintaining it and keeping systems up to date and functional?

“As a DOT guy, I'm learning a lot by spending more time with insurance professionals. This new world will require increased partnerships to achieve our vision of zero fatalities.”



Carlos Braceras is a participant of the *Autonomous Vehicles and V2X Connectivity* panel discussion, which will take place on **Thursday, October 25, 12:00pm**

To book your delegate pass for the Autonomous Vehicle Safety Regulation World Congress 2018 visit


[www.autonomousregulationscongress.com](http://www.autonomousregulationscongress.com)



**SPEAKER HIGHLIGHT!**

## Michael P Lewis

Executive director, Colorado Department of Transportation

 "In a possible future world where everyone rides in fully autonomous vehicles, there should be few, if any, crashes on the road. If there's a crash between vehicles that don't have steering wheels or


pedals, the chances are that the person in the vehicle will not be at fault. I can see the responsibility and liability of crashes shifting from drivers to manufacturers and autonomous systems managers. In this future, drivers might only need to hold insurance coverage to protect against things like vandalism, theft and 'acts of God'."



Michael P Lewis will participate in a panel discussion on *Challenges Surrounding AV Safety and Regulation* on **Tuesday, October 23 at 12:00pm**

## Sandee Perfetto

Coverage director, personal auto/umbrella product development, Verisk

 "Automated vehicles will impact the insurance industry in various ways. Individuals may not need the same type of personal vehicle insurance as commonly exists today, because they

will not actually be driving Level 5 vehicles.

"Furthermore the vehicle, instead of the driver, would play a greater role in policy underwriting and ratings. Questions of legal responsibility may grow, particularly with Level 4 vehicles, where drivers will be able to completely relinquish control for long periods of time. Vehicles' data will likely be a key tool in claims processes, including attributing fault in accidents."




Sandee Perfetto will give a presentation about *Coverage and Claims Trends in a Connected Car World* on **Thursday, October 25 at 4:30pm**

**SPEAKER HIGHLIGHT!**

## Thomas Alleman

Member, Dykema Cox Smith

 "Level 4 and 5 AVs contain myriad highly complex mechanical and electronic devices, which must function properly for them to perform as designed. The AV-to-human interface adds more difficult question; witness the March 2018 crash in Tempe,

Arizona, which raised questions about both AV and human systems. But as complex as these questions already are, AVs introduce something fundamentally new and different to the world of risk management: artificial intelligence. How to deal with the risks associated with the behavior of AI systems is entirely new territory for courts and insurers."




Thomas Alleman will speak about *When Good Machines Make Bad Decisions: Understanding Liability and Insurance Challenges* on **Thursday, October 25 at 4:00pm**

**SPEAKER HIGHLIGHT!**

## Neils de Boer

Director vehicle programs, Nanyang Technological University

 "The issue today is not who is liable, and associated legal questions, but rather what risk and

liability can be used to calculate the insurance premium. The real challenge is to quantify the risk and liability to ensure that insurance risk is appropriately covered in the premium paid."



Neils de Boer will present *A Singapore Technical Reference for Level 4 and 5 Autonomous Vehicles* on **Thursday, October 25 at 11:00am**

**SPEAKER HIGHLIGHT!**

**Autonomous Vehicle SAFETY REGULATION**  
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# Building blocks

ITS is a valuable tool for increasing capacity on our roads but sometimes extra lanes are needed as well, as **James Allen** discovers

## Making room for more

Highways England to increase M62 capacity by a third with smart project

 Contractors for Highways England are working on a smart motorway project that will see an extra lane added in each direction on a nine-mile (14.5km) stretch of the M62 near Manchester.

The scheme will increase the capacity of one of the UK's busiest stretches of motorway by a third. Work started in July and the entire M62 smart motorway scheme is due to be completed by spring 2020, benefiting the 120,000 drivers who use the route every day.




Congestion and unreliable journey times are currently experienced at busy periods and overall traffic is predicted to grow in the near future. Another stretch of smart motorway on the M62, near Leeds, has led to commuters saving an average of 30 minutes each week, despite an increase in traffic.

**30**

The weekly time saving, in minutes, experienced by commuters since the opening of a 15-mile stretch of smart motorway on the M62 near Leeds, England

## Intercontinental connections

First China-Russia road bridge to be completed in 2019

 Work has begun on a bridge to connect Russia and China for the first time.

Once completed, the road bridge will stretch 12.5 miles (20km) from Heihe in China to Blagoveshchensk in Russia across the Amur (or Heilongjiang) river.

Total costs for the project are expected to be in the region of RMB2.4bn (US\$300m) with a scheduled opening of the bridge in October 2019.


Due in part to the environmentally sensitive



nature of the river basin and the surrounding area, a cross-border bridge has been 28 years in the making. The cable-stayed bridge will shorten the route between the two countries by 1,200 miles (3,500km), with an expected tenfold increase in cargo traffic.

## Corridor extension

Florida Department of Transportation appoints Stantec to aid I-4 expansion

 Florida's Beyond the Ultimate (BtU) project, which will extend the I-4 corridor by 40 miles (64km), has recruited the services of multidisciplinary consultants at Stantec.

The Canadian company's US\$20m contract entails work from I-4 at US Highway 27 in Polk County to State Road 472 in Volusia County.

FDOT's BtU project extends the original I-4 Ultimate project another 20 miles (32km) to the north and also adds 20 miles to the south.

The program team will first review



design concepts for the southern sections of the I-4 to identify opportunities to reduce risks and costs while maintaining quality and corridor performance.

The Stantec team has in-depth knowledge of the I-4 corridor through previous work on BtU project development and environment studies, the ongoing segmentation analyses, and as the owner's representative on the I-4 Ultimate.

## Wide remit

Long-awaited I-75 reconstruction project close to starting after lead designer chosen

 Michigan Department of Transportation (MDOT) has made Parsons lead designer for the I-75 Segment 2 project.

Plans to widen and reconstruct the highway have failed to lead to action for nearly 20 years but the expectation that this will change is high with the appointment.

Under the Modernize 75 banner, the three-phase project encompasses 18 miles (29km) of freeway from M-102 (Eight Mile Road) to south of M-59 (South Boulevard) and has a current daily traffic volume of 103,000 to 174,000 vehicles.

Parsons will provide design services for the modernization and be responsible for the design and integration of new



ITS to enhance and expand MDOT's existing capabilities for traffic incident detection and emergency response management, traveler information systems, queue detection, curve speed warnings and connected vehicle systems.

The improvements will ease traffic congestion, meet current and future traffic and commercial needs for the entire region. The upgraded route is also being designed to improve safety, reliability and efficiency.





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# Solar signals

Just a few years ago, they said it couldn't be done – but now, around the world, solar traffic lights are starting to become a reality. **Eugene Gerden** reports on the current roll-out of the technology in Russia

Russia's ongoing roll-out of advanced ITS is set to be increasingly driven by the ultimate uninterrupted power supply – renewable energy. This focus on carbon-neutral power sources was backed by statements of intent from Russia's then Minister for Transportation, Maxim Sokolov, before he left his position in May.

The technology is part of a program known as Digital Economy of Russia, which outlines the introduction of a new generation of ITS and states that by 2023 the majority of it should be powered by renewables.

As part of the plans, traffic lights powered by wind and solar energy have recently been

installed on some of the busiest streets in the capital by the Moscow government, in cooperation with some leading domestic and global ITS providers.

The new technology was designed by the experts at the Scientific and Research Institute of Motor Transport (NIAT), one of Russia's leading research institutions in the field of ITS and road transportation, along with experts at LG and Toshiba.

Maxim Liksutov, head of the Department for Transport in Moscow, says these traffic lights do not need to be connected to the power grid, while installation costs are considerably lower than for conventional ones. The lights can have two independent power sources: a wind generator and a solar battery.

"These traffic lights are fully automated. Solar power accumulates in the battery, which feeds the device in the dark," says Liksutov. "The battery can be charged even in the event of



Above: Solar-powered lights are proving useful on rural roads not connected to the power grid  
 Left: Solar signaled crossings in Russia are equipped with pedestrian motion sensors

**5%**  
 The contribution that upgraded ITS will make to Russia's GDP growth per year  
 Source: ITS-Russia

cloudy weather during winter time and in other extreme weather conditions."

The incentives for Russia to focus on the use of renewable power are not purely environmental. The technology is likely to be extremely important for Russia when taking into account its vast rural territories, many of which have no connections with any power grids, yet have a large number of roads.

### Urban opportunities

Even in Moscow, the renewable-powered lights are cutting the need for the installation of new power networks. The initial stage of the project has seen the lights deployed on the streets of the new parts of Moscow surrounding the city's center, where the density of electric networks is much lower than other parts of the city. However, soon their installation will also commence throughout the city as well as other large urban areas in Russia, such as its second-

largest city, St Petersburg, as the cost equations continue to be attractive, regardless of location.

"Installation of a conventional traffic light where power cable must also be laid can take months. However, traffic lights powered by renewables can be installed in just 10 days," says Sergei Popov, head of the construction department at Story



“These traffic lights are fully automated. Solar power accumulates in the battery, which feeds the device in the dark. The battery can be charged even in cloudy weather during winter time  
 Maxim Liksutov, head, Department for Transport, Moscow



## AV testing in Russia

**Russia's ongoing roll-out of advanced ITS is looking toward a connected and autonomous vehicle future**

As Russia continues to upgrade ITS, particular attention will be paid to the development of technologies for unmanned vehicles. As part of this, the Russian Ministry of Transport is introducing relevant amendments to national legislation aimed at creating conditions for the introduction of unmanned vehicles on Russian roads.

One practical pilot project involves an unmanned shuttle bus – a new technology jointly developed by the scientists of the Russian Central Scientific Research Automobile and Automotive Engines Institute (NAMI), and Russian truck maker Kamaz. The newly designed bus was officially unveiled at the 2017 Moscow Auto Show and was tested in real conditions during the World Cup 2018 in Moscow.

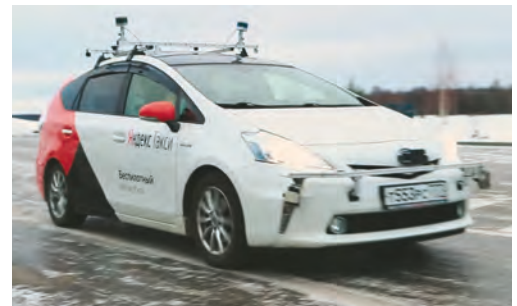
Designed for a maximum of 12 passengers, the bus has no driver and can be called from a smartphone. It can adapt its route in real time to avoid traffic congestion, using onboard digital maps.

“These maps can be dynamically changed using information about road accidents, traffic jams, road works, travel



times, speed limits and meteorological conditions in real time,” says former Russian transport minister Maxim Sokolov. Navigation is aided by roadside beacons, which will help to make precision corrections to GPS location information.

In addition to state projects such as this, private Russian companies are also involved in developing autonomous vehicles. For example, internet company Yandex is currently testing its own unmanned Toyota Prius model, which was shown to President Vladimir Putin during his visit to the company's headquarters in Moscow last year.



Above: **Russian internet giant Yandex is developing automated systems using a Toyota Prius**

Group, one of the largest engineering and construction companies in Moscow.

Popov adds that while the new traffic signals initially cost about the same as conventional ones, they quickly save on energy costs.

A statement from the Moscow Center for Traffic Management (CCDA) confirms that the cost of operating and maintaining such signals is considerably less than those connected to the power grid, saving around RUB15,000 (US\$220) per intersection, per month.

In the meantime, more than 35 traffic lights powered by wind turbines have recently been installed in St Petersburg,

**US\$220**  
The approximate monthly saving on operation costs, per intersection, when comparing solar to conventional lights  
*Source: Moscow Department for Transport*

“Installation of a conventional traffic light where power cable must also be laid can take months. However, traffic lights powered by renewables can be installed in just 10 days

*Sergei Popov, head of construction, Story Group*



on the Baltic coast. The location is a good one, as this is one of Russia's windiest regions.

### Smart adaptation

All the new lights are equipped with traffic management software and sensors, which enable them to read the number of cars approaching or queuing and increase the duration of green time accordingly. Changes in timings can also be transmitted to lights at other nearby intersections.

The Digital Economy of Russia program includes details for the roll-out of wireless data networks in the Russian road traffic systems. These networks have been designed to be fully compatible with all data types, in order to create conditions for the future use of connected and automated vehicles.

As part of these plans, Russia is also installing renewably powered sensors capable of taking readings of several dozen parameters and transmitting them to drivers, vehicles, or a control center. Among the parameters monitored will be temperature, humidity and atmospheric pressure. The sensors will also be capable of monitoring physical indicators of road conditions, including surface conditions. The obtained data will be transmitted via secure radio channel to the control center, or directly to drivers in certain cases, paving the way for a connected vehicle future. ○

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Copenhagen is hosting the ITS World Congress in September. Here are the facts and figures on traffic and transportation in the Danish capital



# The Danish way



Only **29%**

of the households in the city center own a car



**26%** of all Copenhagen families with two children own a cargo bike



**1,700** taxis serve the city



**62%**

of Copenhageners choose to cycle to work and school

**Four** waterbus lines serve Copenhagen



**2,600km** (1,600 miles) of railway carries **360,000** passengers a day



Peak hour traffic adds **100** hours a year of traveling to average journey times, but Copenhagen is still ranked only **124<sup>th</sup>** in the world for traffic congestion (based on 2016 figures)



The **16km** (10-mile) Øresund road and rail bridge connects Copenhagen to Malmö, Sweden



The driverless metro is in service **24/7**. The network is **20.5km** long (12.7 miles) and carries **one million** passengers every week

Sources: copenhagen.com, oresundsbron.com, cycling-embassy.dk, tomtom.com, enmark.dk



# CARRIDA

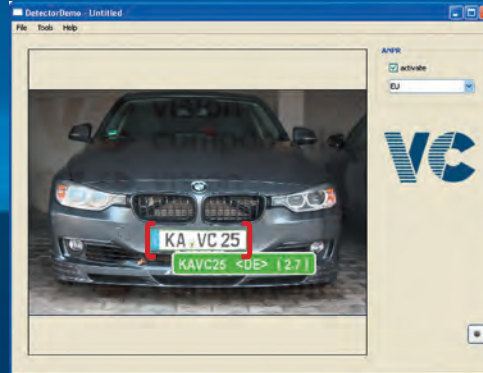
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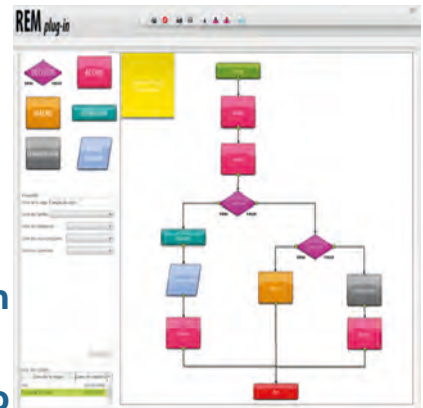
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Booth  
C2-005

# Jacob Bangsgaard, CEO of ERTICO, is preparing for the biggest event in his 18 months in the job so far – hosting the ITS World Congress in his nation’s capital

Interviewed by Tom Stone

This year’s World Congress has particular significance for Jacob Bangsgaard, the CEO of event organizer ERTICO-ITS Europe. Not only is it his first such event in charge, it’s also being held in Copenhagen, the capital of his home nation.

“I am proud that this year’s Congress is hosted in my home country and we anticipate this is going to be the biggest event yet,” Bangsgaard tells *Traffic Technology International*. “As a Danish citizen, I look forward to showing the impressive progress that the city of Copenhagen has made in addressing mobility challenges.

“ERTICO worked with the city authority on a number of projects that looked at using cooperative systems for an optimization of services for citizens, for example on buses. Copenhagen’s ambition is to be carbon neutral by 2025 and the theme of the Congress will be ‘Quality of Life’. When the city presented its proposal to host the Congress four years ago, it was clear that it was strongly committed to organizing an unforgettable event.”

Featuring more than 200 sessions and workshops, an exhibition, numerous demonstrations and technical tours, as well as a series of networking opportunities, the Congress is an ideal opportunity to learn from peers and share knowledge.

“As at every World Congress, we will have a fantastic stand to display the best of ERTICO partnership innovation and, of course, we will celebrate 25 years of this remarkable event with a cocktail reception,” reveals Bangsgaard.

## A life in transportation

Bangsgaard is ideally suited to his new role at ERTICO, having spent his entire 26-year career in the transportation sector, moving from a central EU role in Brussels, an initial stint at ERTICO in 2001 as director of international affairs and communications, before leading FIA Region I for more than six years. “I have represented mobility interests for all the different interest groups in the field, including regional authorities and the European Commission Transport Directorate,” he says.



“

International cooperation goes hand in hand with our ambitions for the European industry to lead the way in mobility





Now, as he settles into his new role, Bangsgaard has a very specific vision of how ERTICO can help enable innovation in transportation worldwide.

“In the past year, we have strengthened an important activity: international cooperation,” he says. “We are committed to developing fruitful collaboration with our overseas partners [the 2<sup>nd</sup> China-Europe ITS Summit will be held on September 19 in Copenhagen]. International cooperation goes hand in hand with our ambitions for the European industry to lead the way in mobility.”

One of the founding principles of the ERTICO organization is to provide a catalyst between mobility sectors, both public and private. It has been particularly successful in implementing research projects across the continent and now those projects are evolving from pilots to real-world solutions.

“As technologies have matured, our focus has grown toward deployment,” says Bangsgaard. “We create Innovation Platforms, which focus on different aspects of deployment. We are currently running seven platforms varying from in-vehicle sensors and ADAS to traffic management and harmonization of EV charging points.

“Through this work, ERTICO is establishing itself as a thought leader in smart mobility. We are supporting the European Commission in advancing important topics, such as multimodality, connectivity and cooperative ITS. In June, we organized our annual think-tank event in Brussels, which covered new mobility services and data sharing. It helped ERTICO engage with new players, including industry associations, startups and public authorities.”

### MaaS future

One key disruptive trend that Bangsgaard has his eye on is Mobility as a Service (MaaS) – the transportation revolution that

Right: Bangsgaard addresses the ITS European Congress in Strasbourg last year



I think the MaaS concept presents an important opportunity to the whole industry for a more efficient and sustainable way to move

some predict will see huge swathes of the world population abandoning private car ownership in favor of on-demand, multimodal transportation solutions.

“Mobility as a Service will certainly change the way people use transportation, including cars,” he says. “I believe private cars will still be around, but will shift from being the primary means of transportation to becoming secondary. I think the MaaS concept presents an important opportunity to the whole industry for a more efficient and sustainable way to move. We are strong believers in it, and this is why, in 2015, we

created the MaaS Alliance, with the aim of bringing different players from the industry together and creating a common understanding and approach to what this new business model should look like. We have been proved right and now the Alliance is a successful ERTICO Innovation Platform with more than 50 members.”

One of the key components of a fully mature MaaS system is predicted to be automated vehicles, particularly in the form of ‘robo taxis’. But could recent fatal accidents involving test vehicles stall the development of such technologies? Bangsgaard takes a practical view: “It is regretful that such accidents happened, but on the other hand, we should not stop the growth of automated vehicles. As we go on in research and trials, we see an enormous improvement of the technology behind automation. If we look at the numbers, on average 100 people are killed each day on roads in USA and 70 in Europe. Most of these accidents are caused by human error. We must continue working on all fronts of technological development to make our transportation system safer, cleaner and more efficient.”

And of course, one of the best ways to get involved as the industry works toward these noble aims is to collaborate with others this September in Copenhagen. Turn the page to find out more about the city and the event highlights. ○



## The 2018 ITS World Congress topics

- Mobility services – from transport to mobility to livability
- ITS and the environment
- Connected and automated transport
- Next-generation goods delivery
- Satellite technology applied to mobility
- Transportation networks evolution
- Cross-border mobility solutions (Host Topic)

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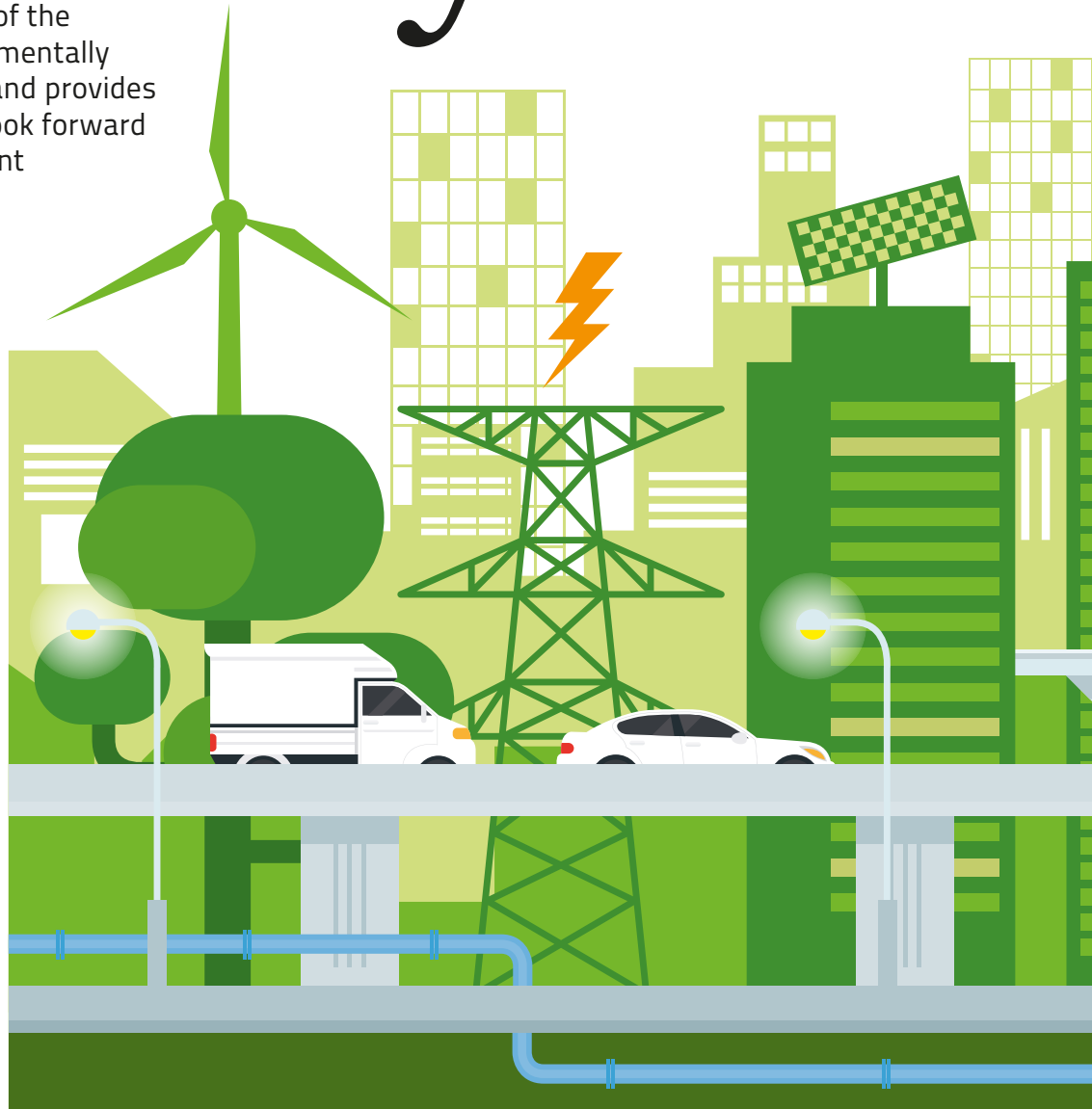
# Green city

What makes Copenhagen such a perfect place to host the ITS World Congress? **Saul Wordsworth** looks at some of the transportation innovations helping to make the Danish capital one of the smartest – and most environmentally friendly – cities in the world, and provides a taster of the highlights to look forward to at the 25<sup>th</sup> anniversary event

This year's ITS World Congress will be held in Copenhagen's Bella Center, Scandinavia's largest conference facility. More than 10,000 visitors are expected from over 100 countries for the 25<sup>th</sup> anniversary event, which will feature an opening ceremony commensurate with the occasion, attended by the event's patron: Frederik, Crown Prince of Denmark.

"There is a strong political commitment within the city towards the Congress for two main reasons," says Steffen Rasmussen, head of the Traffic and Urban Life department, City of Copenhagen, and one of the people charged with helping to run the event. "First, it's a great opportunity to promote green mobility and climate responsibility. Second, it gives Danish companies visibility in the global arena. Plus of course we hope to attract international enterprises to do business here in Copenhagen."

Rasmussen's talk of green mobility touches on the cornerstone of the city's ITS policy: carbon





# 25<sup>TH</sup> ITS WORLD CONGRESS COPENHAGEN

17 – 21 SEPTEMBER 2018

*Quality of life*



**TOP 5 technical tours**

## #1 Traffic overview

### Traffic Management Strategy in Copenhagen

See this 'smart city' in action for yourself. Accompanied by the very people who implemented these solutions, this tour of Copenhagen will allow you to witness first-hand how the city has improved travel time reliability, waiting times and number of stops through the optimization of major corridors. This technical tour of

vital intersections presents numerous approaches to traffic signal control within the city. Not to be missed!

**Tuesday, September 18**

**11:00am-12:30pm**

**Thursday, September 20**

**1:30-3:00pm**

**Maximum participants: 45**



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- ✓ E-Vehicle Charging Stations
- ✓ Parking Guidance Systems
- ✓ Smart City and IoT



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Technologies

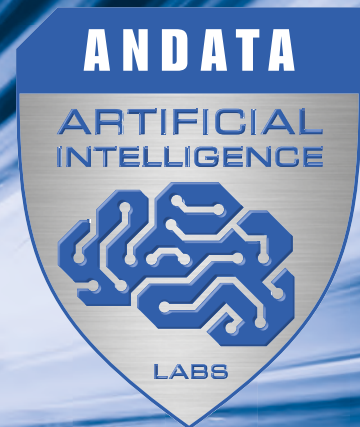
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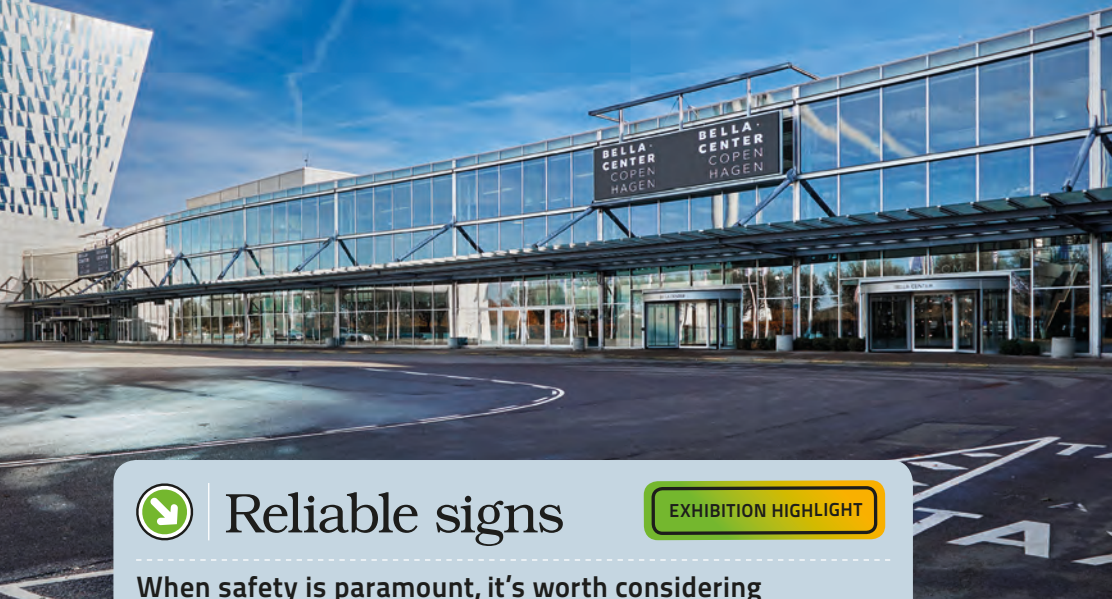
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Copenhagen's Bella Center is the venue for this year's ITS World Congress



neutrality. This is the central principle from which everything flows, and it chimes with this year's Congress theme, ITS – Quality of life. Back in 2012 Copenhagen created a climate plan which decided the city should aim to be carbon neutral by 2025. Since that time all ITS objectives have been devised to support this mission. Mads Gaml, Copenhagen's ITS program manager, picks up the story.

"The first thing we did was to create a traffic management plan encompassing service goals for cars, buses, pedestrians and bicycles. A very important factor was the optimization of traffic flow in some of our most congested corridors. We have a baseline from 2011 and we have travel time targets to reach, including the optimization of seven corridors for bikes, nine for buses and eight for cars. Our mission is

to deliver a livable and healthy city with a good quality of life. That's why when we talk about ITS, pedestrians and cyclists are a critical factor. We've delivered two classic solutions from a traffic



We are trying to push the limits of where technology is today in regard to what we call green mobility  
Mads Gaml, ITS program manager, City of Copenhagen



## Reliable signs

EXHIBITION HIGHLIGHT

When safety is paramount, it's worth considering alternatives to LED-based VMS

Triplesign VMS can be installed in projects for tunnels, highways, toll stations, bridges, traffic management vehicles and portable traffic signs for road work. The company has active partners in

Poland, New Zealand, Australia, the UK, Italy, Scandinavia and the Middle East.

The most important benefit is that the natural security of the message – which displays regardless of power supply – compared with LED VMS can save lives. Other benefits are the extreme reliability and the long lifetime of the system, lower investment, a flexible PLC-based internet control system, lowest power consumption of all VMS on the market and excellent prerequisites for solar.



Triplesign – Stand C3-020



## What to see in Copenhagen

If you find yourself with time on your hands, there's plenty to see and do in the Danish capital. Here are a few of our favorites:

**1 Tivoli Gardens**  
Founded in 1843, this amusement park was a favorite haunt of both Hans Christian Andersen and Walt Disney. With beautiful scenery, exotic architecture, historic buildings and lush gardens, it has something for everyone and is especially stunning at night.

**2 Nyhaven**  
Translation: new harbor. It is not new, though, but steeped in a long and

rich history. Hans Christian Andersen lived here (him again). This colorful harbor is a great place for a stroll or a beer.

**3 The Little Mermaid**  
Perhaps the most iconic image of Copenhagen, this sculpture at Langelinie Pier (pictured right) recently turned 100 years old. It is inspired by and based on the fairy tale by Hans Christian Andersen (and again).

**4 Christiansborg Palace**  
Located on the islet of Slotsholmen in the center of Copenhagen, this is home to the Danish parliament and the prime minister.

**5 Walking Tour**  
If you have a free morning, this is the best way to see Copenhagen. The tour leaves from the Dragon Fountain at the Town Hall Square every day at 10:00am, finishing at The Little Mermaid.





management perspective, and four innovations.”

### Six ways forward

Copenhagen's six solutions constitute an integrated, all-encompassing drive toward a healthier, more optimized city where energy is saved, emissions are down, more people cycle and journeys are quicker. The first module, which is currently being tested, is the city's eco-driving solution, which is designed to reduce the number of stops for road users by providing dynamic speed advice at controlled intersections on designated corridors using time-to-green and time-to-red facilities. Its aim is to reduce CO<sub>2</sub> emissions and make for a more convenient, smoother travel experience.

“The city traffic management system [CTMS] keeps an overview of the time-to-green and time-to-red at intersections,” says Rasmussen. “CTMS passes this information onto vehicle drivers via its ITS-G5 [wi-fi] or cellular 3G and 4G. An onboard application for smart phones derives dynamic speed advice.”

Bicycles are an essential component in Copenhagen's drive toward carbon neutrality. This is illustrated by the variable message signs (VMS) that have been tailored to stimulate the



## TOP 5 technical tours

### #2 Tomorrow's world

#### The Future of Mobility – Ideon Science Park

Less than an hour outside Copenhagen lies the Swedish city of Lund. Here you will find Ideon Science Park, perhaps the most iconic and technologically inspiring place in Western Europe. The Park was the birthplace of both Bluetooth and Ericsson Mobile. These days it works toward developing the mobility solutions of tomorrow.

Those on the tour are free to look around, draw inspiration from new ITS startups, and learn everything there is to know about sustainable mobility.

**Wednesday, September 19**  
**9:00am-2:30pm, departure from Bella Center**  
**Maximum participants: 20**

Above: Lund University helped to set up and now helps run its next-door neighbor Ideon Science Park



The ITS World Congress is a great opportunity to promote green mobility and climate responsibility

**Steffen Rasmussen, head of Traffic and Urban Life department, City of Copenhagen**

cycling community by showing in real time how bike journeys are shorter than those taken by car. In addition, the cycle path experience has been improved through the introduction of green waves.

“We advise cyclists how to avoid congestion on their bicycle tracks,”

says Gaml. “Forty-two per cent of all trips in the city are now undertaken by bike so it's a significant contribution to green mobility. We don't know what would happen if those 42% went back to driving. Probably a lot of congestion!”

Copenhagen's traffic management module means real-time management of flow according to service goals and political priorities. By providing traffic operators, traffic managers, politicians and locals with real-time views on the current service levels for bikes, buses and cars, the traffic management system can better handle rush hour, accidents and



### A grand scale

EXHIBITION HIGHLIGHT

Portable weigh-in-motion systems are becoming increasingly popular for enforcement pre-selection

**H**aenni Instruments brings to ITSWC the strip sensor WL 400. Initially developed for mobile pre-selection, the system composed of two sensors, a position frame and four leveling mats is completely portable.

The sensors, which are installed in a recess in the pavement, do not have a display on them, instead data is sent to a PC via a rugged cable, where it is processed using dedicated EC 200 software.

IP67 protection standards mean the system is extremely robust. It can measure a vehicle



load while it is traveling up to 20km/h (12.5mph) and has a capacity of 20 tons, with an accuracy of ±3%, excluding external factors.

**Haenni Instruments**  
**– Stand C1.051**



### Virtual perfection

The latest in driving simulation software will be demonstrated at this year's ITS World Congress

**F**orum8 is a Japanese producer of 3D VR engineering software. It's premier product VR-Design Studio (formerly UC-win/Road), is at the forefront of Interactive 3D VR transport simulation and modeling technology.

Established in 1987, this award-winning company has offices and partners on every continent and is a member of the ITE and an associate of the TRB visualization group.

VR-Design Studio is the ideal solution for urban, rail, marine and transport planning and design projects; driving



EXHIBITION HIGHLIGHT

simulation and interactive visualizations of pedestrian-based events; and emergency planning and training scenarios.

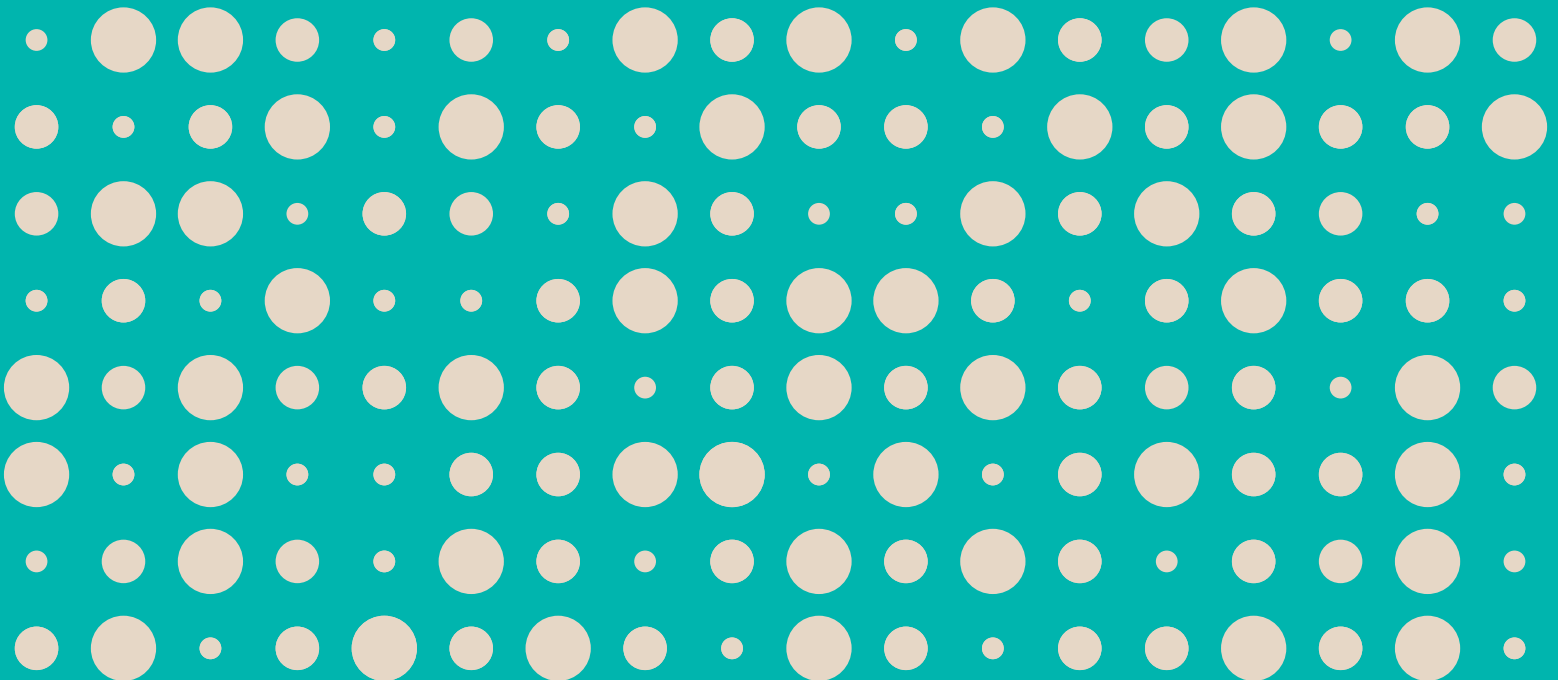
**Forum8 – Stand C1.076**



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TOP 5 technical tours

#3 Sustainable future

Smart and Green Traffic Solutions in Malmö

Another trip to Sweden, this time to the coastal city of Malmö. Even getting there is fun: it lies at the eastern end of the Øresund Bridge, a long road and railway bridge-tunnel running to Copenhagen. Once there you'll get to see a sustainable passenger transport system in action. Like Copenhagen, Malmö prioritizes

walking and biking, public transport and e-mobility over the use of the car. Trip includes a guided tour of the city and a networking buffet.

**Thursday, September 20**  
**1:00-5:30pm, departure from Bella Center**  
**Maximum participants: 45**

extreme weather. This is achieved via a network of sensors combined with GPS-based traffic data and a network of video cameras.

The deployment of intelligent street lighting, meanwhile, has seen levels of illumination reduced by 50% at night (dynamic street lights brighten when their sensors detect approaching vehicles or cyclists).

Lastly, the city's dynamic urban space module drives the flexible daytime use of empty parking spaces for street life activities. This creates a street ambience that, by encouraging the sharing of space between cyclists, pedestrians and drivers, helps build a more vibrant and varied urban landscape.

**Joined-up thinking**

"I cannot speak for all cities of the world but I have observed that solutions can stand alone," says Gaml. "It is important to say that our projects are not standalones. Taking ITS to the next level is about continuously improving and working with traffic situations, seeing if you can change them through available solutions. We are trying to push the limits of where

Above: **The Øresund road and rail Bridge connects Denmark and Sweden**

EXHIBITION HIGHLIGHT

Planning ahead

Advanced simulation solutions for traffic planning, management and driver training

**B**MIA implements immersive simulation solutions used in road evaluation and management and emergency responder training. Its dedicated software products, which will be demonstrated at the ITS World Congress, include: G'Val, an interactive 3D simulator for training traffic operators; G'Nex, electronic help for operator decision and

process management and G'Educom: an interactive multimodal eco-driving simulator.

For over 20 years BMIA has run large software projects for major civil engineering companies in France and abroad. BMIA is also a consultant in SCADA systems, control room ergonomics and intelligent transportation systems.

**BMIA – Stand C2-005**

technology is today in regard to what we call green mobility."

"Overall the solutions have a clear focus, that of a green city," says Rasmussen. "This means a safe city, though not focused on speed limits or enforcement. Many countries have been working with traffic management for years, focused on traditional means of transport. We want to create the cycling capital of the world. We need different tools to operate a city from a bike perspective. When, for example, did you ever hear of traffic information targeting cyclists? You would probably say never. We are trying to be very clear about the targets we want to reach and are using solutions that can support that vision."

Is Copenhagen a smart city? Gaml prefers to talk about smart mobility and solutions that are connected

Safe, efficient roads

The right transportation solutions can make a real difference to the livability of modern cities

**A**t the ITS World Congress 2018 in Copenhagen, Vitronic will focus on the event's tag line, Quality of Life. The German machine-vision specialist will showcase the ways in which industry can contribute to improved livability in urban environments, specifically by creating smart traffic networks. This involves safer roads, regulated and free-flowing traffic and shorter journey times – and as a positive consequence of these outcomes, a more sustainable environment.

The products solutions presented in Copenhagen will



EXHIBITION HIGHLIGHT

focus on road safety, security and tolling. Visitors can see intelligent applications for speed (average and spot) and red light enforcement, wanted cars search, border control as well as electric toll collection.

**Vitronic – Stand C3-031**

V2X firsts

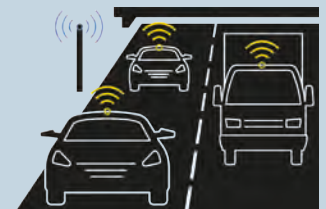
EXHIBITION HIGHLIGHT

Technology from a new V2X project in Slovenia will be on display in Copenhagen

**A**sist, a technological leader in urban and motorway traffic automation, has become the first company to develop and install a V2X system on Slovenian freeways.

The project, co-financed by Slovenia and the EU, has developed a sophisticated, easy-to-implement system, that enables direct two-way communication between drivers and infrastructure in real time.

The system comprises advanced roadside units, and a V2I server in the highway control center to enable reliable communication.



There is a wide range of possible applications, which will all help to increase traffic safety and enhance driving experience. The system's proof-of-concept stage is now complete and will be on display at the show.

**Asist – Stand C3-006**





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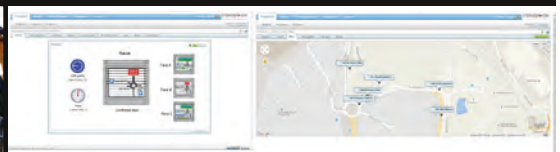
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Visit us at the ITS Congress Copenhagen Nordic Pavilion C3-020



TOP 5 technical tours

#4 Learn fast

Aalborg – Europe’s Best Engineering University

Why not visit Aalborg University, a seat of learning that prides itself on its collaboration with international business? During this visit, ITS professors and students will present their cutting-edge work and research based on theoretical learning and cooperation with multinational organizations. Subjects include

big data, autonomous technology and advanced agile traffic management. Time is set aside for discussion and networking. Will include a light meal.

**Wednesday, September 19  
1:00-5:30pm, departure from  
Bella Center  
Maximum participants: 45**

and infrastructure that is reused. Copenhagen is connecting every solution to its traffic management platform, opening up and using all data available.

Above: Aalborg is Denmark’s fourth-largest city in the north of the country

“A smart city is a broad concept,” says Rasmussen. “I’d rather use the term digitization – getting systems of data to work together. Copenhagen Intelligent Traffic Solutions (CITS) is just one example of where data from our traffic signals is shared and used by the onboard units on trucks and buses, for example.

“Copenhagen’s transport authority, Movia, has a server with a lot of data from buses, including GPS data. We got this server talking with the traffic signals so we can give buses a green light when they

approach. It’s a matter of making systems of data work together. I think that’s pretty ‘smart’.”

**Innovation focus**

Returning to the Congress itself, ERTICO-ITS Europe Congress director, Didier Gorteman, is confident the event will break new ground for the industry. “This year we will put emphasis on creative thinking, interaction and dialog through a variety of sessions,” he says. “Attendees will have access to innovative ideas and concepts from

experts presenting in more than 150 dynamic sessions. Our vision is to enhance the interaction between the speaker and the audience, and thereby increase knowledge and expertise shared between our delegates from around the world.”

This year’s ITS World Congress will also host at least 30 startups housed within a purpose-built pavilion. It is here, according to Gaml, that the future of mobility will be decided for the next decade.

“Those SMEs [small to medium enterprises] are the future, and this

EXHIBITION HIGHLIGHT

Comms specialists

The optimal function of V2X networks relies on picking the correct antennas for the job

Mobile Mark antennas are used in DSRC/V2X projects worldwide, including those carried out by MDOT/University of Michigan (USA), SCOOP (France), Compass4D (across Europe), C-ITS (Korea) and UC Berkeley/PATH (USA).

The antennas are used as mobile V2V antennas as well

as on roadside units (RSUs) and integrated in urban intersection infrastructure.

Mobile options include dedicated DSRC-only antennas or multiband antennas combining DSRC, C-ITS and GNSS. Infrastructure options include omnidirectional, directional and bidirectional antennas, which can be attached to DSRC RSUs or used as standalone solutions.

Mobile Mark’s new Fin-style combination 2xDSRC and GNSS Mobile Antenna will be featured on the company’s stand in Copenhagen this September.

Mobile Mark – Stand C1-010



Global thinking

Integrated mobility solutions for 21<sup>st</sup> century cities

EXHIBITION HIGHLIGHT

As an expert in meeting the challenges of traffic and mobility management, Kapsch will showcase its vision on the future of mobility, as well as displaying its latest innovations, at the 2018 ITS World Congress. The

organization believes that the time has come to consider city mobility as a truly global topic. By integrating mobility across all transport means and stakeholders, it considers end-to-end mobility of citizens as an objective. Kapsch will stage

a live demonstration of its City Mobility Centre, which connects Mobility-as-a-Service (MaaS) and merges real-time traffic, parking and connected vehicle data into mobility applications.

Kapsch – Stand C2-010





**TOP 5 technical tours**

 **#5 Wheel life**

**ITS Solutions for Cyclists in Copenhagen**

A two-hour tour around the city on an electric bike? What's not to like? This is an opportunity to see Copenhagen's dynamic VMS for bikes in action. See how real-time sensor data is used to prioritize bike traffic at intersections. Try the city's I Bike CPH app and witness first-hand the service it offers to cyclists across the city, helping

them to plan the fastest and safest routes for any cycle journey. Plus you'll be riding through one of Europe's safest and most historic cities. There may even be time to stop for a drink!

**Tuesday, September 18**  
**12-2:30pm and 3:00-5:30pm**  
**Maximum participants: 10 per tour**



Above: Copenhagen is one of the most bicycle-friendly cities in the world

over I shall walk around, network and learn about all the thrilling new developments."

ERTICO – ITS Europe Congress director Didier Gorteman says, "This year, we will put emphasis on creative thinking, interaction and dialog through a variety of sessions. Attendees will have access to innovative ideas and concepts from experts presenting in more than 150 dynamic sessions.

"Our vision is to enhance the interaction between the speaker and the audience, and thereby increase knowledge and expertise shared between our delegates from all around the world," Gorteman concludes. ○

*Register now at [itsworldcongress.com](http://itsworldcongress.com)*

part of the exhibition excites me the most," he says. One big part of that future, most people in the transportation world agree, is MaaS (Mobility as a Service). This year's World Congress is likely to see some live demonstrations of such technology, including through the Congress app itself.

"We have created a World Congress attendee app that includes not only information on public transport companies like the metro, trains and buses, but also taxis, car pooling and a bike-sharing system," says Gaml. "It's a solution where we include the last mile, something

that has been one of the great challenges for mobility in the last five years."

However, if you want to track Gaml down at the event, it might be more of a challenge than booking a cab. "I'm going to spend my time looking at the demonstrations and the exhibition center, where we're really going to see something exciting. When I'm not presenting, of course..." Gaml says.

"I will mostly be in our control room ensuring the team is working well and giving all attendees the best possible experience in Copenhagen," says Rasmussen. "With any time left

 **360° solutions**

**Advanced traffic enforcement solutions combine the advantages of different types of technology**



Jenoptik offers solutions for detecting and tracking vehicles while recording evidence to decide if any action is necessary to help enforce traffic laws.

Innovative object detection systems evaluate all information about traffic conditions and road users. Solutions are based on the very latest hardware

and software, supported by a range of operational and support services.

The product portfolio, which will be showcased at this year's ITS World Congress, comprises comprehensive systems relating to all aspects of road traffic.

To monitor toll payments for example, Jenoptik offers a unique solution that combines sensors and other components with specific advantages to achieve the required measurements. It will be on the company's stand at ITSWC.

**Jenoptik – Stand C2-037**

 **Intersection of dreams**

**A highway intersection is a key point in any city where technologies can be easily combined**

Miovision is at the convergence of three of today's most significant technology trends: smart cities, the Internet of Things (IoT), and connected and autonomous vehicles (CAV). City authorities often look to these trends in the hope of achieving visions of creating more liveable urban centers. However, when it comes to application, they are often lost, not knowing where to start.

One of the convergence points between these trends, physically and virtually is the urban highway intersection.

At the ITS World Congress Miovision will be offering ways to collect better intersection data and create smart, connected intersections to enable cities to start improving road safety, reducing emission levels, creating better traffic teams, and much more.



**Miovision – Stand E-081**



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LEADING THE WAY



# End of the road?

Is the public money available for road construction and upkeep about to run out? **Michael Donlevy** reports from the fifth Mileage-Based User Fees Alliance Conference in Washington DC, and discovers a growing community pressing the case for a change in funding methods



Pay for the miles you drive or face not having roads to drive on – that was the message from the fifth Mileage-Based User Fees Alliance Conference, held in Washington DC in June.

The conference brought together government, business, academic and transportation policy leaders to discuss the state of the practice of mileage-based user fees (MBUF), and it started with a positive... followed by a negative. Firstly, Oregon congressman Earl Blumenauer, who delivered the keynote address, praised the MBUF community for trying to find a replacement for the

gas tax. Yet Blumenauer, who knows all about tax from sitting on the House of Representatives' Ways and Means Committee, said that in nearly 400 hearings held in the past seven and a half years, only one witness testified, for five minutes, on the subject of road usage charging (RUC).

"If Democrats take control of the House, Blumenauer plans to greatly expand opportunities to discuss transportation funding," says Pat Jones, executive director and CEO of International Bridge, Tunnel and Turnpike Association (IBTTA), who was a moderator at the conference.



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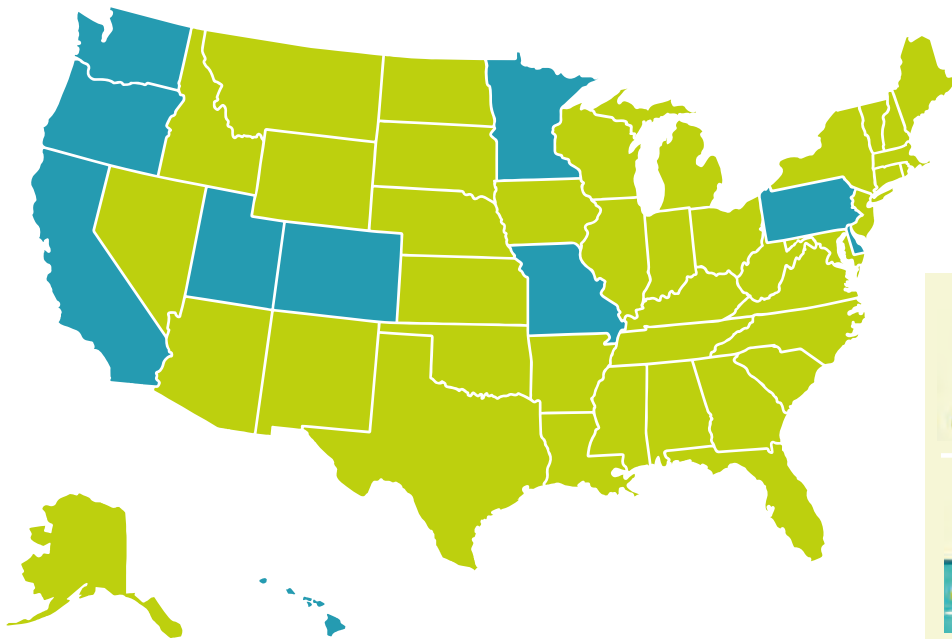


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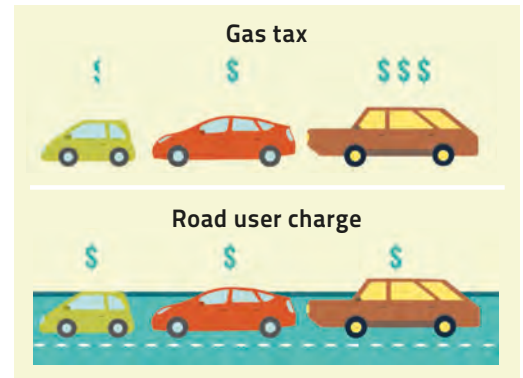
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Below: An illustration of dollars paid for identical journeys under the two charging regimes



Other topics included state legislation and policies, public perception, examples of road charging in other countries, and the technologies to enable MBUF.

“Most attendees expressed the sentiment that educating people about MBUF is an uphill battle,” Jones adds. “Also, because of frequent turnover in state legislatures, MBUF proponents are continually re-educating state legislators.”

### Leading pilots

There are plenty of RUC pilot schemes in operation. Oregon, which was the first state to introduce the gas tax in 1919, is now running an ongoing, but voluntary, RUC scheme. There have been notable trials in California, Washington, Delaware and Colorado, not to mention one by the I-95 Corridor Coalition, concerning the road that stretches 1,917 miles (3,100km) from Maine in the northeast USA to Florida in the southeast.

There are still technological challenges, but those working in the field believe these are secondary to a far greater issue. “We have the technology to implement RUC today,” says transportation consultant Jack Opiola, who worked on the Washington Road Usage Charge Pilot Project. “Technology is not the

Above: A map showing, in blue, the US states with planned, current or completed RUC pilots

primary issue – communications and public acceptance are the key issues.”

### Selling the idea

“The biggest challenge is public understanding about how we pay for roads,” agrees Jones. “DHM Research president Su Embree talked to the conference about focus groups and other techniques to gauge public opinion about RUC. When you ask people about their greatest concerns, they name the economy, terrorism,

“The biggest challenge is public understanding about how we pay for roads

Pat Jones, CEO, IBTTA



healthcare, crime, taxes and guns. Transportation is rarely mentioned. When researchers probe further about how we pay for roads, the response is often crickets chirping [i.e. very little at all].”

That makes selling the RUC concept a tough task. “When speaking to the public, MBUF proponents often want to dive right into a discussion about how

to pay for roads, but the public isn’t ready for it,” says Jones. “It’s like opening a conversation by telling someone about the main course when they didn’t know they’d been invited to dinner.”

The focus groups raise a lot of questions, he adds. “Will MBUF replace the gas tax or will I be charged in addition? Are you going to track my movements? Why don’t you simply increase the gas tax?”

“Once upon a time, all vehicles had a similar range in miles per gallon. As such, taxing fuel was a crude way of taxing the distance you drove,” says Opiola. “This model worked until about 2005, when we started to see dramatically increased fuel economy. Hybrid engines extended that range further, and around 2011 electric vehicles entered the mainstream. These vehicles use the road but don’t pay gas or excise tax. They’re getting a free ride. As the number of EVs grows and ICEs become more efficient, the economic sustainability of the gas tax weakens. Yes, governments will increase the gas tax on the ICEs but this only exacerbates the tax equity issue where less fuel-efficient vehicles pay more and more than hybrids and EVs.”

The good news is that RUC pilot projects are helping to change public perception. “What we found in surveys is that people said, ‘Okay,





## Technology to the rescue?

High-tech payment options and more travel options via Mobility as a Service could be key enablers for mileage-based user fees

The State of Washington's RUC trial features four payment options: a pre-paid permit for a fixed number of miles, a bill for miles driven, a GPS device plugged into a vehicle's diagnostics port to capture miles driven, and a smartphone app.

"RUC can be sold on user choice," says transportation consultant Jack Opiola. "The technology exists today to do it. Newer communications protocols, specifically 5G, will make it easier. Vehicle telematics will alleviate the need for third-party add-on equipment, while

digital payment systems via smartphones or in-vehicle touchscreens and blockchain accounting will provide added security. Smartphones will provide information related to your RUC account, your charges, your remaining balance and travel-related data and information."

That travel-related data can go a lot further thanks to the concept of Mobility as a Service. "I see MaaS as the complement to RUC," says Opiola. "It will provide you with information on the current state of the network and how best to navigate from A to B. It can book parking and identify

refuel/recharge points. It can direct you to a parking lot at a terminal or station, handle the parking and buy a ticket for your connection. It will also re-route and re-ticket you if that route choice should change due to incidents and accidents. All of these considerations are outside RUC and very much the essence of MaaS, but together they provide a duet of services necessary to handle today's and tomorrow's demands."



it's not that bad,'" says Opiola. "In fact around 73% of participants in the California trial thought it was better than the gas tax. People will say it was a biased sample, but it's people's perceptions that need changing. If you ask Joe Public about RUC, he thinks of toll roads or having a device like a taxi meter in his car. He thinks, 'This is expensive.' Immediately people think worst-case scenario. Tolls are expensive, but RUC will cost you around 20 cents for a 10-mile journey. That beats US\$20 in a taxi."

### Trials so far

So far, trials have focused on the technology, how to introduce it into the vehicle and how to encourage volunteers to take part. "They've generated a theoretical equivalence to current fuel taxes, but I don't think any pilots besides Oregon in 2013 have actually collected any revenue," says Jones. The pilots are in essence using 'play money' to let people know what they would have been charged from driving these miles at these times if this was a real-world setting. As the toll industry



**“Fuel is the one thing we buy in the USA where we have no idea what tax we pay. We make the gas tax invisible and we need to change that if people are to accept RUC**

**Jack Opiola, independent transportation consultant**

petrol, which is x, while tax is y and the total is z. Gas pumps have digital displays, so why can't I see that? Why isn't it on my bill? The tax is on my bill if I eat in a restaurant, stay in a hotel or rent a car. Fuel is the one thing we buy in the USA where we have no idea what tax we pay. We made the gas tax invisible and we need to change that if people are to accept RUC. But we raised this issue with legislators in the USA and internationally, and the response was, 'Why would we want to do

has found, getting people more familiar with MBUF will make them more accepting and open to it."

Opiola believes ingrained secrecy surrounding the gas tax is restricting the ability of US states to sell the concept of RUC: "A gas pump should show you how much you pay for

that? If you tell people how much tax they pay on fuel, they'll start complaining.' But these trials – publicize – and need to publicize – what you pay in gas tax versus what you pay in RUC.

"You cannot carry on hiding the gas tax simply because it has served us so well for the past 100 years – it is an anachronism. Many countries are looking to ban ICEs over the next 20 years so now we need some form of tax that will serve us for the next 100 years."

### Learning from tolls

"Once you get the public on board with the concept of MBUF you can approach the policy and technology challenges," says Jones. He believes RUC proponents can learn much from the toll industry's experience of trying to achieve regional and nationwide interoperability of electronic tolling systems.

"The issue comes down to trust," Jones says. "A state government or MBUF operator might say, 'I know how my system works because we developed it and we have lots of experience with our customers. But I don't know how your system

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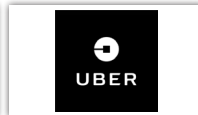
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## California dreaming

The California State Pilot Test on Road Charging got a thumbs-up from the motorists who took part (source: Caltrans)

5,000  
motorists took part



87%

found participating in the test easy



61%  
were more aware of what they paid for roads through participation and receiving monthly comparisons



73%  
preferred RUC to the gas tax



85%  
were satisfied with the overall experience



96%  
of participants completed the trial



works or whether you will treat my customers the same way as I treat them. And until I trust your system I won't use it or allow you to force it on my customers."

### Ready for the future?

RUC may one day cover the USA, but it will take time. "Most proponents and experts seem to agree that migration to RUC will happen on a state-by-state basis," says Jones. "I agree with that assessment, because RUC is too new and complex an issue for the federal government to take on. By providing money for pilots – US\$95m for each state willing to match that figure with their own US\$95m in the last Transport Bill – Congress was encouraging states to take the lead. But I imagine that it will take until 2028 for 10 states to have fully operational RUC systems that have replaced the gas tax."

Timing is a thorny issue, says Opiola. "Five years ago, RUC was 10

years away from being implemented. Today, RUC is 10 years away from being implemented. In five more years, RUC will be 10 years away from being implemented. So are we 5, 10 or 15 years away? I don't know.

"We'll endeavor to try every conceivable option to fix our transport issues: exhaustive studies, public transport initiatives, ITS options, telematics in vehicles, tolling, congestion charging, environmental charging, low-emission zones, mobility charging, Mobility as a Service, autonomous vehicles, ride sharing, and other options we haven't yet thought of or assigned a catchy acronym to. The

ultimate solution is multivariant and is the adoption, to a degree, of all the above. No single concept is the key to a total solution. Road charging does, however, provide revenue sustainability based on actual usage."

Winston Churchill once provided a great insight to the American nature – and I think to all human nature – when he said, 'You can always trust the Americans to do the right thing after they have exhausted all the other possibilities.' I think this applies to transportation policy, too.

"We're facing clogged modes – all modes – of travel. Congestion will consume us. It will eat away at our economy and bring life back to urban village existence. You'll work, live and play in smaller and smaller circles because transportation to expand opportunities, business, job markets and entertainment will diminish. If we don't embrace road charging those circles will carry on getting smaller." ○



RUC will happen on a state-by-state basis... because RUC is too new and complex an issue for the federal government to take on

Pat Jones, CEO, IBTTA



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# Roads to SUCCESS

IBTTA's Toll Excellence Awards are one of the highlights of the organization's Annual Meeting. The winners showcase the very best in tolling innovation and provide inspiration for the global industry. **Jack Roper** reports on this year's success stories

**E**stablished in 1932, the International Bridge, Tunnel and Turnpike Association (IBTTA) provides advocacy, thought leadership and education to a community of toll facility owners, operators and associated businesses spanning six continents.

Every year, the IBTTA Toll Excellence Awards recognize industry-leading achievement in six categories – and we introduce all six winners in the following pages. The awards are presented on October 16, 2018, at the IBTTA's 86<sup>th</sup> Annual Meeting in Baltimore, Maryland. One supreme winner selected from the six will receive the coveted IBTTA 2018 President's Award.

"We received 36 submissions, 29 from the public sector and seven private sector entries," explains Oklahoma Turnpike's David Machamer, who chairs the Awards Committee. "The committee,

consisting of 11 members, selects five public sector winners and one private sector winner, scoring submissions against criteria after reviewing the entries and learning about the excellent work toll agencies perform."

This year, a common focus on all-electronic tolling is apparent, with awards for outstanding work on temporary tag recognition, managed lane systems monitoring, and tri-protocol interoperability, while the IBTTA's 2018 emphasis on 'Trust and Accountability' is also underlined.

"Striving for excellence through innovation, service and governance improvements clearly displays the desire of IBTTA members to advance tolling transportation as trusted leaders, holding themselves and the services provided to the highest standards," says IBTTA president Tim Stewart. "I applaud the work of all recipients."



Gantries on the North Carolina Turnpike are the first in the US to have achieved full, three-way interoperability

**WINNER**

## Technology Award

**North Carolina Turnpike Authority**  
Customer value and interoperability through tri-protocol reader technology

In September 2017, the North Carolina Turnpike Authority (NCTA) became the first US tolling agency to read all three transponder protocols being considered for national interoperability in a tolling environment, a development of immediate interest to other IBTTA member authorities keen to follow their example.

With two new toll facilities scheduled to open in late 2018, NCTA investigated ways to develop its customer base by offering free and low-cost transponder options, while avoiding the customer disruption of a potential transponder recall. In doing so, it began to develop a solution that would also enable it to lead the way in preparing for future national interoperability. A multi-faceted procurement ensued, NCTA eventually executing three contracts with Kapsch TrafficCom IVHS to provide tri-protocol readers, and both 6C and TDM transponders.

Retrofitting of the Triangle Expressway's automatic vehicle identification system with Kapsch's MPR2 readers across 80 lanes and 20 toll zones was executed off-peak to minimize closures and disruption



to existing NC Quick Pass customers, with 50,000 vehicles using the busiest section on an average weekday. Following the September 2017 go-live, NCTA was able to begin offering free NC Quick Pass stickers, while reducing the cost of E-ZPass interoperable transponders and supporting previously purchased tags. Ten months on, NCTA has distributed 9,000 transponders monthly, doubling the previous average. Weekday transponder-based transactions are up from 58% to 63%, reducing costs associated with post-paid, license-plate billing, while saving customers adopting transponders 35% on the cost of tolls. For the first time in NCTA's history, transponder-based transactions exceeded 60% for an entire quarter.

"The North Carolina Turnpike Authority, with its world-class facility, partnerships and research, is proud to lead the nation with its modern toll technology," says Turnpike Authority executive director Beau Memory. "This is another example of our commitment to improving the customer experience, lowering costs for our users, and supporting national toll interoperability."

**“**We are lowering costs for our users and supporting national toll interoperability

Beau Memory, executive director, NCTA





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The total cost of the Halifax Harbor Bridges Big Lift refurbishment project

**WINNER**

## Customer Service and Marketing Outreach Award

**Halifax Harbor Bridges**  
Big Lift Communications and Engagement Plan

The refurbishment of Macdonald Bridge created some breathtaking sights



Nova Scotia's Macdonald Bridge had given 63 years of stalwart service carrying commuters between Halifax and Dartmouth, but its deck was wearing out. Halifax Harbor Bridges (HHB), which runs two tolled suspension bridges with 33 million annual crossings, came up with a remedial strategy only once before performed on Earth: retrofitting suspended spans with new deck while keeping the bridge open to traffic at peak times.

The 'Big Lift' commenced in 2015, a titanic rolling removal of 46 deck segments, replaced with new road deck, floor beams, stiffening trusses and suspender ropes. Accomplished during overnight and weekend closures, this US\$205m project was funded by a government loan to be repaid entirely through toll revenues and will extend the bridge's life by 75 years. Nevertheless, such a complex and disruptive program of works on a commuter bridge



supporting 45,000 daily crossings posed major communications challenges, prompting the IBTTA to recognize the eye-catching success of the Big Lift Communications and Engagement Plan.

"Our objective was to educate and engage through a 'Show, don't tell' approach," explains Big Lift communications project leader, Alison MacDonald. "Photos were a big part of our strategy. We created some short videos of the overnight deck replacements, a 20-minute documentary, and a hardcover book focusing on the ironworkers."

The strategy proactively reinforced the Big Lift's essential reality: it was

**66** Our objective was to educate and engage through a 'Show, don't tell' approach. Photos were a big part of our strategy

Alison MacDonald, communications project leader, Big Lift

disruptive, but necessary. "Over 12 months, we gave perhaps 70 presentations," she continues, "to the Chamber of Commerce, neighborhood groups and professional associations. The CEO and chief engineer would give their time. Logistical communications were just as important: we had an app, our website, a phonenumber and signs on the bridge, letting everybody know when it was going to close."

Anecdotal accounts suggest a prevailing sentiment that the project was far less inconvenient than anticipated – and a wonder to witness unfolding.





# Administration and Finance Award

**E-470 Public Highway Authority**  
 Colorado Senate Bill 90: Temporary license plate legislation

While awaiting permanent plates, newly purchased car owners in Colorado must display a temporary license plate, which until recently was just a piece of paper taped anywhere inside the vehicle. This created inconsistencies and allowed scope for counterfeiting, compromising the safety of law-enforcement officers and causing lost revenue at electronic toll facilities.

In 2012, Colorado's E-470 Public Highway Authority initiated a program to improve the effectiveness of temporary plates using standardized tag design, specified vehicle tag placement, and an owner identification database. To realize these plans, E-470 launched a legislative effort earning the support of Colorado



**“It resulted in better safety, better identification of vehicle owners by law enforcement, and a reduction in unreadable plates**

**Tim Stewart, executive director, E-470 Public Highway Authority**

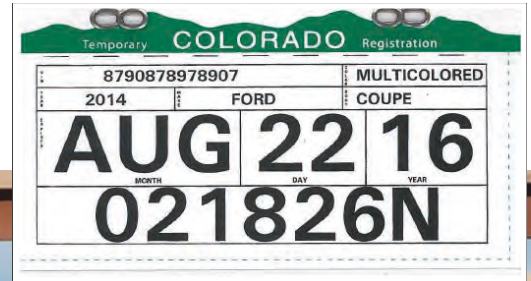
Right: Tagging temporary-plated vehicles cut rejected images by 22%

government agencies, local auto dealers, county clerks, law enforcement and the Colorado Department of Revenue. The improved system was signed into law in 2015 under Colorado Senate Bill 90, demonstrating how a local toll authority could partner with a range of state and government agencies and private stakeholders to pass legislation streamlining business processes for all involved.

Through a one-time grant, E-470 was able to spare taxpayers the cost of implementing the project.

The new system went live in 2016 and, 18 months later, rejected images related to temporary tags were down 22.4% on the preceding period and total revenue loss decreased by US\$6.7m, enabling E-470 to break even on the project investment in just 64 days. “Senate Bill 90 provides E-470’s image-processing staff with improved capabilities to identify temporary license plates in all ambient light conditions,” says E-470’s deputy executive director Dave Kristick, “providing much-needed help in effective license plate toll billing.”

“This initiative was about much more than reducing uncollectible revenue,” adds executive director Tim Stewart. “It was a true effort of collaboration, resulting in better safety, better identification of vehicle owners by law-enforcement, a reduction in unreadable plates, and a streamlined system for Colorado’s auto dealers.”



Colorado Senate Bill 90 reduced revenue loss for the E-470 highway by **US\$6.7m** thanks to innovative new temporary license plates





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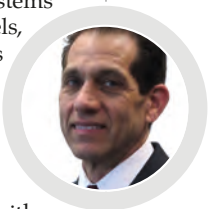
**WINNER**

## Toll Operations, Engineering and Maintenance Award

**Florida's Turnpike Enterprise**  
 Supplemental Lane Analysis and Monitoring (SLAM)

A primary risk of converting to all-electronic tolling (AET) is loss of revenue when toll collection systems fail to perform at optimum levels, which is why, in 2005, Florida's Turnpike Enterprise (FTE) initiated its IBTTA award-winning SunWatch Operations Center to detect and diagnose hard system failures or severe degradation with potential to cause back-office revenue leakage. But the persistence of more subtle forms of system degradation prompted a further initiative: SLAM.

"With a growing number of cash lanes converting to AET, the Supplemental Lane Analysis and Monitoring (SLAM) team was formed in 2015," explains SLAM team leader Pete Shloss. "It comprises a multi-



**“**SRTA wanted to encourage commuters to explore alternatives to driving alone during the most congested periods  
 Pete Shloss, SLAM team leader, Florida's Turnpike Enterprise

disciplinary staff experienced in maintenance, lane and back-office engineering, and finance. They defined a set of performance metrics derivable from transaction and back-office data and setup means to collect, summarize and monitor this data via reports and dashboards."

Performance metrics are collected every three hours and a schedule for daily monitoring and weekly trend analysis was established, with repair issues immediately forwarded to



Above: SLAM allows the detection of subtle forms of system degradation

front-line maintenance. For example, a fall from 65% to 50% in automated plate reading at a tolling point would generate an alert, perhaps indicating a dirty camera lens, while subtler, design-level issues can be tracked and investigated over time with assistance from lane vendors and back-office software architects.

"SLAM has had immediate pay-off in detecting issues, but more importantly has created opportunities for optimizing lane and back-office systems," Shloss continues. "Improved automation and accuracy of video tolling has realized over US\$10m per year in manual image review labor savings and reduced image review rejections. FTE's commitment to an analytical monitoring approach has paid off on its bottom line." Over US\$30m has been saved so far through detecting degraded equipment, lane system improvements, video toll-processing software, and workflow improvements. All in all, a grand SLAM for FTE!





# Private Sector Innovation Award

## Emovis New Mersey Gateway Bridge

The UK's New Mersey Gateway Bridge is an innovative response to a seemingly impossible situation faced by many local transportation authorities around the world. Congestion on Halton Borough Council's aging Silver Jubilee Bridge had reached dangerous levels, jeopardizing community access to essential services on either side of the River Mersey. Built in 1961, the Silver Jubilee Bridge was exceeding its traffic capacity nearly tenfold, with daily peaks of 85,000 users by 2017. When national government funding

for a new bridge was denied due to scarce public resources, it fell to a community of 125,000 with an annual budget of around £100m (US\$130m) to fund a £615m (US\$800m) infrastructure project.

In return for urgently needed mobility, the community accepted tolling on both the existing bridge and the new one, a majestic 1.4-mile (2.3km) cable-stayed structure carrying six lanes of high-speed traffic over the Mersey's estuarial waters, after traffic modeling deemed revenue from the new structure alone

insufficient to cover capital and operating costs. The Borough Council overwhelmingly supported the project, as did local businesses and most residents, preferring two tolled crossings to no new bridge at all.

Enter experienced toll service provider Emovis, which was able to realize the community's vision with an innovative approach involving all-electronic free-flow tolling, winning community support while delivering the revenue required to meet the council's contractual obligations. "The whole Emovis team is very honored to accept the 2018 IBTTA Private Sector Innovation Award for our UK Mersey Gateway project," says Benoît Rossi, speaking on behalf of the Emovis team.

"This is not only recognition of our company, but also a tribute to Halton's local authorities, who have delivered this flagship infrastructure on time and on budget. It clearly demonstrates how a user-fee approach can garner local community support, given leadership, trust and accountability from both public and private sectors."

**“**This project vividly demonstrates how a user-fee approach can garner local community support, given leadership, trust and accountability from both public and private sectors

**Benoît Rossi, global head of marketing and communications, Emovis**



Above: The Queen attended the official opening of the UK's New Mersey Gateway Bridge  
Below: The cable-stayed bridge is 1.4 miles (2.3km) long







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# Social Responsibility Award

**Virginia Department of Transportation**  
Reinventing equity in mobility

How can toll agencies fulfill their social responsibilities, building a sense of trust and accountability, when contractual obligations necessitate tolls that are detrimental to the poorest members of a local community? The Toll Relief initiative led by the Virginia Department of Transportation (VDOT) aims to provide meaningful financial relief to low-income users of the Elizabeth River Tunnels (ERT), many of whom must traverse these toll facilities daily to commute between Norfolk and Portsmouth in the state, crossing the Hampton Roads.

**US\$458k**  
The total financial relief paid to 2,094 disadvantaged local residents in the VDOT Toll Relief scheme in 2017

With less affluent local residents ambivalent about ERT tolls and further Commonwealth tolling projects in the pipeline, VDOT embarked on a public awareness-raising exercise, explaining tolling's role in funding much-needed highway improvements. At the same time, it set about providing relief to those most burdened by tolls through this radical new scheme, which was announced by Governor Terry McAuliffe in October 2016. Under its terms, residents in Norfolk and Portsmouth with an annual income at, or below,

US\$30,000 who are E-ZPass-enrolled may receive financial help in the form of a US\$1 refund per tolled trip when using the Downtown or Midtown Tunnels eight or more times in a month. The tunnel operator, Elizabeth River Crossings, is contributing US\$5.5m over 10 years to fund the project under an agreement forming part of a broader deal to reduce the financial impact of crucial road improvements on Hampton Roads motorists. In 2017, its inaugural year, Toll Relief delivered US\$458,000 in financial relief to 2,094 residents; enrolment for 2018 has already passed 3,000. Could such means-adjusted tolls point the way to a socially equitable future of infrastructure finance? ○



## Home of the brave

**This year's IBTTA Annual Meeting venue is Baltimore, Maryland**

The IBTTA returns to Baltimore, Maryland, for its 86<sup>th</sup> Annual Meeting. Founded in 1729, Baltimore is steeped in history, with more public statues and monuments per capita than any other US city. Once the second-largest port of entry for immigrants to the USA, Baltimore became a focus for resistance to British taxes during the American Revolution, inspiring Francis Scott Key to write *The Star-Spangled Banner* here in 1814. Still a thriving port – ranked America's ninth-largest for total cargo value – Baltimore has blossomed into a diverse 'city of neighborhoods' and a major gateway to the US Capitol in Washington DC, 40 miles (64km) southwest. The IBTTA Meeting is hosted by the Maryland

Transportation Authority (MDTA), established in 1971 to finance, construct and operate Maryland's toll facilities and develop new, revenue-producing transportation projects. Financed by toll revenues rather than tax dollars, MDTA operates eight toll facilities that embrace some spectacular infrastructure. Used by 27 million motorists annually, the 4.3-mile (7km) Chesapeake Bay Bridge was the largest continuous over-water steel structure on the planet when it opened in 1952. The 1.4-mile (2.3km), eight-lane Fort McHenry Tunnel was also the world's widest immersed tube vehicular tunnel when it opened in 1985. Delegates will be able to tour both impressive facilities and visit MDTA's



**IBTTA 2018 BALTIMORE**

Emergency Operations Center, which integrates primary traffic and systems management with MDTA Police Dispatch to provide Maryland citizens with an optimum standard of service. MDTA continues to improve Maryland's infrastructure,

having secured US\$765m to finance a new Nice Bridge connecting the state with Virginia, where construction begins in 2020. Meanwhile, MDTA is extending its northbound I-95 Express Toll Lanes, where AET is already established.

Above: Baltimore, Maryland, will host the 2018 IBTTA Annual Meeting



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# Blockchain:

## The hidden costs

Blockchain-enabled 'smart contracts' could give road users the ability to book slots with guaranteed arrival times. But will authorities be financially liable if such systems fail? And what else should traffic managers be preparing for in this ongoing data revolution? **James Gordon** investigates

Illustration Sean Rodwell







**F**or many traffic managers, blockchain is still an arcane concept rather than a disruptive force. But this leading-edge technology has the very real potential to be a game-changer, creating the dynamic and decentralized transportation networks of tomorrow.

As Richard Nash, an intelligent transportation expert for IBM, stated in a recent concept paper for the UK's Transport Systems Catapult (TSC): "100% of transport organizations will adopt blockchain in some guise."

IBM defines blockchain as 'a shared, distributed ledger facilitating the process of recording transactions and tracking assets in a business network'. But what does it mean for the global traffic management community today? And why is it the potentially game-changing technology of the future?

#### **Real-world applications**

Erwin Vermassen, a senior manager in ERTICO's Connected & Automated Driving Division, oversees several





projects where blockchain could make a big difference.

One initiative is the Corealis, Port of the Future project, where research into blockchain is being carried out to see whether traffic flow in and around a sea port can be improved via Mobility as a Service (MaaS).

“We are looking at a blockchain-inspired MaaS business model as a way of substantially reducing the number of cars,” says Vermassen. “The challenge is of course to give car drivers not just a viable alternative but a better, hassle-free alternative that will take them to work, home or wherever they want to go, using end-to-end public transport services. Blockchain-enabled smart contracts could work out the quickest route and enable the commuter to pay for the multimodal journey in one hit. Commuters will then choose to leave their cars at home and thereby reduce the city’s traffic footprint.”

But why is blockchain so important to the roll-out of MaaS services? “For such services blockchain is absolutely critical, since multiple stakeholders are involved in

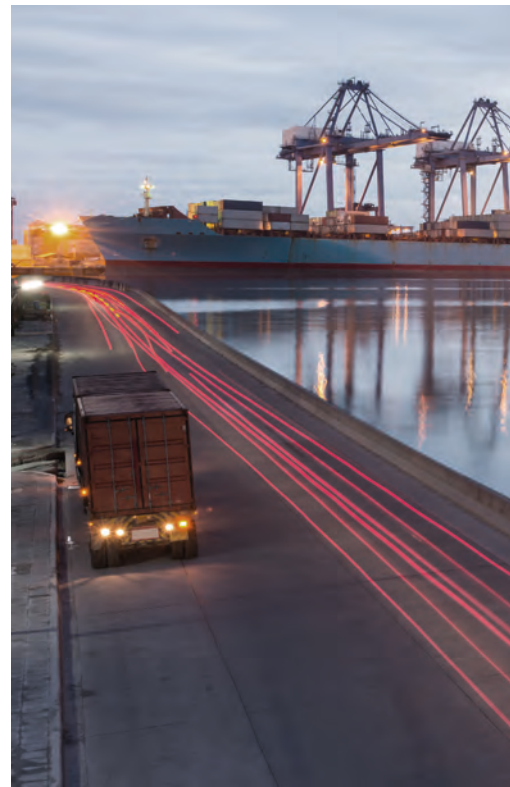


We are entering a golden age of data, and traffic managers have access to a particularly rich seam of information

**Prof. Lenny Koh, director, Advanced Resource Efficiency Centre (AREC), University of Sheffield**

the realization of these transactions, stakeholders are not necessarily connected by a bond of trust,” says Vermassen. “Whether your journey involves one mode or several modes of transport, blockchain is the technology that provides that trust.”

Prof. Lenny Koh, director of the Advanced Resource Efficiency Centre (AREC) at the University of Sheffield, UK, agrees that blockchain represents a huge transformative force in transportation: “We are entering a golden age of data, and traffic managers have access to a particularly rich seam of information. It’s everywhere. It’s being generated and transferred through our smartphones, laptops, cars and by sensors in the roadside. If this information is harvested correctly, it can revolutionize how we move people and goods on our road networks. To do this, however, you need to be able to capitalize on all the





## Countdown to deployment

How long will it be before blockchain-based services become commonplace in our transportation networks?

Predicting an accurate timeline for blockchain applications in transportation is not easy, according to Charles Carter and Prof. Lenny Koh, authors of the TSC paper *Blockchain Disruption in Transport*.

"There are so many use cases, and each will use blockchain in a very slightly different way," explains Carter. "But from our study, which canvassed opinion from OEMs, technology giants and academia, we concluded that it will take two to three years for low-volume, high-latency cases to be rolled out, and longer for high-volume, low-latency concepts to enter service."

Koh adds, "In regard to predicting an accurate timeframe for blockchain MaaS networks to come online, Gartner, a leading technology consultancy, predicts blockchain will be a mainstream technology in the next 5 to 10 years. But of course it is a little bit more complex than that. Each use case in traffic management is different, and ultimately it is complexity that will decide when they are market ready."

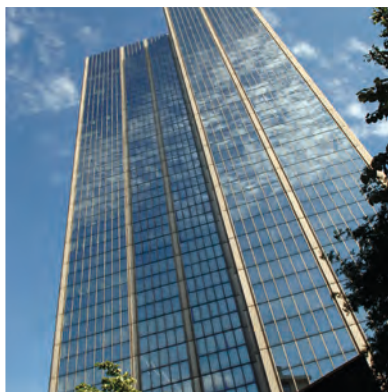
And global take-up of the technology? Koh says, "As far as global strategy and policy is concerned, there's clear evidence that the UK, China and the USA are leading major

blockchain initiatives. So it may not take as long as we think for the decentralized technology of the private sector, the regulator and, most importantly the customer, to be fully aligned and realized."



Left: ERTICO is testing blockchain-enabled MaaS systems in sea ports

Below: ERTICO's 'blue tower' headquarters in Brussels, Belgium



real-time floating data that can tell us so much more than the centralized data that is collected by a road authority. That information could relate to traffic speed, volume of traffic, vehicle occupancy and vehicle emissions – all of which are integral to transforming a town or city's transport network.

"But therein lies the problem," she continues. "How can this extremely rich source of data, which if used correctly could cut congestion, reduce costs and improve air quality, be trusted? Blockchain is the technology that enables a single version of the truth. It does this by sifting through millions of datapoints from millions of sensors. Before the data is added as a new block to the chain, those who belong to the blockchain network approve the data. This information can never be erased from the immutable ledger, which further increases trust in the data."

### Booking commuter time slots

Vermassen is convinced blockchain technology has the potential to support the easing of congestion

It will need the self-driving revolution to take off... but we think we'll be able to sell a commuter a time slot through a blockchain-centric, integrated platform

Erwin Vermassen, senior manager, Connected & Automated Driving Division, ERTICO-ITS Europe



through concepts like MaaS, and could facilitate even more innovative solutions. For instance it could enable drivers to buy designated time slots for certain journeys.

"The aviation industry has been doing this for years," he says. "But with increasingly detailed floating data from cars and cell phones added to information from roadside infrastructure, and blockchain providing the single version of the truth, it will be possible in the future to sell commuter slots on our roads. It will need the self-driving revolution to take off, but when level 3 and level 4 automation become commonplace, we think we'll be able to sell a commuter a time slot through a blockchain-centric, integrated platform, which will all but guarantee unbroken passage into a city center."



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Koh agrees that “the concept of selling smart time slots could be a good one – especially in mega cities,” which often have major congestion.

She says, “I think that this idea could improve traffic flow and reduce congestion and emissions, and the smart contract could certainly be covered by blockchain through a decentralized system. So I think that traffic managers should certainly think about implementing schemes like this, but only where they are really needed.”

Vermassen believes such ideas could one day be an important part of traffic management. “Introducing technologies such as slot management alongside other upcoming C-ITS and MaaS services will make it much easier to manage traffic streams and reduce the number of vehicles on our roads.”

### Compensation quandaries

But what if such a system were to break down? Surely any driver who has booked a guaranteed arrival time but is then delayed will demand some sort of compensation? Vermassen accepts there are many unanswered questions around revenue collection, and notably whether, with such a system in place, a town or city would be wholly responsible and legally liable for congestion.

He says, “Local authorities will have a large stake in the organization

## “ Research is needed on liability, user acceptance, business models and physical implementation of slot management

Erwin Vermassen, senior manager, Connected & Automated Driving Division, ERTICO-ITS Europe

of blockchain-based services. This said, it is important to note that these technologies are still in their infancy and much more research is needed to come to fully workable solutions. Also the evolution in vehicle automation will play a large role in this story. Research is not only needed on the pure technological aspects, such as which blockchain model to use, but also on topics such as responsibility and liability, user acceptance of these new technologies, organization of the business models and, by no means unimportant, the physical implementation of a service such as slot management.”

### Challenges ahead

In continental Europe, with MaaS one of the key blockchain use cases, ERTICO-ITS Europe is hosting innovation platforms such as the MaaS Alliance and the Traffic Management 2.0 (TM.2.0) to identify, develop and explore a series of use



Above right: The headquarters of the UK's Transport Systems Catapult in Milton Keynes

cases, which it hopes one day can be rolled out by traffic management centers in town and cities across Europe and the world.

But nothing is yet certain, and the Organisation for Economic Cooperation and Development (OECD) says “the field is very volatile” with new entrants being established “on a weekly basis”. Several blockchain consortiums and forums such as the Mobility Open Blockchain Initiative (MOBI) and the Blockchain In Transport Alliance (BITA) have emerged, but very few standards exist around how transport data stored using blockchain is mined and shared.

To complicate matters further, in its recent study TSC says that the majority of the transport pilots will “use private or hybrid blockchains” that require permission, rather than public ones, which don’t.

For Vermassen, it is not just the permissions structure of the technology that is important, but

## Data security

Blockchain is way ahead of any other currently available data security system – but is it infallible?

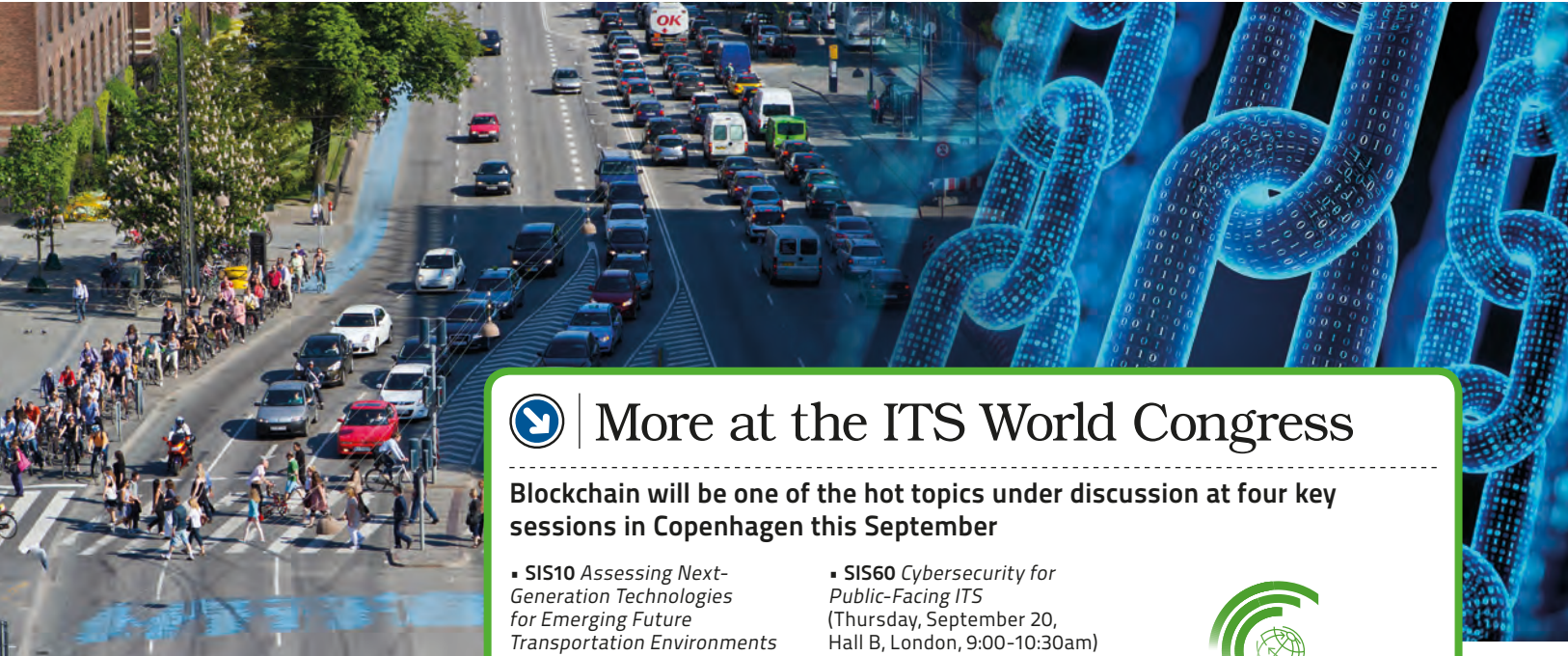
How secure is blockchain? What assurances can proponents of the technology provide that our data is safe?

ERTICO’s Erwin Vermassen says, “No technology is absolutely bullet-proof, but blockchain will, I believe, enhance security and privacy by taking cryptography to a new level. I think that is necessary as today’s centralized systems are vulnerable to hackers. If a hacker were to steal a cryptographic key belonging to a traffic management center, he or she could potentially

manipulate key data and wreak havoc in a city. “Blockchain clearly offers some important advantages over legacy technologies. However by using new technologies such as quantum computing, hackers might still be able to manipulate a blockchain ledger. Therefore, many TMCs in the future will, I believe, use hardware security modules to store private cryptographic keys, which will create an extra layer of security that will be much more difficult for cyber-criminals to penetrate.”







that there is data liquidity. “Real-time information,” he says, “must remain unsiloed and accessible to all. Regulators must continue to preserve the decentralized nature of blockchain by ensuring that ordinary people as well as traffic managers and city planners have access to a wide range of open-data platforms. In Belgium, this is already starting to happen. Government, for example, has insisted that parking companies in the private sector publish information relating to the number of parking spaces in each city. However, while regulations protect an individual’s privacy, a framework needs to be established around how blockchain systems handle, distribute and protect commercially sensitive information in order for the technology to flourish.”

**Surmountable issues**

It is a view shared by Charles Carter, an innovation manager for TSC, who believes that the challenges highlighted by Vermassen are “very real, but by no means insurmountable”.

He explains, “If the current barriers to data sharing remain, there will be social, economic and environmental costs. TSC estimates, for example, that the UK economy could lose £15bn [US\$19bn] in benefits



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- **SIS60 Cybersecurity for Public-Facing ITS** (Thursday, September 20, Hall B, London, 9:00-10:30am)
- **ES11 Enhancing Cybersecurity and Resilience of Transport Infrastructure** (Thursday, September 20, Bella Center, Auditorium Bordeaux, 1:30-3:00pm)
- **Blockchain and Distributed Ledger Technologies for Transport and Mobility** (Wednesday, September 19, venue TBC, 9:00-10:30am)



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**“One way of ensuring data traceability could be through using blockchain to create virtual data passports**

**Charles Carter, innovation manager, TSC**

per annum. But there will also be consequences for traffic planners, transport modelers and solution providers. If they don’t get access to the information they need, then there will be repercussions with congestion, delays and environmental impacts in our cities. Part of the problem is that companies and the general public across the globe – who between them own 50 billion connected devices – have little visibility of the data supply chain and what happens to their data. One way of ensuring data traceability could be through using blockchain to create virtual data passports, which would immediately notify the data set creator whenever someone is using their data.”

But while Carter thinks that blockchain data passports could give companies and individuals much greater visibility and control of the information they own, he thinks that with increased trust, businesses, struggling to understand the monetary value of their data, could be enticed to share their information in return for data another organization may have.

“Another innovation in development is the combination of blockchain with Zero Knowledge Protocols and algorithm sharing,” Carter continues. “This could enable the flow of insights in the transport data ecosystem, without the need for sharing the raw data. Transport authorities that need insights from third-party data, such as from OEMs and mobile network companies, to improve transport infrastructure and MaaS networks, could transfer their algorithm or code to the company. The business could then provide them with the insights without revealing any sensitive information or losing control of their data. It could also help data protection compliance.” ○



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# Cool it!

What's the best way to get motorists to slow down, thereby fighting congestion and pollution, and reducing the severity of accidents? In the Netherlands, average-speed enforcement (also known as section control) has been so effective that it's now being used on provincial roads for the first time, as **David Smith** discovers

**F**or the first time, the Dutch Department of Justice (DoJ) has opted to deploy section control average-speed enforcement systems on dangerous stretches of provincial roads on a large scale. Although the point-to-point camera systems have been used successfully on freeways in the Netherlands since 1997, the DoJ has only used them on a trial basis on provincial roads, on a very small scale. However, the danger for motorists driving on provincial roads – which cover only 6% of the network, but contribute about a quarter of all accidents – has forced the DoJ's hand.

The 20 provincial road sections have been chosen because other traffic calming measures have failed. When accident statistics show the perils of a provincial road, the DoJ's first step is usually to make adjustments, such as making the lines and road markings clearer. The next step is to introduce mobile controls. But sometimes, these strategies fail and the roads continue to be dangerous.

The Netherlands Public Prosecutor's Office, which is the part of the DoJ in charge of this project,

believes the time has come to try point-to-point cameras. "We've studied the effectiveness of section control on a dozen stretches of motorways in the Netherlands and the results have been positive. Research shows section control has contributed to reducing accidents,

“ Research shows section control has contributed to reducing accidents, as well as cutting levels of pollution and noise

**Stefan de Bruijn, senior project manager for section control systems, Netherlands Public Prosecutor's Office**



as well as cutting levels of pollution and noise," says Stefan de Bruijn, senior project manager for section control systems at the Netherlands Public Prosecutor's Office (DoJ).

## Selecting roads and vendors

Before selecting 20 suitable roads, the Public Prosecution Service carried out intensive analysis of accident data held by Dutch municipalities and police forces. They are mainly single- and double-carriageway roads with maximum speeds between 80km and 100km (50-60mph). Each section is at



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Section control has been in place on Dutch freeways for 21 years



**1%**  
The typical proportion of speed offenses on section control stretches of road, compared with an average 20% baseline  
Source: Sensys Gasto

information to a data analytics platform operating as the back-office enforcement system. Meanwhile, ARS T&T's SmartCam is a modular ALPR camera solution.

The average-speed enforcement systems will be in operation for a minimum of six years. "The two systems had to do a number of things, including checking for speed 24 hours a day; and recognizing different vehicle categories to determine vehicle speed limits. They also have to recognize the license plates of foreign cars and be almost completely error-free. We had further stipulations around data storage and processing, as well as security," says de Bruijn.

**Behind the curve?**

The decision to install section control on provincial roads is welcome, but a little belated, according to Dr Charles Goldenbeld, a researcher at the Dutch Institute for Road Safety Research (SWOV). He points out section control systems have been on Dutch freeways for 21 years and the evidence for their effectiveness has been mounting over a long period of time. There are now a dozen in operation. "I'm delighted the Ministry of Justice [MoJ] has made the decision, it's just a shame it's been such a long time coming. We advocated section control on provincial roads about 15 years ago. They were reluctant, believing drivers might avoid the cameras by taking alternative roads, but they've realized

least 1.5km (1 mile) long with few access or exit roads. All 20 roads have high accident and speed violation rates. Common risk factors include access roads, cyclists and other vulnerable road users, and high numbers of trees.

After a tender process, the Public Prosecutor's Office selected two providers, Sensys Gasto and ARS Traffic & Transport Technology, to install, manage and maintain their systems. Each company will take charge of 10 roads, with deployment scheduled to begin in February 2019 and be completed by the end of the year. "We chose the systems after a European-wide tender that ensured we got the best products for a reasonable price," says de Bruijn. "We also wanted to work with more than one provider in order to stimulate product development, so that better systems become available over time. We'll monitor performance of both technologies and when there's a new tender, those results may be taken into account."

The two systems are somewhat different. Sensys Gasto's T-Series platform uses a 20MP camera offering 30fps. The company's tracking radar measures the speed and position of up to 32 vehicles in the coverage area. The unit's integrated wi-fi transmits

“Studies show a high level of compliance because drivers don't want to pay fines. As a result, you get much more homogenous speeds along the whole route

Dr Charles Goldenbeld, researcher, Dutch Institute for Road Safety Research

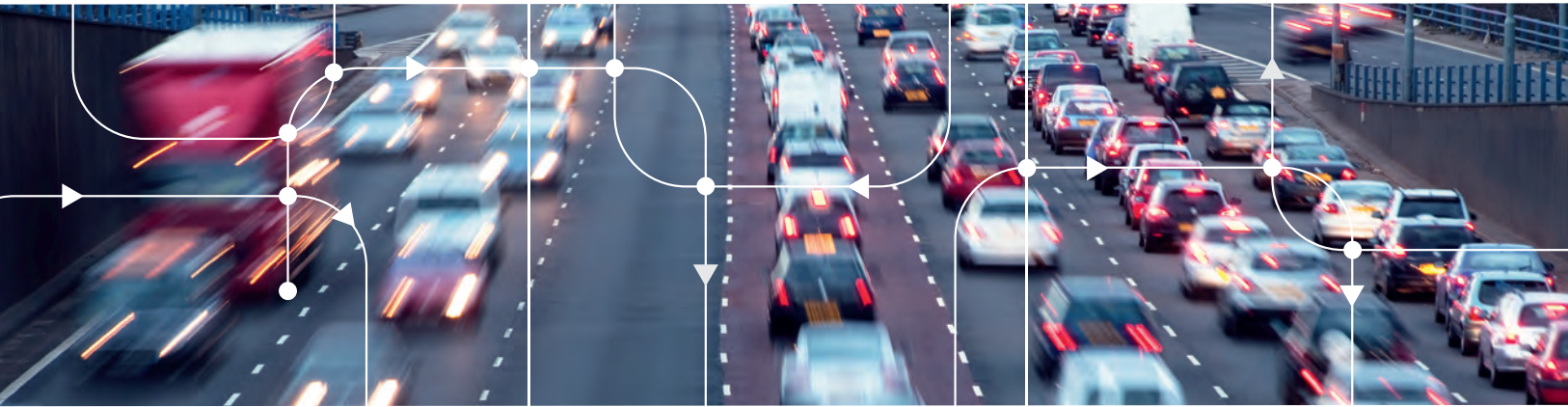




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now that there are enough suitable provincial roads and it's the best solution. The main alternative of redesigning roads would cost billions of dollars, which unworkable."

### Wishful thinking

If money were no object, Goldenbeld would introduce section controls on up to 50 Dutch provincial roads with high accident rates. He says that even if the systems are costly to install and run, they pay for themselves within three or four years. Reducing accidents saves money on healthcare, infrastructure upkeep and police time. One of the funding issues in the Netherlands – as in many countries – is that the ministry paying for the cameras is not always the same ministry that reaps the rewards.

"Road safety is important for governments, but there are always financial considerations. In the Netherlands, we have the MoJ paying for the camera systems, but the Ministry of Infrastructure and Environment is responsible for road safety. Then it's the Ministry of Health that benefits when there are fewer accidents. The best way to operate road safety measures is to get them co-financed by three ministries."

Goldenbeld is an enthusiast for section controls, but only because he has studied the international data for many years. He considers the evidence for section controls to be pretty convincing on a number of levels, citing studies from the UK, Austria, Norway and Australia showing it reduces overall speeds as well as the variability of traffic speeds. "Studies show a high level of compliance because drivers don't want to pay fines. As a result, you get more homogenous speeds along the whole route," Goldenbeld says. The result is a conveyor belt of vehicles traveling at the same speed, with little braking and larger headways. Once vehicles are on the conveyor belt,

## The Dutch difference

### How the system of speeding enforcement and penalties differs in the Netherlands from other jurisdictions

In the Netherlands, speeding fines are calculated differently to many other European countries. When caught speeding, everybody gets a deduction of 3km/h for speeds below 100km/h (60mph) and 3% above 100km/h. Furthermore, cameras are typically calibrated with a margin of 7km/h for speeds of 80km/h (50mph) and 8km/h for speeds of 100km/h.

What this means in practice is that the cameras on an 80km/h stretch are tuned to 87km/h. But if a driver is caught doing 87km/h, it will be reduced to 84km/h for the purposes of the fine. Both the measured and the corrected speed will be printed on the fine.

Another difference with the UK, and other systems, is that no matter how many speeding



fines a motorist receives, he or she won't be disqualified unless they have been driving very high speeds. This means 40km/h (25mph) more than the speed limit on highways, or 30km/h (19mph) higher on rural roads. Dr Charles Goldenbeld at SWOV says there have been long debates in the Netherlands about whether to introduce a UK-style points system.

"On the one hand, people who can afford to pay a lot

of fines don't change their behavior. We had a government minister a few years ago who kept getting caught speeding on his motorbike, but he said publicly that he would keep doing the same thing.

"On the other hand, there is evidence that the effect of a points system wears off after 18 months and it would cost a lot to change the administration processes," he says.

Goldenbeld also says there's a perception in the Netherlands that it's easy to cheat the system by claiming that a friend or relative was driving the car to avoid disqualification. "The same argument applies to speed awareness courses. It's easy to send someone else in your place," he says.

Communication with the public is of great importance. Before the systems are implemented, we will be carrying out extensive media campaigns

Ernst Koelman, spokesman, Netherlands Public Prosecutor's Office

47%

reduction in crashes after the installation of section control systems on a Rotterdam freeway

Source: SWOV

A reduction in variability of traffic speeds is just one benefit of average-speed cameras





Goldenbeld says, the journey becomes predictable and repeatable. Compared with spot speed cameras, section control reduces the ‘surfing effect’, where drivers brake on approaching a camera, and accelerate after passing it.

### Real results

Evidence from the Netherlands confirms international study findings. Section control on a freeway near Rotterdam with 140,000 vehicles passing through daily found only 1% of offenders contravened the 80km/h (50mph) limit (which had been reduced from 100km/h). The study showed a 47% reduction in all crashes, as well as a 4-6% cut in NO<sub>2</sub> concentrations and a reduction in daily noise of 0.4dB. The air around the road became 10% cleaner than it was before. “Reducing pollution, from emissions and noise, was the main goal of the first section control systems in the Netherlands,” says Goldenbeld. “Safety was a secondary goal, but we soon learned what an excellent way it was of controlling speed. The main difference with the new project on the provincial roads is that safety is the goal from the start.”

More evidence came from a 2014 thesis analyzing the safety effects of seven section control systems on 14 different roads in the Netherlands. According to the author, Eline W Korthof, a civil engineer from TU Delft faculty, the best results came when section control was combined with speed limit reduction, which was the case on most roads. Mean speed decreased by 16% and speed variance decreased by 41%. The number of serious injuries fell by 37% and the number of casualties dropped by 15%.

An important benefit of section control, Goldenbeld says, is that the public tends to regard it as a fairer method of speed control than less visible methods. A 2009 Dutch study (Poppeliers et al) found 77% of Dutch drivers considered section control acceptable. DoJ research has the figure closer to 90%.



A section control study took place on a freeway near Rotterdam



## A portable alternative

### Handheld laser devices offer a portable alternative to section control

Laser Technology Inc. (LTI) revolutionized traffic enforcement over 30 years ago with the introduction of the very first laser speed measurement device. This breakthrough enabled law enforcement officers to pinpoint an individual vehicle in dense traffic, while giving them a tool unaffected by radar detectors.

LTI continues to develop technologies that help law enforcement agencies improve safety on the world’s roadways. The company offers a full range of laser ranging solutions, including a groundbreaking all-in-one device that helps enforce speed, tailgating, aggressive driving and distracted driving.

LTI’s TruCAM II, an all-in-one speed enforcement tool, combines lidar with a built-in digital video camera and is one of the most sophisticated traffic enforcement tools available. It collects and stores a complete chain of video evidence along with a high-resolution image identifying vehicle make, model and license plate number.

The mobile TruCAM II unit has been decades in the making and amplifies the capabilities that made its predecessor, the original TruCAM, one of the most widely used laser enforcement

tools in the world. The TruCAM II caters to law enforcers’ most pressing demands, which include the need for a quality image that also can be used for fixed installations or mobile speed enforcement.

Easy-to-use, lightweight and with an IP55 rating for professional performance even in bad weather, the TruCAM II’s larger LCD backlit screen enables viewing in any lighting condition, and wi-fi, Ethernet and cloud-based capabilities for roadside printing. It also features AdapTec auto-focus and auto-iris for accurate point-and-shoot detection as well as crystal-clear license plate images, day or night.

The included ShareView software allows for remote screen viewing and the ability to send images back to the department.

This lidar unit also integrates with the LTI Blitz software for sending images to another officer down-road during speed enforcement operations or to the FTP server, which can push images to multiple tablets and quickly display the recorded infraction to drivers.

The TruCAM II traffic and speed enforcement laser is one of the most advanced, versatile speed enforcement tools and sets a new standard for effective roadway policing.



90%

The reported public support for section control speed enforcement in the Netherlands

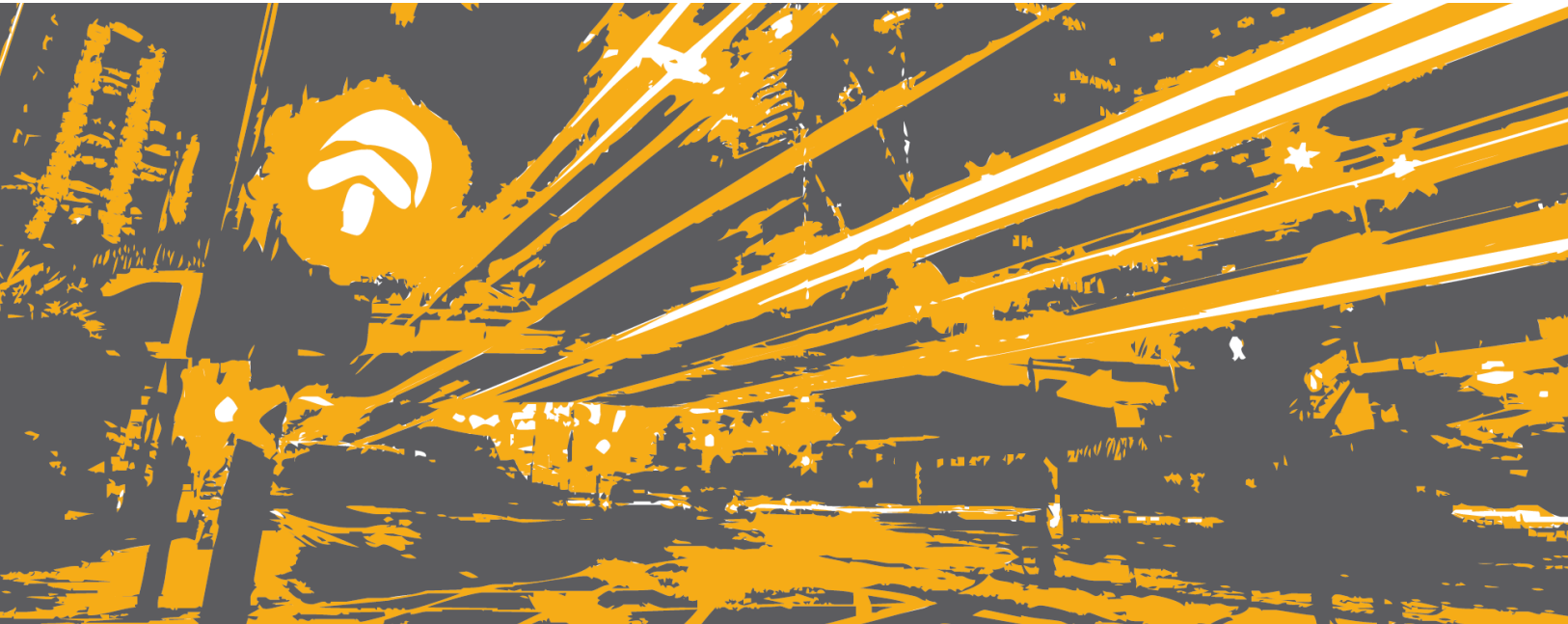
Source: Dutch Public Prosecution Service

“When it’s clearly communicated with signs saying where it begins and ends, people find visible checks much fairer than invisible ones – you have to be speeding over longer periods rather than for one moment. We also have radar checks in the Netherlands and when drivers don’t see where the unit is they get very angry. They hate invisible checks,” says Goldenbeld.

The public perception of section controls is important to the MoJ as respectful drivers can quickly begin to suspect the authorities of raking in cash at their expense. Spokesman Ernst Koelman of the DoJ says it will do all it can to avoid becoming what he calls “a

rewarding subject for pub talk”. The DoJ, he insists, is aware of the importance of good public relations, especially with a system untested on provincial

roads. “We believe good communication with the public is of great importance. Before the systems are implemented, we will be carrying out extensive media campaigns. Then, when we install the cameras, we will announce the beginning and end of each section control with large signs on the side of the roads. The MoJ will also publicize the number of fines imposed per system three times a year, so that nothing is hidden from the public.” ○



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# CONNECTING

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## V2X is go!

Colorado is preparing for connected vehicles with the deployment of vehicle-to-everything technology

Colorado DOT (CDOT) is working with Panasonic Corporation of North America to create what will be the most connected roadway in the USA.

Following a successful pilot program, the two organizations will now install 100 vehicle-to-everything (V2X) roadside units (RSU) along the I-70 Mountain Corridor from Golden to Vail.

The real-world deployment will enable drivers and traffic managers to receive information on traffic delays and weather conditions through continuous and automatic communications between vehicles and the roadside infrastructure. CDOT expects to see an 81% decrease in unimpaired multivehicle crashes, as well as more reliable travel times.

"Car manufacturers worldwide are preparing for the future, so we must be prepared as well," said Amy Ford, CDOT's chief of advanced mobility.

"Toyota will be rolling out V2X-equipped vehicles in 2021, and Ford as early as 2020. When those cars roll off lots, who will have an environment they can work in? Colorado."

In addition to the RSUs, more than 100 CDOT vehicles regularly driving on the highway will be equipped with technology enabling two-way communication with the Traffic Operations Center.

By the end of 2018, RSUs installed along the I-70 Mountain Corridor will be communicating with all equipped vehicles, providing real-time information to drivers and traffic managers. For example, drivers will receive alerts to slow down when vehicles ahead suddenly apply their brakes. If an airbag is deployed, an alert will be instantaneously sent from the vehicle to an RSU, so traffic managers can dispatch emergency responders and tow-trucks to the exact crash site.



### 70: Open data 2.0

A pan-European project – SOCRATES 2.0 – is exploring the possibilities of data sharing and the potential benefits that it could provide for road users and traffic managers.

### 75: Understanding omnidirectional antenna options



### 76: Automated digital tachographs – a new application for DSRC











# Traffic data unlocked

A pan-European project bridging the private/public sector divide is exploring the potential of sharing traffic data for the benefit of road users, traffic managers and businesses alike. **James Allen** reports

**T**he information a traffic manager, a navigation service provider, or even a logistics company possesses can legitimately be considered one of the most significant aspects of its business, making it stand out among its competitors.

Whether it is from a vehicle sensor, or simply via the collection and storage of personal information supplied by customers, the data retrieved can be leveraged to greatly enhance the service provided.

It is why many go to great lengths to ensure their data is protected from external parties unaffiliated with the business and its interests.

One project in Europe, however, is pushing against such attitudes.

Harnessing the strengths from organizations on both sides of the public/private divide, SOCRATES 2.0 (System of Coordinated Roadside and Automotive Services for Traffic Efficiency and Safety) will see companies share data in a way previously unheard of.

Tiffany Vlemmings, a project manager at Rijkswaterstaat (RWS), the Dutch government department responsible for maintaining road infrastructure, explains the underlying issue that has led to the emergence of the project.

"What we see today is that road users have discontinuous information," she says. "There may be variable message signs on the roadside saying there's an accident

ahead, but at the same time they have their own in-car navigation service and the information provided by each don't tend to match up.

"It's not very convenient to have these conflicting messages because, as a driver, you still need to decide what to do, and you don't know what advice is most informed.

"At the same time, traffic managers use the data they have about the situation to make decisions, but they don't necessarily have all the information to accurately forecast where congestion spikes will be."

### Sharing is caring

The basic premise of SOCRATES 2.0 is that the more traffic-related data is shared, the better traffic managers



can respond to incidents on the roads, the more likely navigation services can offer the best journey plan, and the more informed drivers can be in avoiding congestion ahead of them.

Funded by a subsidiary of the European Commission, RWS is overseeing the project, but of the four sites earmarked for it, just one is located in the Netherlands.

Involving all 11 partners, the Amsterdam pilot will be the largest trial, but ITS World Congress host city Copenhagen in Denmark, Munich in Germany and Antwerp in Belgium are also locations SOCRATES will be piloted in, to ensure services are scalable and can be replicated Europe-wide.

Project partners include the municipal governments of the respective cities, car maker BMW, mapping and navigation service providers Here and TomTom, as well as data-processing firm Technolution and traffic management businesses Be-Mobile and MAP.

"These private companies collect their own traffic-related data that benefits their customers, but it is often incomplete or out of date because traffic management measures have been installed without their knowing," explains Vlemmings.

"So, for instance, if you are providing a navigation service, and you don't know that in five minutes one of the lanes in the road will be closed – reducing capacity – maybe you would suggest another route.

"We want to make the best navigation service for road users, improving the quality of traffic information, making it more consistent. To do that, we think data from private entities and public organizations should be integrated."

### Putting it into practice

It is one thing, however, to acknowledge the potential benefits that collaboration brings; but given the status in which data sets are held, it is quite another for large, data-rich, multinational corporations to actually share their data with outside parties.

Vlemmings is aware of how precious many firms hold their data, but that grip is noticeably loosening among SOCRATES partners.

**“What we see today is that road users have discontinuous information when driving to their destination**

**Tiffany Vlemmings, project manager, Rijkswaterstaat**



"The companies do not and will not share their cleaned data with other companies, so, within SOCRATES, the raw data they share is aggregated and processed with all the rest in such a way that it will not interfere with or undermine a company's operations, but will be incredibly helpful in completing the picture of what's happening on the road," she says.

### Wider benefits

Greater understanding of road activity has clear advantages for traffic management centers. Knowing a certain number of vehicles are heading in a similar direction enables managers to make the most effective decisions for maintaining traffic flow, but, according to Vlemmings, the potential benefits reach further.

"This collaboration is not just beneficial to the public sector, but is also very necessary for the private sector," she says. "They need to have good-quality navigation information for their customers and the problem

with satnavs these days is that every system has very similar information.

"So, you can never be sure you are getting the best route planner as it can send you right into a traffic jam, because it's not just you but all the other drivers that have been rerouted along the same road, clogging up another route.

"In the early days, when only a few people had them, they were very effective for avoiding congested routes, but now everyone has a digital navigation device, so today what sets one apart from the rest is finding how much capacity on the road network is still available and factoring that in to the route planner.

"It's not just about giving individual route advice, but making sure the advice given doesn't send people into another traffic jam, and you can only do that if you have complete information – so not just floating car data, but also roadwork and traffic management information."

### Unforeseen advantages

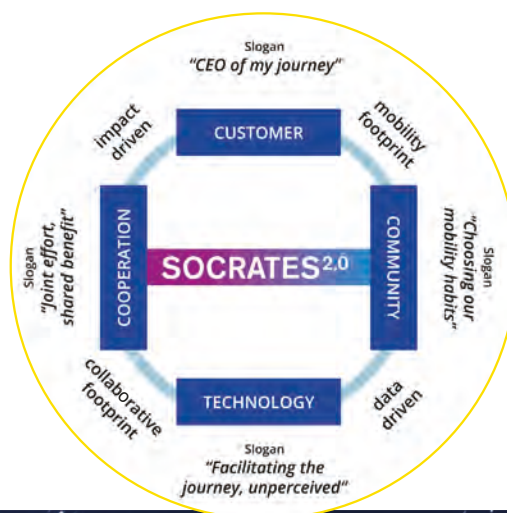
Reducing congestion and improving the driving experience for road users are important intended outcomes for the project, but Vlemmings is also hopeful more complete data sets could lead to the provision of new services.

She envisages a scenario in the future where road authorities could incentivize drivers to avoid certain roads with rewards schemes, to ensure key performance indicators, such as emission levels, for those roads are met. Alternatively, to achieve the same outcome, navigation providers could be paid to direct a percentage of drivers off certain roads.

Such considerations are interesting propositions for traffic managers to ponder, but are a way off from becoming reality just yet.

Currently still in the planning phase, the team behind SOCRATES is building momentum toward full pilots in its four locations from January 2019. But that doesn't mean the hard work can wait till next year but, as Vlemmings explains, a substantial amount of groundwork has already been laid.

Below: Diagram summarizing the aims and beliefs of the SOCRATES project







“We are 11 partners, from both the public and private sector, in one consortium. So what we really needed was a common language to talk to each other with, to make sure that we all mean the same thing,” she says. “We also needed to lay down shared aims and objectives, because each partner is in the project for their own, unique reasons.”

**Agreeing on a course of action**

Much of the partner efforts have, so far, been focused on constructing a common framework that incorporates these requirements – and also looking at how data will be managed, communicated and processed.

It is this last aspect that is very much up for debate, with the pilots trialling various setups. For most, a designated intermediary will be responsible for ensuring smooth data exchanges between the public traffic management centers and the back

offices of the private enterprises that are involved. But in one scenario to be tested there will be no intermediary, with the partners involved responsible for constructing their own lines of data exchange.

Irina Koller-Matschke, a development engineer for BMW, who was project leader for the creation of the framework, explains, “It is expected that for the different pilots there will be no one-size-fits-all cooperation model and variations to the intermediary types are possible.

“The upcoming SOCRATES 2.0 pilots will experiment with different cooperation models and intermediary types for each use case, in order to experience more and learn the effects of different options. The results will be used to update the framework.”

Once the trials are completed, the partners will reconvene, as well as engaging with stakeholders outside of the consortium, to draw

Above: **The SOCRATES 2.0 project is taking place in four locations in Europe. The 11 partners are BAST, BeMobile, BMW, Brandmkr, City of Copenhagen, Here Technologies, MOW Vlaanderen, MAPtm, Rijkswaterstaat, TomTom and Technolution**

conclusions as well as to provide recommendations and guidelines for deploying services on a more permanent basis.

With what has been achieved already, Vlemmings is sanguine about what the next 12 to 18 months have in store.

“If it turns out that we have indeed produced a blueprint for how public and private corporations collaborate, then SOCRATES will certainly be recognized as a success, but even if it doesn’t work, it has been a huge learning curve for future data exchange. And that is extremely valuable because the potential of data fusion to achieve cleaner data sets is almost limitless.

“But we have very skilled people, who are very keen on making sure it’s going to succeed. It’s in the best interest of all the parties involved and that makes everybody very committed.” ○



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2. Pre-Qualification Requirements –The participants or other entities participating in the applicable consortia shall be required to demonstrate compliance with the Professional Pre-Qualification Requirements, Financial Pre-Qualification Requirements and all other requirements, all as detailed in the Invitation for Pre-Qualification.
3. The Invitation for Pre-Qualification and any updates thereto shall be available for online review, at the following website:  
<https://www.nta.co.il/ppptender>, for no charge.
4. Any questions or requests for clarifications shall be addressed in writing only to Tender’s Mailbox: [ntatender@nta.co.il](mailto:ntatender@nta.co.il) by no later than October 15, 2018.
5. Submission Date – the date for the submission of the Pre-Qualification Submissions is December 13, 2018, by no later than 14:00 (Israel standard time).
6. This notice contains general and preliminary information only. Participants are required to comply with all the provisions of the Invitation for Pre-Qualification in their entirety.



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# Understanding omnidirectional antenna options

Omnidirectional antennas are an easy way to build out a network because the installer does not need to determine antenna alignment within the network.

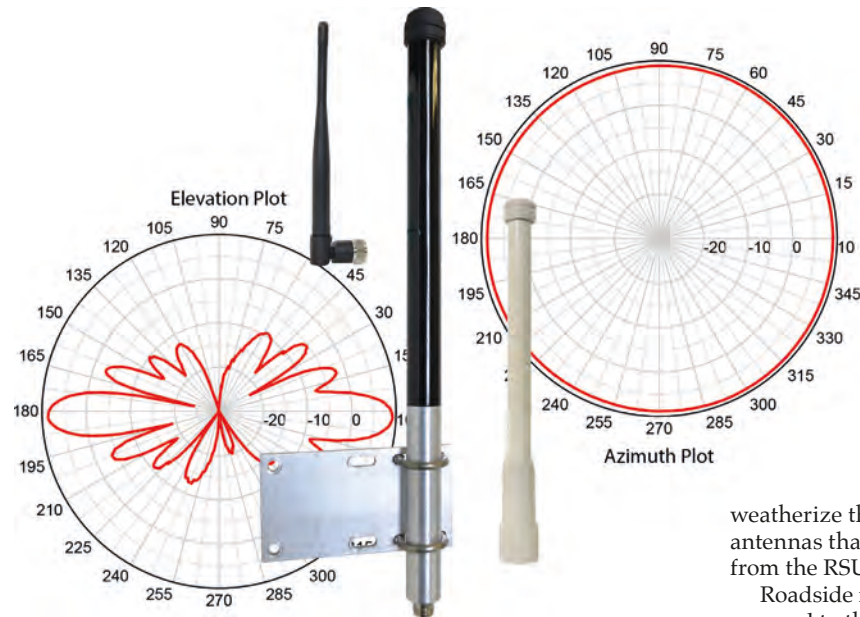
## Electronic design factors

The most common omnidirectional antenna is the quarterwave. It is simple but requires a ground-plane such as a metal vehicle roof or a metal electrical cabinet. Gain varies from unity (0dBi) to 5dBi depending on the actual design and ground-plane. The downside is that the peak radiated energy is not on the horizon, but tilted up a bit. This is caused by the ground-plane.

The second type of omnidirectional antenna is the halfwave – typically called a dipole. The halfwave antenna has the advantage of not needing a ground-plane to work properly and therefore, peak radiated energy is on the horizon. The gain of a halfwave antenna is approximately 2.5dBi. An example of the halfwave rod antenna found on modems.

Collinear array antennas contain multiple halfwave elements with a specialized feed structure that enables the elements to work in parallel. They are more complicated but manage to keep the peak radiated energy on the horizon, while providing higher gains. Typical omni gains are 3, 6, 9, or 12dBi. The azimuth beamwidth remains at 360°, but the elevation beamwidth becomes smaller with higher gain.

The last type of 'omnis' are folded dipole antennas, commonly used in VHF/UHF applications. The open metal elements look like compressed loops and are mounted to metal masts. The unique aspect of the



Mobile Mark offers a wide choice of omnidirectional antennas so that planners can optimize the network design

## Need to know

### Criteria to consider when selecting an omnidirectional antenna

- > **Coverage:** What radiation shape is needed? Will the setting be a limited area with wider variations in height, or a wider area with minimal height variations?
- > **Mounting:** Does the antenna need to be located somewhere other than the roadside unit for optimum coverage?
- > **Environment:** What will the installation be exposed to and what does the antenna need to withstand?
- > **Other uses:** How else and where else might the antennas be used?

folded dipole is that they are fully configurable by the installer. One element on a mast provides 2.5dBi gain; a second element added with a special cable harness will achieve 5dBi. When mounted closer to the mast, the antenna becomes directional.

## Installation factors

DSRC infrastructure frequently uses collinear array antennas in roadside units (RSU). A direct-mount antenna allows for a water-tight connection with no cable loss. The entire unit can be mounted right-side up or up-side down, depending on the coverage pattern required.

There are settings where the coverage pattern will be better served if the antenna is located away from the RSU. If the signal to and from the RSU will be partially blocked, a pigtail or coax-fed antenna can be mounted remotely. The RSU might be located at the side of the road and the antenna mounted on the traffic-light bar in the middle of the street. Care must be taken to fully

weatherize the connections for antennas that are mounted away from the RSUs.

Roadside installations are exposed to the full range of weather conditions. In general, omnidirectional antennas are less prone to ice build-up than directional antennas because they have a narrower mass. They can also withstand higher winds.

## Convenience factors

Many of the omnis can be configured with a mag-mount base that means the antenna can be temporarily mounted for network testing and then easily moved to another location.

For heavy-duty industrial vehicle applications, omnidirectional network antennas can be configured with spring-mounts so that they flex when hit by obstructions. In addition, the antennas can be foam-filled for use in high-vibration settings. ○

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# Updating digital tachographs – a new application for DSRC

The European Union (EU) will update digital tachographs from 2019. New smart tachographs will use dedicated short-range communication (DSRC) with GNSS integration. DSRC is a well-established technology used in electronic tolling systems throughout Europe.

Using a tachograph for recording distance, speed and truck driver working hours has a long tradition within the EU.

It has been shown to increase road safety, improve working conditions and provide fair competition. In 1986, the EU introduced a Regulation with an Annex 1 requiring heavy vehicles to have an analog tachograph based on a paper disk. This first step was susceptible to fraud, so, in 2006, the EU introduced Annex 1B (EU-Reg. 1360/2002) as the first generation of digital tachographs, including chip cards and high-security devices. In 2011 and 2012, this annex was updated to include independent motion detectors and new motion sensors. The recent EU regulation 165/2014 requires new smart tachographs to integrate GNSS in order to prove their geographical position, DSRC for remote enforcement, optional ITS integration via Bluetooth, and also an update of the cryptography used.

Smart tachographs will become mandatory from the middle of 2019 for all new registered trucks in the EU.

## How does it work?

The main part of the smart tachograph is a vehicle unit, which will typically be built into the dashboard of the truck. Connected to the truck CANbus, information from the motion sensors is the main source for recording driving behavior.



Above: Detached antenna for the smart tachograph

Above: Components of the smart tachograph

## Need to know

### Key new technologies found in smart tachographs, mandated by the EU

- Full vehicle CANbus integration
- GNSS satellite location information
- DSRC to verify location data and prevent fraud
- Bluetooth ITS integration interface

Via the optional ITS interface, data access for external devices may be permitted via Bluetooth. This will enable the use of tachograph data for external ITS services, while respecting data protection rules.

Examples of available data include driver activities, card and vehicle unit data, and continuous GNSS data.

In the smart tachograph, the geographic positions provided by satellite navigation systems at specific locations have to be stored in its memory in order to verify compliance with regulations. The position at the start of a working day, location after three hours of accumulated driving, and the position at the end of the day, will be recorded.

## Integrating DSRC

DSRC operates at 5.8GHz and is a well-established technology used in Europe and many non-European countries for road tolling, compliance checking with GNSS-based tolling systems, and for other purposes.

The smart tachograph will use the same technology to provide information about potential misuse or manipulation while the vehicle is in motion. A predefined set of encrypted data will be regularly sent from the smart tachograph unit to DSRC receivers (DSRC-VU).

This data contains vehicle- and calibration data; and

information concerning potential manipulation, security breaches and malfunctions.

Authorities can use roadside or vehicle DSRC interrogators to retrieve this data at any time, even when in motion. After decrypting and authenticating the data, sufficient information is available to selectively stop suspicious vehicles. This will make the checking process much more targeted and therefore promote proper driving behavior and increase safety on our roads.

Companies and truck drivers that fulfill all legal regulations can avoid time-consuming and unplanned stops at specific locations. For the road authorities, costly truck checking points on freeways may become obsolete. Instead, enforcement vehicles all around Europe will be equipped with mobile enforcement technology for increased efficiency of on-the-road checks. Fixed enforcement installations at borders, at traffic junctions,

## Governments must mandate connectivity or risk automated vehicles failing



“We are seeing some deployments in new cars of a variety of non-compatible equipment”

vehicles. I've been to several industry gatherings of experts in our field over the past few years when this issue has come up. Most folk assume that automated vehicles will be connected because if they are autonomous the impacts would wipe out any roadway efficiencies otherwise accrued. They figure that they have to be connected. However, recent experience suggests otherwise. The auto industry could have adopted the V2V standard voluntarily and everyone could have manufactured to it. Instead they dropped back into 'my company' mode and are promulgating different approaches.

The history of automotive improvement and the role of the US federal government strongly suggest that without regulation the system will not get safer. Safety glass, airbags, ABS were all mandated. Connectivity needs the same approach.

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or for random checks at the roadside, can also be used. The DSRC device in the truck has to be mounted on the windshield or dashboard and will typically be connected to the vehicle unit via an independent CAN interface. Power will be supplied to the windshield module by the tachograph vehicle unit.

### Real-world deployment

All tachograph suppliers are believed to be introducing new generations of tachographs to fulfill the requirements of smart tachographs. Some of them are already cooperating with Norbit to provide the best DSRC solution for remote tachograph monitoring, and contracts are expected to be signed soon.

Based on unique technology developed for tachograph DSRC, Norbit has also created a 'detached antenna' concept. This cost-optimized solution avoids the need for a CAN interface and a wide-range power supply. The DSRC functionality is split between a small antenna and the DSRC processing, which is located in the tachograph itself.

In addition to the cost advantage, this allows for a very small antenna design for the limited space available on the windshield and it enables simple wiring to the tachograph using only a single RF cable.

Norbit is also offering a CAN DSRC solution, which is based on the same antenna technology, to other suppliers of smart tachographs. It is suitable for aftermarket installation. ○

“

Automated or autonomous? There is a lot of confusion about these two ways of referring to self-driving cars, but I'm not going to write about nomenclature here. Instead I'm interested in the very important question of whether, when there are millions of self-driving cars on our roads, they will be driving independently or in a coordinated manner.

A car that lacks a human driver or has limited human intervention is automated. On the other hand any car in the network that is independent is autonomous. When I drive my car today, it's autonomous. It's unconnected to other cars in the network.

Automated driving has 5 defined levels, with levels 1 to 3 relying a great deal on the driver. Levels 4 and 5 can be considered self-driving. However, the levels make no reference to whether the cars are connected to each other. That's been another independent policy discussion that has not gone well.

The auto industry took 10 years to agree on standards for connectivity, i.e. V2V. It is expected to yield huge safety benefits. In early 2017 the NTSB was prepared to issue a rule but was stopped by the Trump administration. Today we are seeing some deployments in new cars of a variety of non-compatible equipment. Cars from the same manufacturer will communicate with each other, but not with those from other manufacturers. Hot on the heels of this failure we have the question of whether automated cars will be autonomous or connected.

Most experts believe it will be a huge mistake if they are not connected, as they would require more roadway to maintain safe distances. Even today, the safe distance that adaptive cruise control maintains from the car in front is farther than many drivers would allow if they were in control. On the other hand, if the car were in contact with the vehicle in front it would have more to go on.

It would know when that car's brakes were applied and it would know the safe stopping distance. In fact a connected car can travel much closer to the car in front, making the roadway more efficient. The unconnected car needs more distance and the roadway will therefore carry fewer

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# Unclogging the traffic data bottleneck



For a machine-learning algorithm to offer a solution to a particular problem with any degree of success, it usually helps to train it with a lot of good quality data.

Take the example of healthcare. To develop a way of accurately predicting someone's risk of heart disease simply by looking into their eyes, Google researchers were able to feed their algorithm retinal images from almost 300,000 patients. That's a vast trove of health records, and data sets of this size are invariably out of the reach of many researchers – be it for privacy, regulatory or commercial reasons.

Indeed, for data scientists looking to solve all manner of

hard problems with advanced modeling techniques like machine learning, access to good data can make all the difference. This is also true when considering another complex challenge: the effort to unclog our roads.

## Using road data

The data science ensuring that drivers navigate through traffic in the safest and most efficient way has advanced a great deal in the past decade. The growing abundance of GPS probe data, traffic sensors and weather information has helped. Today, we push all that data, along with seasonality information, historical traffic patterns and incident statistics, into increasingly sophisticated

algorithms for routing, predicting and managing traffic. Yet, despite the industry's best efforts, there are still obstacles to be overcome.

One reason for this is that while GPS data flows thick and fast in many markets, it can still be patchy in others. Furthermore, the data that exists largely resides in multiple different siloed systems that do not talk to each other. That, you might argue, is just a function of the competitive market for traffic services. This is true, but if traffic operators want to build truly scaled data services for vehicles, more collaboration between data producers and gatherers will be essential.

Many organizations are

trying to push in that direction. For example, several auto makers have started to pool some of the data that's coming off their cars using the Open Location Platform (OLP), a collaborative big location data platform run by Here Technologies. This includes information captured by the vehicles' cameras and other deeply embedded sensors. Aggregated, analyzed and enriched with location contextual information, these snippets of data can reveal great insights into what's happening on roads.

Here developed an application to test out some of the new data. The application would alert drivers about the risk of encountering an animal

## Need to know

**Here Hazard Warnings service uses data collected from vehicles to generate...**

- Accident warnings
- Broken-down vehicle warnings
- Slippery road warnings
- Reduced visibility warnings, including fog and heavy rain



**Here's Open Location Platform aggregates vehicle sensor data and turns it into services for drivers**

on the road. The Here team chose to test the application in the Ebersberger Forst area – a woodland east of Munich where drivers frequently encounter wild boar and deer. The platform then listened for messages automatically transmitted by vehicles that had detected an animal in their path.

The OLP used animal detection data represented in the Sensoris format, which provides a standardized interface for high-volume vehicle-to-cloud data transmissions. However, the application could easily be modified to support other message formats such as decentralized notification message (DENM) or custom data schemas. The data was then processed and mapped to the road network.

To analyze the data and recognize patterns, Here built machine-learning algorithms. The resulting model used a mix of historical and real-time data to produce notifications with low-, medium- and high-risk warning levels. These were delivered as targeted messages

to cars driving through the area, or rendered on a map. The more data fed into the model, the better its predictive capabilities became. While narrow in scope, the application helped the company to better understand how combining car sensor and location data could help address real-world problems.

Here has also launched a new commercial service called Here Hazard Warnings. Testing with this system involved a wider set of live sensor data than from the Ebersberger Forst. Among the data streams added were hard-braking, tire traction and windshield wiper usage information, all stripped of personal identifiers and transmitted to the platform in the Sensoris format. The geographic coverage was also wider, covering North America and Western Europe.

The service has been designed to alert drivers to hazards on the road – all within a few seconds after being originally detected by the source car. For example, if a vehicle traveling on a highway sensed that its tires just lost traction, a car one or two

miles (1.6-3.2km) behind would be warned in good time that it had better approach the area with caution. The service was also able to draw on high-precision positioning data to improve and correct GPS signals, and more accurately pinpoint an event. This was especially useful when identifying exactly in which lane black ice may be present.

Currently, the service is ingesting data from more than one million cars and the fleet continues to grow. Auto makers' willingness to pool their data is helping to flatten data silos in a market where dozens of brands are fighting it out. (In the USA, Germany and Japan, for example, the biggest volume manufacturer has just 10-12% of the overall market. And the numbers inevitably thin out across other regions. Mercedes-Benz, the biggest-selling foreign brand in Japan, accounted for just 2% of the country's car sales last year.)

BMW was the first brand to have taken advantage of the scale benefits of Here's Hazard Warnings and bring the service to its drivers.

The ability to tap into a bigger pool of data is something that Here believes will entice other automotive brands, along with cities road transportation agencies and traffic operators, to get involved too. In anticipation, the company plans to add new marketplace functionality to OLP in the coming months, making it easier for developers to bring and exchange large-scale data sets, as well as sell their creations.

When that happens, the increased data density will create opportunities for developers to collaboratively address other big challenges. How about a service that uses ignition and ultrasonic data to guide cars to a vacant on-street parking space? Or one that uses suspension data to alert city managers to fresh potholes? ○

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# Portable systems for the enforcement of toll payments



Above: **The Portable Label Check** verifies the validity of vignette stickers on cars

**W**ith more than 20 years of experience, EFKON is a leading provider of intelligent transportation systems (ITS), electronic toll collection, and enforcement and traffic telematic solutions. The company has considerable expertise in all major electronic tolling technologies and provides customized turnkey solutions.

### Automatic checks

EFKON's Portable Label Check has been in operation since 2010; it actively checks for valid vignette stickers on cars.

When cars pass the Portable Label Check, it identifies the vignette in real time and confirms if the sticker is valid, according to its expiry date. The detection of the vignette stickers and the automatic recognition of the license plate numbers can be seamlessly executed while a vehicle is traveling at speeds of up to 160km/h (99mph), regardless of the weather condition.

The Portable Label Check can be installed quickly and easily next to roads, and on bridges. It needs to be connected to a power supply and can work for

weeks without local support. The system wirelessly sends data to the enforcement center.

In autumn 2017, the Portable Label Check was updated so that it could also read digital vignettes.

In addition, EFKON developed the Portable Licence Plate Enforcement System – an innovative system that meets the high demands of effective toll monitoring.

The system has been in use on Austrian highways since December, 2017.

In Austria, there are three different time periods available

## Need to know

### EFKON's Portable Label Check can...

- > Automatically classify vehicles using ALPR
- > Collect high-quality images of passing vehicles
- > Check the validity of vignette stickers

for vignette stickers: 10 days, two months and one year. Consequently, the system has to distinguish automatically which time period applies to the stickers affixed to each car.

The validity period of each vignette is coded by holes (on the sticker) that have a diameter of less than 5mm (0.2in).

### Double checks

Proof of paid tolls is obligatory for Austrian highways users. With the 2017 change of the toll law, proof of toll payments can either be digital or shown as a physical sticker on a car's windshield. Stickers are read by the Portable Label Check and digital vignettes are checked using ALPR technology. The checking of vignettes takes place without interruptions to the flow of traffic. If a vehicle doesn't have a valid vignette, data will be sent to enforcement personnel to penalize the vehicle owner for the infringement of not paying the toll.

In addition to the automatic check with the portable system, ASFiNAG (Autobahnen- und Schnellstraßen-Finanzierungs-Aktiengesellschaft) – the organization that operates Austrian highways and collects

Right: **The Portable License Plate Enforcement System can be set up and operated by a single member of personnel**

toll for its usage, is executing mobile enforcement. It executes mobile enforcement to check for possible toll violators by checking vignettes on cars and stopping violating vehicles.

Vignette stickers can be easily checked by enforcement personnel, because they only need to check the windshield for the presence of a valid sticker. Digital vignettes require an electronic tool for the checks to be performed.

### A system for digital checks

The Portable Licence Plate Enforcement System automatically recognizes if a vehicle has a valid digital vignette associated with it. Due to the system's simple installation process, it can be installed at different locations frequently and easily.

High-resolution images of the monitored vehicles are recorded using a camera unit and the images are analyzed in an accompanying computer unit. The camera is either mounted onto a tripod or onto existing brackets, depending on the location. The computer is connected to the central system of the toll via radio-communication.

Selected, processed and evaluated data is displayed on the handheld terminal of the enforcement personnel.



A rechargeable battery unit electrically powers the entire system. The battery is housed in the same tower as the computer.

The control system for the Portable Licence Plate Enforcement System is easy to use. After a one-off training session, enforcement personnel will be able to set up and operate it.

Due to its light weight of 22kg (48.5 lb), the system – the camera, computer unit, battery unit and accessories – can be carried and transported by one person.

By developing its Portable Label Check system, EFKON has demonstrated its knowledge and experience as a leading worldwide supplier of ITS, as well as offering a customized solution based on standards and proven concepts. ○

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# Five things you need to know about autonomous vehicles



**G**rowing numbers of automotive manufacturers are entering the race to develop self-driving vehicles, and reports of successful road tests frequently crop up in our news feeds. Optimism for a future with roads full of self-driving cars continues to increase. Much has been said about the benefits of autonomous vehicles, including time savings, better safety, and increased efficiency and productivity. But as the mainstream press and the average driver dream of the benefits of a self-driving future, those of us in the transportation industry understand that the reality is much more complex –

and we still face several hurdles to reach our goal of fully autonomous vehicles.

We are at a critical juncture when it comes to building roads for automated fleets. Here are five things to keep in mind as we prepare for the complex and exciting years to come – and work to build safer, more efficient roads for people and machines.

## 1. There's a difference between automated and autonomous

People outside of the transportation industry often use the words 'automated' and 'autonomous' interchangeably when referring to any vehicle

with driver assist or self-driving capabilities, but there are important differences.

The Society of Automotive Engineers (SAE) has defined six levels of automation, ranging from no automation (level 0) to full automation (level 5). Many newer vehicles are equipped with advanced driver assistance systems (ADAS), considered to be level 1. Many assume the vehicles being developed and tested by Tesla, Cadillac and other automotive manufacturers are self-driving. But they are in fact only level 2, meaning they have automated functions but a human driver needs to be engaged and ready to take control of the vehicle at any

time. Both level 1 and level 2 vehicles should be thought of as 'automated'. A human driver needs to be in control, while the vehicle assists with situational awareness and decision making.

For a vehicle to be truly 'autonomous', it needs to be able to take full control of all driving functions under most or all conditions. A level 4 vehicle could operate autonomously under most conditions, but would require a human to take control at times and with sufficient warning. Level 4 vehicles aren't yet available to the general public and won't become common anytime soon, but there are currently level 4 shuttles operating on pre-

Opposite and right: **Future cars with SAE level 5 automation may or may not have steering wheels**

mapped routes in certain cities. A level 5 vehicle won't have an option for human intervention because the vehicle will be prepared to handle any situation. We are still far from seeing level 5 vehicles on roadways.

## 2. The vehicle is just one piece of the puzzle

When we talk about self-driving vehicles, we need to remember that a complete system will be required for us to reach our safety and efficiency goals. The vehicle is only one part of a system that also includes the road, infrastructure, other vehicles and the cloud-enabled communication.

Roadway infrastructure is a key part of this system, but often gets overlooked as static or secondary. Automated vehicles require infrastructure, including signs and pavement markings, to enhance their situational awareness and ensure appropriate reactions. As we expect human drivers to be the majority of road users for at least the next decade, it's safe to assume that infrastructure investment won't drastically change in the near future. We will need to find ways to implement infrastructure that meets the needs of human drivers, and automated and autonomous vehicles, all while working within current budgets.

## 3. Humans will have to share their roads for a long time

If a vehicle malfunctions or makes an incorrect decision, the risk is significant. In light of this, there are challenging



conditions – including work zones, inclement weather, rural areas and urban canyons – that need to be tested and resolved before fully autonomous vehicles are developed.

Additionally, according to an IIHS Markit study, the average age of vehicles on US roads is 11.6 years. Given the size of the investment that consumers make when purchasing a privately owned vehicle, it is unlikely that they will purchase automated or autonomous vehicles as soon as they become available. Further, recent studies indicate that the majority of consumers will need greater confidence in vehicle technology before investing. These factors underscore the likelihood that the transition from human-driven, to automated, to autonomous driving will be gradual. We need to be prepared for people and machines to share roads far into the future.

## 4. The transition won't be consistent

Autonomous and automated vehicles will enable new transportation models. As the technology improves, we're

considering the benefits of semi-trailers platooning on highways and robotaxis providing urban transportation. It is not yet clear what tomorrow's vehicle composition will look like when factoring in the potential increase in ride-sharing businesses, autonomous shuttles and the gradual introduction of automated individual vehicles.

There may be areas in which extreme innovation takes place, while other areas remain unchanged. We expect that the earliest adopters of next-generation transportation technologies will be densely populated, progressive cities. Tech-focused urban areas are already designating zones for robotaxis, autonomous mass transit and autonomous delivery services. Automated or partially automated trucking fleets offer significant economic and safety upsides for long-haul routes, and the trucking industry is currently working to adopt these advancements.

## 5. We need to work together – now

For the safety and mobility benefits associated with

## i | Need to know

### The Society of Automotive Engineers' (SAE) levels of automation are:

- > Level 0: no automation
- > Level 1: driver assistance
- > Level 2: partial automation
- > Level 3: conditional automation
- > Level 4: high automation
- > Level 5: full automation

automated and autonomous vehicles to be realized as soon as possible, everyone involved in the transportation ecosystem – government bodies, automotive manufacturers, Tier 1 and Tier 2 suppliers, infrastructure manufacturers, academic researchers and transportation authorities – needs to communicate and collaborate regularly and transparently.

3M Connected Roads is contributing to the progression of safer roadways by working proactively to develop next-generation infrastructure solutions for future roads. The organization's solutions include high-visibility, high-contrast, retroreflective pavement markings and highly visible road signs designed to assist in situational awareness for both humans and CAVs. ○

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# Cooperative, connected mobility at the ITS World Congress

ITS in urban areas is increasingly important. This is for a good reason: cities are growing and they are growing fast. In 1960 one billion people lived in cities worldwide. By last year, this number had grown to 4.1 billion and there are no signs of the trend slowing anytime soon.

The development of urban mobility has become of central importance to city life, encompassing new concepts such as smart cities, mobility on demand, and Mobility as a Service. In an attempt to focus the efforts of cities, the European Commission issued Mandate (M/546) to develop ITS standards for the urban environment quickly.

One of the greatest challenges is increasing the availability of road transportation, given limited space. Therefore, a key focus for improving urban mobility is bicycles – and in

## Need to know

### A glossary of relevant European ITS standards and organizations

- > **Mandate M/546** – The request from the EC to develop new standards to improve urban mobility.
- > **CEN TC278 ITS** – the European ITS technical committee, which has produced 150 standards in 25 years.
- > **WG17 Urban ITS** – A working group started two years ago to support M/546



particular electric bikes. This is why Q-Free is inviting visitors to this year's ITS World Congress in Copenhagen, Denmark, to jump on an e-bike to experience both bicycle- and car-focused ITS around the city. The demo has been developed in cooperation with Copenhagen bicycles ([www.bycyklen.dk](http://www.bycyklen.dk)).

In this 'cooperative connected mobility' tour there will be two routes to choose from: a short one that is the main technology demonstrator, and a longer ride that gives more feeling for how new ITS operates in the real world.

### Technology overview

Technologies demonstrated on the short loop will include smart navigation via audio direct to the cyclist. This will be done in a non-intrusive way to avoid distractions and is based on full ITS Station functions with communication, geozones and standard messages.

On the route a cycle counter device and display sign (Q-Free HI-TRAC CMU and CID) will

show how many bikes have passed and other statistics. The sensor system is based on piezo technology, originally developed for weigh-in-motion. Intelligent intersection control will also be demonstrated, based on standards (SPaT/MAP) where cars and bicycles compete for priority.

Quite apart from bicycle-based technologies, another focus of the ride will be city parking for cars. Knowing where free spaces are is important, and guiding traffic there efficiently is an essential part of urban logistics, freeing up lane space for all road users. The demo will show a new product (Q-Free ParQSense ITS 420) in operation, which works by using battery-powered parking sensors with NB-IoT technology that can stay embedded in the pavement for 10 years. While parked, vehicle registration validity is checked by an enforcement officer using a handheld DSRC reader (Q-Free RSE 622) to access the data stored in the on-board DSRC tag.

All bicycles used in the demonstration will be fitted with the latest-generation DSRC tag (Q-Free OBU 615), enabling tolling technology to be put to new use. The tags can be detected and accurately located using the new DSRC reader (Q-Free RSU 651). If the bike passes in the correct lane, the tag will beep. The result is shown on a screen so that the cyclist can see how steady their ride was compared with others.

Video technology is also an essential part of the ITS toolbox, and in the World Congress demonstration it will be used to read a small license plate on each of the bikes, using optical character recognition (Q-Free Intrada ALPR).

### Real-world demonstration

The longer 2km (1.2-mile) loop will have the same elements as the short loop, but since it is on open streets, it is possible to see exactly how the technology functions in the real world.

The traffic lights will provide real-time info to prepare the

## Urban life should be enhanced, not diminished, by transportation solutions



“We’re not only managing traffic, now we are managing traffic and mobility”

And for cities? Cities will experience fewer road accidents and reduced emissions. A big win-win for mankind, because it makes our planet safe and healthier to live in. At the end of the day, that’s all that really matters.

All that said, infrastructure still has a part to play. And, once again, Amsterdam demonstrates this well. Yesterday the city opened one of the most high-tech metro lines in the world. The new North/South line also makes RAI Amsterdam easily accessible from the city center. I had to try it and, indeed, within the blink of the eye I was at Amsterdam’s famous Albert Cuyp Market. A nice example of an easy and convenient way to access the city.

As is so often the case, complex problems require multiple solutions. Although for me, a ride on my bike still often works best...

*Richard Butter is director of traffic technology at RAI Amsterdam and is responsible for Intertraffic worldwide events, [www.intertraffic.com](http://www.intertraffic.com)*

“They say it happens to every writer, but for me it was a first – as I sat down to type this column I experienced my first writer’s block. Searching for inspiration I came across the website of American author Jeff Goins. He says, “To overcome a writer’s block, the best way is to go for a walk.” Or in my case, for a ride on my bike. On reading this I felt fortunate, because I had already planned to cycle to work the next day...

At 6:00am the following morning the weather was perfect for my ride. It was already 20°C [68°F], no wind, the sunshine rapidly burning off a little light fog, and it was peaceful and quiet on the roads – giving me the opportunity to really enjoy the ride and the scenery. The inspiration came immediately. This column had to be a philosophical one. I was enjoying life on my bike even though I had ridden the same route at least 40 times since I first started work at the RAI four years ago. So, how can we harness such good feelings in the traffic technology industry? Is it possible for a commuter to get the same great feeling as I had that morning, without necessarily cycling on a beautiful day like I did?

That’s a difficult question to answer. On the one hand I observe several big trends that won’t bring such a situation closer. For instance, world economic growth is increasing mobility; we travel more often and travel further; the infrastructure capacity is becoming a bottleneck in cities; there’s worldwide urbanization (70% of us will live in cities by 2050, according to the World Economic Forum); and sustainable and healthy living in urban areas are a coming under pressure as well. On the other hand, the combination of digitization and mobile communication is changing the social concept of traffic, which could be extremely positive.

It’s crystal clear – we’re not only managing traffic anymore, now we are managing traffic and mobility. The technology brings us the flexibility in the way we travel and the insights that it gives us save money, but most importantly it can give us extra quality time to enjoy life – as I did that morning on my bike.

Left: Q-Free’s RSU 651 DSRC reader detects passing, tagged bicycles and displays trip diagnostics on a nearby screen

cyclist to stop and to get ready again. This is done through a C-ITS communication system based on fully standardized hybrid communications. The cyclist will also pass public transport stops and be informed about schedules and ticket prices.

The City of Copenhagen is also providing information services. For example, each cyclist will receive live traffic conditions and air pollution information, which can be used to decide which transportation mode to use.

At the end of the ride, the calories burned will be calculated. But be prepared: Denmark is flat, and with an electric bike the calorie burn is relatively modest. But the good news is that as long as you can ride a bike, visitors will be able to experience both routes of the demonstration. If you can ride a bike at all, you can take the longer trip.

After your ride, you can walk around the track to get a closer look at the technology and learn more about the products. There will be technology experts available for discussions. It will also be possible to experience the technology without doing the actual bicycle ride.

Visit the Q-Free stand (C2-065) at the ITS World Congress in Copenhagen on September 17-21 for more information. ○



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# All-inclusive tolling

The advent of multilane free-flow (MLFF) tolling – part of the all-electronic cashless tolling (AECT) family – which uses electronic transponder technology, has enabled paying customers to drive through tolling points at highway speeds.

Operationally, AECT is maximizing benefits and revenues for toll operators, but how does it affect travelers?

Advantages include the elimination of barriers, stop-and-go traffic and queues at tolling plazas. While the higher rate of revenue collection is opaque to the traveler, the convenience of paying through an account reduces the need to have cash readily available. The traveler can simply set up an account, validate a debit/credit card for billing, and place an initial charge against it.

## Optimization is key

Old toll operations typically had a mixture of manual lanes, semi-automatic lanes with coin machines and electronic toll collection (ETC) lanes. As with AECT, in order to use the ETC lanes, the traveler needed to establish an account using a debit/credit card.

Old, mixed tolling facilities are now looking to maximize benefits and revenues as they transition to AECT. The need to maximize toll revenues is foremost in the minds of tolling managers and individuals at senior state government levels.

## Is maximizing myopic?

'Maximizing' refers to a primary focus on the immediate benefits in one's own domain – be it within an organization, on toll roads' needs, or on the reputation of an organization or manager. 'Optimization', on the other hand, refers



to the recognition and actualization of benefits to the larger system or ecosystem as a whole. While AECT/MLFF may maximize revenues and benefits for the toll organization, optimization may increase benefits to both the toll organization and the traveler. In many ways, 'optimize, not maximize' is a golden rule that toll organizations should employ today.

## Inclusion, not exclusion

To ensure the low cost of transactions in AECT maximization, all users of the system must have a transponder, an associated toll account and a bank account with a debit/credit card to make payments.

Unbankable travelers – those who do not have a bank account

## | Need to know

### Features of A-to-Be's automatic toll payment machines include:

- > An easy-to-use interface with 10in (25cm) color screen displays
- > Versatile configuration options: full-featured; no change; cash only; and card only
- > Double-decked, to serve vehicles of different heights
- > An intercom that links machine users to remote service desks

or are not deemed financially stable enough to have a credit card – are a problem. The percentage of unbankable travelers varies according to location.

The net effect of unbankable, non-creditworthy and fiscally conservative travelers on a toll road can be approximated at 20% of the total number of travelers. This percentage is meaningful. It can mean that AECT/MLFF is excluding 20% of the potential users of a facility and is unknowingly discouraging potential users that previously paid by cash.

A result of this exclusion is high violation rates after an AECT conversion. This is something that the State of New York recently suffered when customers wanted to pay

their tolls, but did not have ETC accounts for the newly installed AECT system. New York State toll authorities were eventually forced to pardon the transgressions of violators by writing off millions of dollars in unpaid tolls and fines. While appeasement calmed the situation, this magnanimous action does not address the alienated customers, bad public relations and future avoidance of service by the affected drivers.

Steps should be taken to be all-inclusive and not prejudiced against any road users who have a right to access toll roads. At present, the discriminatory element of AECT/MLFF is seldom observed as a result of the rush to maximize operations. Instead, a holistic look at the impact on all potential users of the toll facility should be considered.

### Semi-automation

Semi-automatic toll collection could make AECT more inclusive. In the past, the term 'semi-automatic toll collection' implied the use of automatic coin machines as a self-service toll collection method that did not employ a human toll collector. Unfortunately, this type of self-service methodology results in stop-and-go traffic in the payment lanes, which leads to tailbacks.

Toll authorities adapted by employing 'hybrid' configurations with dedicated AECT/MLFF lanes and another set of lanes for manual or semi-automatic operations. In these hybrid configuration cases, manual lanes can be eliminated and self-service lanes are able to handle the percentage of

travelers who do not want to be burdened with a toll account.

A new generation of self-service or semi-automatic toll collection machines has been used in Europe for years and is now finding its way onto US toll roads where operators wish to optimize rather than maximize. In locations in the southwest of the USA, and on the Illinois toll road, automatic toll payment machines (ATPM) developed by A-to-Be have been installed.

Unlike their semi-automatic predecessors, the new class of ATPMs caters for all payment methods – cash/coins, credit/debit/special gift cards, as well as digital payments through payment smartphone apps such as Apple Pay. In short, they can be used as part of a hybrid configuration with AECT lanes and ATPM lanes, and they do not discriminate against any method of payment. It is even feasible for the traveler to be issued a uniquely coded non-payment slip if all means to pay are lacking at the time of the transaction. Coded non-payment slips can be used to send payments online or via mail at a later date.

### New generation

ATPMs represent a new generation of self-service for toll facilities. While conventional wisdom envisages a future cashless society, toll payments still need to be made during this interim period. Rather than ignoring travelers without toll accounts and focusing on maximization with tags and transponders, it may be better to optimize operations to the realities of the transition period and provide both AECT/MLFF and ATPMs. ○



Left: Automatic toll payment machines (ATPM) – such as these in Virginia's Pocahontas Parkway – allow road users to pay for tolls using any means of payment

Above: ATPMs by A-to-Be are now in operation in Illinois, USA

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# The future of mobility: networked and informed

Drivers are becoming more connected than ever before, for the benefit of the entire road network

Seeing schools of shiny fish move through a blue sea is always a magnificent, amazing and aesthetically pleasing sight. When they change direction suddenly, the form of the entire group changes, as if at the push of a button. The grace and simplicity is almost dream-like – and without incident.

It's no wonder that 'swarm intelligence' took root as part of a promise of a smarter future, especially in transportation. Where, if not here, would digitization and networking offer better conditions for swarm intelligence? For the wisdom of crowds? And also for effortless, coordinated mobility?

Like many ideas and fashions, the term 'swarm' has now been almost completely forgotten. But its intention remains more relevant than ever: We use information *from* everyone *for* everyone. We use statistical data that is available to us from long-standing traffic-flow surveys and combine it with data from the existing infrastructure. We link this data to live data on weather, roadworks, incidents, emissions, time and day of the week, and make this information available to individual road users when they wish to access it, whether that's during breakfast or when they leave the office. And, based on all this information and the knowledge of the user's requirements, we are now able to suggest to them the best route and the most sensible means of transportation. A slight detour here, an alternative there.

We offer them an overview that they have not had before.



Serviceplan Austria GmbH & Co. KG



We not only tell them that there is traffic here or there (which they can already expect from their everyday experience, as they regularly lose time at the same locations), we also give them the instrument with which to get around this traffic, to avoid obstacles almost elegantly and with ease. By broadening the horizons and choices of road users, we are contributing to improving the flow of traffic in urban areas. To get traffic moving again, road users utilize the new possibilities available to them. Furthermore, the traffic itself generates fewer emissions, creates less noise, consumes less fuel, and is more efficient overall.

Such solutions help individuals make more reasoned and better-founded decisions according to the bigger picture. Road users are given a level of autonomy based on the principle of collaborative routing. This is made possible by digitization of mobility data. Digitization enables all of us to recognize common interests and to collaborate. We are no longer 'out for ourselves and against many'. We are coordinated and smartly mobile.

### Planning for the future

Madrid is one of the cities that is working hard on the practical implementation of this digital transportation revolution. Kapsch TrafficCom has been assigned the task of launching an intelligent mobility system in the Spanish capital. In it, traffic conditions will be available in real time, based on comprehensive, anonymized mobility data collected from

pedestrians, cyclists, motorcyclists and motorists.

This is big, really big and yet it is only the beginning of something much bigger. This pool of data, this digital information, establishes the conditions that are required to enable the roll-out of connected, automated vehicles. This vision has been conjured up time and again since the late 1950s, but the possibility has never been as tangible as it is today.

And yet the full benefits will be a little while in coming; a few more years than most people think. One reason for this is having to wait patiently for the necessary transformation of the entire vehicle fleet. This process lasts an average of 9.5 years in Germany. It takes even longer in other countries. The transformation is a basic requirement, as a network of automated vehicles will have to reach a critical mass before becoming truly beneficial. Communication must also be perfected across all systems.

### Shuttles and platoons

However, another form of autonomous vehicle will soon prevail, especially in urban centers, and that is the 'robo-shuttle'. This small, driverless, automated bus combines numerous benefits. It 'knows' its district and its area well. A restricted district means a manageable volume of data and an enhanced ability to determine its position to the exact centimeter. It is therefore a good opportunity for 'machine learning' and can be brought to level 5 autonomy with minimal

effort (it will take another 10 to 15 years for other vehicles to reach level 4).

Another form of automated and networked driving is just as quick and even easier to implement, and that is truck platooning. This enables exact coordination in terms of speed and distance that results in uniform speeds and optimum driving in slipstreams – and consequently a reduction in energy consumption of between 11% and 15%. Networking the vehicles is now no longer a problem technically and there is hardly any better illustration of what mobility must offer in the coming years: the perfectly coordinated movement of numerous modes of transportation. Vehicle-to-vehicle communication solutions are unquestionably able to do this. What is lacking is a legal framework. And what is still uncertain is the reaction of other drivers to platoons. But we can – and have to – assume that there will be a rapid familiarization and learning effect. People quickly get used to new circumstances and use them to their advantage.

The future of mobility can be shaped by us here and now. We must think about all the options, and discuss the interactions between safety, shorter travel times and lower emissions. But it's important to also keep one thing in mind: solutions must be user-oriented. After all, this is the proviso of Kapsch CEO Georg Kapsch: We must never forget that all technological solutions serve people – not the other way round. ○

## About the author

**Alexander Lewald is chief technical officer at Kapsch TrafficCom**



Katharina Gossow

> Lewald has been a member of the executive board of Kapsch TrafficCom since 2015. As CTO, he is responsible for corporate technology and engineering, research and development, solution centers, tolling, back office, connected vehicles, and highway and tunnel traffic management. In this article, he describes how we can reap the benefits of machine learning and networking. "The digitization of mobility will have a more lasting and profound impact on how we travel than most people think," he says.

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# A toll system for all of Europe

In 2004, the EU adopted a directive on the European Electronic Toll Service (EETS) called the EETS Directive 2004/52. Toll4Europe is now providing a toll system to deliver this ambition.

In addition to saving time for transport companies, Toll4Europe's toll system will offer a range of smart value-added services throughout all of Europe. The services will be phased in successively.

Truck drivers across Europe are subject to many differing toll systems – different in terms of technical standards – in a total of 28 countries.

This diversity is what led to the European Union (EU) adopting the European Electronic Toll Service (EETS) Directive 2004/52 and, in 2009, to define the characteristics of the planned new European electronic tolling service and its technical components.

The EETS is aimed at linking two main technologies: the global navigation satellite system (GNSS) and dedicated short-range communication (DSRC) – and making all tolling systems interoperable with a single onboard unit (OBU) as standard.

## EETS from Toll4Europe

One of the providers of the Europe-wide tolling system is Toll4Europe. This company, a joint venture comprising of T-Systems, Daimler and DKV Euro Service, is offering a convincing, reliable and interoperable technology that will greatly simplify tolling collection in Europe.

Toll4Europe's combination of competencies is unique in the EETS market. T-Systems, considered a pioneer in the area of satellite-based tolling

systems, brings years of experience in route-based and use-dependent toll collection systems to the effort. DKV Euro Service brings the leadership skills and know-how it has gained in years of experience, in over 40 countries, with toll and payment processing and related customer service. Daimler, a quality and technology leader, is driving the relevant trends and setting standards for smart applications in the automobile and truck construction sectors.

For many years, T-Systems has been operating the TollCollect system in Germany. In addition, since 2016, with the introduction of the satellite-based system in Belgium, it has been proving the operability of a satellite-based nationwide toll collection system that is able to cover all roads and can conform to high quality standards. In connection with the Toll4Europe, T-Systems is expanding classic DSRC technology to its portfolio.

Ultimately, the toll collection technology that is used is not the decisive factor. "The real challenge is providing a toll system for all of Europe while, at the same time, managing the enormous complexity involved – complexity with respect to data, interfaces, invoicing procedures, and so, the entire IT infrastructure," explains Mirka Dworschak, managing director of Toll4Europe. "While we do have unified standards, they are open to interpretation. Every country has its own different interfaces into its own invoicing systems and other downstream IT services. Toll domains differ in the way they classify the toll – in some areas, it is treated like a fee, while in others it is handled like a tax. Some toll domains offer options for reselling, while others do not.



"Differences are also seen in invoice layouts and in enforcement. To link all of this in an intelligent, state-of-the-art way takes a great deal of experience and a wide range of competencies as a systems integrator and IT systems operator. At the same time, we do of course have to understand our customers' requirements, and provide a excellent customer service that adequately meets all of those needs."

## DSRC and GNSS

Toll4Europe's smart EETS solution reflects the experience that it has gained in these many

Above: Satellite-based tolling systems allow cars and trucks to be charged for actual road usage and help manage traffic flows



different worlds of tolling. Its EETS platform is modular, and therefore can handle any and all of the requirements specified by the EU – such as DSRC versions 2009 and 2015, which are specified in CEN Standard 12813 and are important in enforcement.

In its EETS platform, Toll4Europe integrates tolling and vehicle services, and it also employs interface technologies that automate, and thus considerably simplify, the integration of third-party systems.

“Thanks to Toll4Europe’s service, companies can quickly

and efficiently offer the EETS service as part of their own portfolios,” Dworschak adds. “And Toll4Europe relieves them of the extensive certification overhead involved and frees them from having to maintain costly direct relationships with toll chargers. Technologically, this is achieved via web-based service interfaces similar to those now offered by all providers of internet or cloud-based services. In addition, Toll4Europe plans to supplement its toll service with value-added services on varying levels of service sophistication.”

### Mobile OBU updates

The Toll4Europe solution can be employed right away and anywhere, because it has been designed and developed in keeping with the latest requirements. This applies both to support for satellite-based toll collection in countries such as Germany and Belgium, as well as to full interoperability with various different DSRC standards such as CEN/ETSI (in France, Spain, Portugal and Austria) and UNI (Italy). A newly developed DSRC combined module makes this possible.

“Trucks will only need to have one OBU and that will cover the different toll systems in Europe,” Dworschak emphasizes. If new toll domains are added in the coming years, they will be activated over the air. As a result, OBUs will always stay up-to-date. It will be possible to update them at any time with additional functions, registration data, or additional toll-domain activations.

“Toll4Europe’s great strengths include its long

experience with satellite-based toll operations and with secure management of large data volumes,” says Dworschak. “As a leading EETS provider, we provide a reliable, interoperable technology that has already proven itself – with more than 10 years of error-free and interruption-free operations – in Germany and Belgium. Anyone who trusts our solution can thus quickly switch to EETS and get an absolutely reliable toll service for the future.”

### Need to know

#### Background and expertise of the three Toll4Europe partners

- > **T-Systems** is a pioneer of satellite-based toll systems and has years of experience in route-based and use-dependent toll collection
- > **Daimler** is an automotive quality and technology leader and, as a truck manufacturer, has brought innovations to this field
- > **DKV Euro Service** has expertise in toll and payment processing and in customer service

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# Well-deployed speed enforcement can help achieve Vision Zero

Speed enforcement is typically perceived as a way to profit from drivers, leading to negative publicity and public opinion. However, Latvia has proved that the public image of such undertakings can be significantly improved.

Since the introduction of a next-generation speed enforcement camera network in 2015, Latvia has seen a substantial decrease in traffic accidents (-47%) and the number of serious traffic accidents (-45%) in areas controlled by speed cameras. Most importantly, in the areas where the speed cameras have been placed, there have been no road traffic fatalities connected with speeding.

This success cannot be attributed to a single factor, rather being a set of coordinated activities and a smart roll-out of technological solutions. Starting at the top, the political leadership for this project was assumed by the Ministry of Transport and the Road Traffic Safety Directorate. Working closely with law enforcement agencies, they created a national program for deployment of speed cameras, as well as a series of public education campaigns. That was a significant contribution to changing the public perception of the project – from enforcement and profit to improving road safety.

## Back-office scalability

To ensure maximum efficiency and flexibility of the solution, a dedicated, cloud-based back-office service was deployed. This service provides 24/7 monitoring and maintenance of the camera network, resolution of any network issues (with any of the involved parties, including power utilities and mobile network operators),



## Need to know

### Features of the new Latvian speed enforcement system, deployed with Dots.

- Cloud-based back-office provides 24/7 monitoring of camera network
- Complete control over data lifecycle ensures strict adherence to predefined SLA
- Crashes reduced by 47% since installation and serious crashes by 47%
- Built-in scalability enabled the network to start small and grow as necessary

automated data ingest from cameras, and data processing with export function for law enforcement agencies.

As a result, Latvia could start small, installing just a few speed cameras at first, and then scaled up as quickly as necessary without additional investment in IT capabilities. More importantly, having control over the complete data lifecycle – from camera network availability to speeding ticket export for law enforcement agencies – ensures high data quality and strict adherence to the predefined service-level agreement (SLA). The whole process can take as little as a few minutes, from the detection of a violation to an enforcement case that is ready for export.

Not only is data automatically imported from the cameras, but it is also

pre-processed using deep neural networks to segment, classify and recognize vehicles, doing so with previously unattainable granularity and precision. As an example, while many speed cameras can classify only trucks and passenger vehicles, the Latvian solution can distinguish emergency vehicles, motorcycles, buses and other vehicle classes as well. These new capabilities improve the flexibility of speed enforcement (for example, allowing for more granular thresholding of different vehicle classes, applying various thresholds based on visually detectable weather conditions, etc), while also significantly increasing the productivity of back-office workers, making it possible to process a much larger number of cases (e.g. applying different workflows for emergency



## Protecting tolling customer privacy is of increasing importance

“Over the past few years, major data breaches and the theft of individuals’ private data has made data privacy and security an emerging and critical discussion in almost every market. Virtually everyone with a digital identity has been affected, even if they don’t know it. People used to think that it was just the financial markets like credit card companies and banks that had the problem. But recently a company was hacked not for social security or credit card numbers, but for demographic data. Hundreds of millions of people’s information was stolen.

We have all created a digital life of online shopping and surfing, which includes credit card purchases and toll transactions. What we may not realize is that when this data is tied together it forms a detailed picture of our lives and likely patterns or trends for future spending decisions, which is how companies can provide targeted advertising through data mining methods.

Data mining has not only arrived, but has become a critical part of most companies’ marketing operations. Although these reminders may be helpful and convenient, they can also bring surprising consequences. I remember an early court case that an agency was pulled into that involved transponder data. This was later used in a divorce settlement to prove a spouse’s movements. Since then it has been commonplace to get requests for transaction data from law enforcement and private citizens, both customer and non-customer. In recent weeks commercial entities have taken steps to protect data and restrict data mining. Apple has locked down its cell phone in the latest update, and Facebook and Google are changing their policies on data privacy despite the potential revenue consequences of not selling our data profiles.

In road pricing we are held to a higher standard, especially where public trust in government-run systems is far less. Where are our vulnerabilities? How do we manage these risks? We all realize the risks involved in the financial side of our back-office operations and take precautions to mitigate those risks. But is standard compliance enough? I have seen internal hacks take down systems and



“As we add to our service offerings, the financial value of hacking user profiles is much greater”

system implementations. As we add transit, parking and fast food to our service offerings, the financial value of hacking into user profiles is much greater. Just look at the early cell phone market or the cable and satellite industries. When we as operators look at future systems and even contracts for extended services, we should consider the potential risks and vulnerabilities that we may be exposing our customers to.

This is complicated by the many systems and business plans that we currently operate on. We need varied expertise, from system engineers to security analysts and people savvy in data mining. As a public agency we not only risk damaging our brand, but also trust in the industry as a whole. Security is costly, confusing and never-ending, but a comprehensive security mitigation program can pay dividends if, or more likely when, a data breach impacts your organization.

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



vehicles and motorcycles with no license plate facing the camera, etc).

### Toward zero fatalities

As a part of the national ITS architecture, the national speed camera network is viewed as an important driver behind improving traffic safety. According to NTSB in the USA, speeding contributes to 30% of highway crash fatalities. Making every road a Route Zero – one with zero fatalities – may take time, but, as the Latvian example shows, it is an attainable goal. ○



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# Establishing the ideal behavior patterns for vehicle platoons

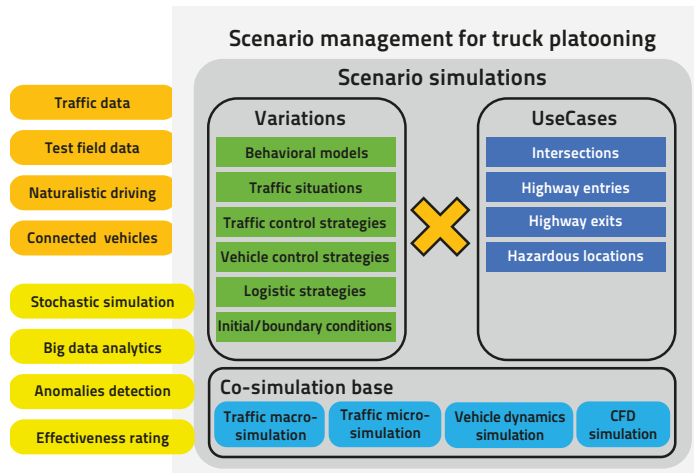
Automated driving is predicted to achieve some major improvements in levels of traffic of congestion, but getting there will be far from straightforward. Just putting automated cars onto our roads will not necessarily lead to any reduction in congestion. Primarily such vehicles need to be safe, so they must be designed very conservatively and defensively. Additionally they will have to drive in an environmentally friendly manner, which may mean going more slowly than the average human driver would in similar traffic situations. These factors mean they could end up increasing congestion when first deployed.

So how can they improve traffic flow at all? Some of the expected advantages are likely to be achieved not through automated systems themselves, but via the twinned technology of connectivity. This will result in automated cars and traffic infrastructure being better able to predict and react to the behavior of other traffic participants, without being overly defensive.

## Room to platoon

An example of such cooperative, connected, automated behavior is platooning. Because of connected communication between the participating vehicles, they will be able to drive with shorter distances between each other while maintaining speed and remaining safe, thereby increasing traffic densities.

Connectivity enables the leading vehicle to express its braking and accelerating intention to the following vehicles, which can react immediately in a proper



Left: Schematic detailing the multiple parameters tested in truck platooning scenarios

traffic simulations, multiple parameters will be adjusted (including traffic situations, behavioral patterns, traffic participants, traffic control action and strategies, and road and driving conditions) to find the best control strategies. These will be evaluated and specified to determine the best possible cooperative driving behaviors of automated vehicles. For realistic simulations of traffic scenarios, the behavioral pattern of the traffic participants will be taken from massive traffic data collections and real observations, together with geographic information systems. The investigation of the massive amount of data, from both simulation and real traffic measurements, will be done using big data analytics.

The Connecting Austria consortium comprises the major Austrian stakeholders in the topic. The project leader is the company HiTec marketing, and the work package of research and development is led by Andata. Companies such as Swarco and Siemens are responsible for other practical areas, including the conformation and realization of communication standards, roadside units and traffic control. The whole project consortium and the contributions of the partners can be found at [www.connecting-austria.at](http://www.connecting-austria.at)

## Need to know

### Major use cases being investigated in the Connecting Austria platooning study

- > Highway entries
- > Highway exits
- > The passage of hazardous locations (like construction sites)
- > The passage of intersections

manner. That way they may also be much more responsive to traffic lights and other traffic controls.

Due to the fact that automated vehicles are doing precisely what they are told, one can expect them to execute cooperative behaviors in a much more disciplined manner than humans. The vehicles may have a much better perception of the environment than humans do, because they have information from other participants. This implies that we need to better know and formulate what cooperative behavior must

look like in any kind of traffic situation and condition.

## Connecting Austria

The Austrian lighthouse project for automated driving – Connecting Austria – is investigating necessary driving behaviors that will lead to improvements in traffic flow and energy consumption from platoons, while always maintaining safety.

Unlike other research and development projects, Connecting Austria will use a top-down approach to answering its questions. Instead of putting automated and connected vehicles into real test fields first and establishing that they will do no harm, it will first look explicitly for beneficial driving patterns and then try to specify them for automated driving strategies in all situations and conditions. Those strategies will then be tested in the real world.

Before doing some real vehicle experiments, all the use cases (listed left) will be investigated with millions of scenario-based simulations. With the help of vehicle and

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# Interactive transportation simulation

**F**orum8, the Japanese interactive virtual reality (VR) specialist, is experiencing significant growth in the demand for urban, rail, marine and air transportation simulation projects.

The demand is fueled in part by the latest research into autonomous and advanced driver assistance systems, both by vehicle manufacturers, as well as research institutes and universities. These customers want the best possible driving simulation (DS) systems to replicate the real driving experience within a real 3D VR driving environment.

In addition to the simulation features within the previous versions of VR-Design Studio, recent developments have a particular relevance to modern automotive research.

## New features

These include a software-in-the-loop (SIL) function and the ability to synchronize both the 3D visualization and simulation during the same cycle.

A real-time plug-in satisfies the simulation demands of vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and vehicle-to-pedestrian (V2P) communication and autonomous driving research, sending real-time simulation data to a third-party software. The multi-user cluster feature enables the simulation of multiple vehicle information (from autonomous and normal vehicles) to be combined and run simultaneously.

The simulation of different lights now includes the description and control of: rear lights, fog lamps, side lights and 10 extension lamps, brake lights, indicators and hazard lights. Previously recorded vehicle motion can also now be replicated.



Left: A screen view of a traffic simulation in Forum8's VR-Design Studio

Below: Test drivers in Cave vehicles can interact with each other in the same 3D VR road environment

## Need to know

**VR-Design Studio enables researchers to interface with trainees. Examples include:**

- Reporting on driver performance
- Monitoring drivers' progress and locations using an overhead 2D view
- Adjusting the time of day, traffic density, road traction, precipitation, and visibility and viewing distance

Another significant growth area is research into the effect extraneous distractions have on driver performance and hence road safety. The ability to provide the driver with a multiplicity of driving scenarios within the safe confines of a laboratory has obvious financial and safety benefits, as well as the advantage of repeatability.

In addition to being able to activate an almost limitless number of driving events and emergency situations, either preset or dynamically from a control desk, the driver's



overall performance can also be monitored and reported on.

## Real applications

These features of the Forum8 technology are also critical in the whole area of driver training – whether training professional drivers or members of the general public.

The ability to offer customers a range of hardware platforms is also a key factor in the growth of drive simulation within the Forum8 customer base.

Another important feature of driving simulation using VR Design Studio is the ability for multiple drivers to drive and interact within the same 3D VR road environment.

The following situations are examples of how an instructor or researcher can interact with trainees: activate multiple driving scenarios; monitor and report on driver performance; and change the time of day, visibility and precipitation.

The way the vehicle behaves on the road can also be changed to simulate dry, wet, snow or icy conditions.

The driver's viewing distance can be altered, as can the traffic density, whether on-road or off-road. There is also a way to track the driver's progress and location using an overhead 2D view.

VR Design Studio drive simulation technology is not only used for car and truck simulation, but also for any vehicle whether on- or off-road, or within the confines of a campus such as in the training of airport ground staff.

Finally there is the traditional use of interactive 3D VR simulation and modeling technology in the area of urban and transportation planning. Whether for consensus building through stakeholder consultation of contentious urban developments, or the importing of microsimulation traffic modeling data into a real interactive 3D VR simulation environment. ○

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# Saving costs and time with camera enforcement

This year, London's Wandsworth Parking Operations Team (WPOT) wished to introduce unattended traffic enforcement cameras at a number of locations where violations were frequent. It undertook competitive trials with all major suppliers. As part of the organization's drive to improve operational efficiency and save costs, it hoped that the trials would help identify the system that could provide the best value in terms of performance and running costs.

Adam Westwood, a parking operations officer at the WPOT shared parking service, says, "We continuously challenge ourselves to provide the best services at the lowest cost. Our goal is always resident satisfaction at a price that taxpayers can afford to pay."

## High productivity

After WPOT benchmarked the technologies and performance for each system, Videalert's CCTV enforcement cameras and digital video platform came out

## Need to know

### Benefits of Videalert's CCTV enforcement system include:

- > Supporting multiple applications using the same infrastructure
- > Combining ALPR and video analytics for high capture rates, even in busy traffic conditions
- > An ONFIV-compliant platform that ensures interoperability between all devices
- > Low maintenance costs



**Videalert's digital platform captures a range of traffic violations, including box junction offenses**

on top with consistently higher capture rates, particularly in busy traffic conditions and complex moving traffic contravention scenarios.

This is because the system combines automatic license plate recognition (ALPR) with the latest video analytics and algorithms to improve data accuracy and ensure the delivery of industry-leading capture rates.

Videalert's system captured high-quality evidence and data using the latest ONFIV-compliant digital cameras with the potential to reduce the number of appeals against issued penalties. The company's automated evidence pack review suite also enables contraventions to be reviewed and validated in seconds before processing and sending them to the back office.

## Low infrastructure costs

Another key factor in WPOT's decision-making process when choosing an enforcement system was the flexibility of Videalert's technology, which is able to capture multiple traffic contraventions from a single

wide-area network (WAN) unit, reducing infrastructure costs.

In fact, Videalert's digital video platform supports a range of traffic enforcement, traffic management, community safety and crime-prevention applications from a single CCTV camera – without requiring specific equipment for every point application.

It can be integrated into any environment and provides cost savings by enabling additional applications to be quickly and easily added as required.

## Maximum system uptime

To ensure that system uptime is as close as possible to 100%, Videalert uses multilevel, 24/7 monitoring to optimize system upkeep. This is supplemented with the latest self-maintenance technologies to automatically detect, diagnose and recover the majority of faults, with all rebooting and recovery processes taking place without human intervention.

Steve Cull, assistant head of shared parking services for WPOT, says, "The trials demonstrated that the use of unattended cameras was justified in terms of effectiveness, efficiency and compliance. Deploying

Videalert's unique digital video platform means additional camera assets and enforcement applications can be cost-effectively added, thereby providing an investment for traffic enforcement."

As a direct result of WPOT's trials, Videalert cameras have already been installed at four locations in Wandsworth. WPOT will continue to transition from its current system with further installations based on expected efficiency and productivity gains.

Tim Daniels, sales and marketing director at Videalert, says, "We offer a radically different way of using CCTV for traffic management and civil enforcement, for today and tomorrow. Using sophisticated ALPR and video analytics, Videalert can deliver the highest productivity, while minimizing equipment infrastructure and communication costs at every target enforcement location." 



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# The complete parking occupancy detection system

Availability of information about the occupancy of parking spaces can be very valuable to every driver looking for a spot. ADEC (Advanced Detection) Technologies offers products to address this need. Its parking occupancy detection system consists of detectors, data collection and transmission stations, and a cloud system that permits access to occupancy information through web browsers and APIs for third-party software.

## Perfect PODs

ADEC's Parking Occupancy Detectors (POD) are key components in its system. They use four sensing technologies for maximum performance in all weathers. The magnetic field sensor is supported by an ultrasonic transducer, a daylight sensor and an active IR transmitter/receiver. ADEC PODs are battery powered and designed to provide seven or more years of operation before the capacity is exhausted. The built-in radio achieves a transmission range of up to 820ft (250m) in an urban environment. The POD is compact, roughly the size of an ice hockey puck, and is encased in a rugged, durable plastic housing.

POD installation is simplified with the in-pavement mounting adapter. The commissioning is straightforward and can be accomplished using a web-based GUI, Windows software (with internet connection) or an Android app.

When using the Android app, detectors are added to the cloud during installation using the near-field communication tag built into each POD, containing its unique ID. This information, combined with the GPS location provided by the mobile device,



## Need to know

### Key features of ADEC Parking Occupancy Detectors (POD)

- > Magnetic field sensor
- > Ultrasonic transducer
- > Daylight sensor
- > Active IR transmitter/receiver
- > Radio transmitter with 820ft (250m) range
- > Rugged, durable plastic housing
- > Seven-year minimum life

associates the unique ID with the location of the POD, so questions about where a given POD is sited are resolved right from the beginning.

## How it works

The detectors transmit occupancy changes via RF to ADEC's IoT Parking Gateway

BS2. The gateway, installed nearby, is grid or solar-powered with backup batteries for up to five days of darkness. Data is transmitted from the BS2 gateway, using a built-in 3G modem, to ADEC's server. The communication between the PODs and the BS2 gateway is bidirectional, allowing the gateway to update POD firmware or change configurations. Each gateway accommodates up to 100 PODs within an 820ft (250m) range. The gateway can optionally be customized to transmit occupancy information to any third-party server. By default, ADEC's cloud server is used.

ADEC's cloud services consist of various software modules that receive occupancy updates from BS2 gateways and manage the data in the cloud. The occupancy status information can be visualized using a GUI in any web browser. ADEC has also extended its DET-Soft commissioning software to show parking spaces overlaid on digital maps, such as Google

Above: BS2 IoT gateway with solar panel

Above left: POD (top) with in-ground mounting adapter v(left) and surface-mount adapter (right)

Maps. In this way, it's easy to get an up-to-date view of the occupancy status of any geographic location where PODs are installed. Customers who use their own parking dashboard can easily access current and historical occupancy information through the straightforward RESTful web APIs when using ADEC cloud services. ADEC uses Exosite cloud services, which are built on the Amazon Cloud, one of the most reliable cloud service providers in the market today. ○

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# Using ALPR to protect the public

There are several good reasons to install public surveillance cameras. Stopping one terrorist, for instance, could prevent the harm and distress witnessed worldwide on a daily basis.

Some crimes include the use of a vehicle. For example, a car may be used to travel to the crime scene or even as weapon – by being driven intentionally to hit people or buildings. Vehicles may also be taken without the owner’s permission or used for the transportation of drugs, firearms or for other illicit purposes, such as kidnapping.

## ALPR for crime prevention

“Denying criminals the use of the roads is an objective of authorities who are responsible for the public’s safety,” says Adrian Cadd, head of business development at Jenoptik Traffic Solutions Global. Automatic license plate recognition (ALPR) is a highly effective camera-based tool that supports the work of such authorities.

ALPR is highly beneficial for law enforcement agencies that



The Vector unit contains two ALPR cameras that enable license plates to be read – even in the dark and in poor weather conditions

are trying to fight terrorism and other crimes. However, it is not only frontline police officers who benefit from its use. Smart ALPR cameras combined with sophisticated back-office analytics can be used as a solution by intelligence officers, detectives, data analysts and other investigators.

## Active measures

“In 2017, Lithuania was ranked in the top 10 European Union countries for deaths caused by traffic accidents,” says Cadd. “A solution was required that would solve the country’s public safety needs. It being at Europe’s eastern border and a country of transit between the EU, Belarus and Russia has created additional safety issues.”

Stakeholders required a solution suited for traffic law enforcement and speed monitoring, in addition to tackling issues such as illegal border crossing. Such a solution could help the Lithuanian Road Administration (LRA), or institutions in the country’s Ministry of the Interior (police, traffic police, customs agencies and border patrol agents) to

reduce smuggler activity and other serious criminal offenses.

## Learning and processing

When a vehicle passes an ALPR camera, its registration number is captured and stored using algorithm-based technology. Average speed enforcement is an advanced form of ALPR-based journey-time measurement. By identifying a vehicle at two sites a measured distance apart, a very accurate speed calculation can be made. If a vehicle is wanted for other purposes, ALPR can potentially pinpoint exactly where the vehicle traveled during certain periods throughout the day, resulting in more arrests being made.

In most traffic applications, Jenoptik’s deep learning ALPR devices can distinguish between vehicle types and colors, whether the driver is wearing a seatbelt or using a cell phone, or whether the vehicle has made an illegal turn.

Jenoptik’s back-office facility (BOF) provides a number of options for the use of big data. For example it can predict patterns in where a crime might

occur, which can help authorities identify unusual vehicle activity or behavior so that they can intercept suspects.

Information collected by Jenoptik’s ALPR devices can instantly be checked against a database of vehicles of interest. In many instances, when a vehicle passes an ALPR camera, its details are stored and accessed if required during investigative purposes.

In Lithuania, 50 ALPR average speed cameras – equipped with a fully comprehensive back-office solution – were delivered and installed 1-8m (3-26ft) apart at 25 intersections. The entire solution was implemented within 10 months. This quick completion was achievable because of Jenoptik’s years of experience in developing and installing ALPR technology worldwide. ○

## Need to know

**Jenoptik Vector cameras are suitable for use in a range of ALPR applications, including:**

- > Average speed enforcement
- > Bus lane enforcement
- > Railroad crossings and red light enforcement
- > Yellow box violations
- > Journey time measurement

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# Applying artificial intelligence to traffic management

Results of a recent study by Partnership for New York City showed that congestion costs the New York Metropolitan area US\$20bn annually – and New York isn't even the most congested city in the USA.

Live Traffic Data (LTD) was conceived to help cities around the world cope with the increase in demand for smart mobility. The company's easy-to-use traffic optimization software, Signal Performance Analysis Toolbox (SIGPAT), is a cloud-based platform that promotes vehicle-to-infrastructure (V2I) communication and artificial intelligence (AI) to collect datapoints that show traffic volume, arrivals on green, delays, queue lengths, travel times, vehicle trajectories and time-space diagrams and predictive traffic metrics.

## Predictive traffic with AI

LTD has more than 6,000 signalized intersections integrated into its platform, with an additional 30,000 scheduled to go live in 2019.

LTD continues to expand its platform to ensure that SIGPAT remains compatible with technology of the past, present and future. This deference to long-term sustainability defines SIGPAT as an ever-evolving platform that can integrate antiquated infrastructure with modern technology.

SIGPAT now provides predictive traffic capabilities and anonymous re-identification (ARID) data processing on signalized corridors. SIGPAT collects data in one of three ways, depending on the agency's infrastructure: advanced traffic management system (ATMS); traffic signal controllers; and LTD data collection units. As a first step toward using ARID



## Need to know

**SIGPAT facilitates V2I communications by providing real-time data on:**

- > Traffic volumes
- > Delays caused by congestion
- > Queue lengths
- > Journey times
- > Vehicle trajectories

data, SIGPAT now computes travel time and origin-destination estimation using wi-fi/Bluetooth sensor re-identification.

ARID allows for origin-destination reporting and travel time measurements, which provide traffic engineers with quantifiable journey times on signalized corridors, when combined with signal phase and timing (SPaT) and detector data. Traffic engineers are able to

identify complexities in congested areas with increased detail and reliability, as well as forecast future traffic flows. LTD's predictive capabilities are fully accurate for pre-timed signals and within three seconds for most coordinated actuated signals.

## Comprehensive solution

While some cities have experimented with myriad roadway optimization strategies, substantial congestion mitigation cannot occur without the implementation of a solution that is robust and logistically feasible for cities.

LTD provides cities with traffic management solutions without interfering with city management operations. With emphasis on the long term, LTD's business model deliberately focuses on modifying – not replacing – existing infrastructure. There are alternative traffic management solutions, but cities remain subject to

a dynamic technological environment.

The implementation of new technology can be risky, as new technological developments are not always compatible with old ones. It is in this sense of technological sustainability that cities can find unique value from LTD.

As a cross-functional platform, SIGPAT provides a one-stop shop for urban management and development. As LTD increases SIGPAT's capabilities, it also expanding the scope of the platform's applications. SIGPAT is not only traffic management software, but also a universal tool for many aspects of city planning – ranging from congestion mapping and traffic predicting, to city planning and policy making. ○

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# Traffic monitoring infrastructure as part of a smart city

Smart cities of the future are set to include everything from drone deliveries to garbage cans with fill-level sensors. The unifying objective of smart city projects is finding solutions to the very real problems of growing urbanization. Over the years, cities have become denser, putting more strain on limited resources and creating higher levels of pollution. Today 5.2 billion people live in cities and this number will grow by another billion by 2030 (from 55% to around 60% of the world's population). Optimizing vehicle traffic in cities is an important part of making cities smarter, and traffic monitoring systems can assist in solving the challenges of urbanization in more ways than one might think. Traffic systems supplier Vitronic is helping shape this smarter future.

## Smart mobility

A concept that naturally brings together technology and traffic monitoring, smart mobility focuses on using the already limited space more efficiently, especially in city centers, to create a better living environment. Distributing traffic can also help to reduce pollution levels.

Fixed, semi-stationary and mobile systems used for speed enforcement are often simply image-processing solutions. However, systems from Vitronic's Poliscan product portfolio do more than measure excessive speeds; they define vehicle classes, capture red-light violations and ensure the correct use of lanes. They also gather additional live information about traffic flows.

In the past, vehicles in traffic were counted manually. A city employee would tally the number of vehicles that passed



by on a standardized form, which was later placed in a file. Today this can be done digitally. Data is captured in real time and sent direct to the city's administrative departments. This means that, not only can city employees access and analyze the data, but they can also send it to other interested stakeholders, who may want to, for example, optimize delivery routes or develop new traffic apps, helping to make the city smarter. Information about congestion, gathered via traffic monitoring systems, could be

communicated to drivers via such apps, and alternative routes could be offered, thereby relieving congestion.

## Getting even smarter

Reducing our impact on the environment is also a focus of smart cities. The basis for this is laid out in the 17 Sustainable Development Goals (SDG) defined by the UN member states. SDG No. 11 is titled Sustainable Cities and Communities and looks to "make cities and human settlements inclusive, safe,

resilient and sustainable". Smart city initiatives can help to achieve this by optimizing the configuration of urban systems; digitizing public services; and creating new, sustainable business models for operating intelligent infrastructure.

In Germany, SDG 11 is central to a new public project known as the City of the Future, in which Darmstadt has been named the 'model city for digitization'. The city has infrastructure that includes air-quality monitoring stations, as well as Vitronic devices used to capture and enforce traffic speeds. As part of the project, Vitronic is now working with Darmstadt University of Applied Science on a study entitled Sustainable Traffic Area Management. The study uses the Poliscan speed-enforcement pillars already installed in Darmstadt.

The question Vitronic wishes to answer is to what extent the elements already integrated into the city's infrastructure can play a part in supporting the SDGs if

## Automated vehicles – a new thought paradigm for DOTs



“My favorite dystopian, DOT proposal is to create new, AV-only lanes to speed traffic and increase throughput”

one lane of AV demand. The idea of using high-occupancy lanes exclusively for AVs suffers from the ‘just right’ Goldilocks predicament – any such a perfect time for AV-only lanes will be short-lived. AVs will continue in mixed traffic for decades, and we should focus on the implications of that challenge.

As I said in my previous article, it’s time for industry and DOTs to get together and start real discussions about how to improve safety for AVs. They will continue to struggle with many operating domain edge conditions that will constrain safe deployment. It’s not too early to focus on the real opportunities of AV deployment, and stop roadway agencies from responding with new, expensive highway projects to find benefits. The real benefits of AVs should come from enhancing the safety and throughput of the existing system, not building a new layer of highway lanes.

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

“A few months back I wrote about the need for road operating agencies and automated vehicle developers to start working more closely together to improve ‘edge condition’ roadway designs that could otherwise stall AV deployment. I mentioned roadway design AV puzzlers in San Francisco, including faint traffic lights, complex roundabouts, narrow two-way streets, and short lane merges.

In fairness to AV developers, they have taken the approach of accepting the roadway system as it is, rather than as it might be, because of the DOT funding struggle across the USA. AV developers do desire more consistent signing, striping and surface conditions, but even those basic safety features are a funding challenge for public road agencies.

Yet in these times of constrained DOT project capacity, I continue to read how DOTs are contemplating the AV future, ready to spend untold millions they do not have. My favorite dystopian DOT proposal is to create new AV-only lanes to speed traffic and increase throughput. While such lanes could no doubt meet these narrow goals in the future, their efficacy on numerous fronts is dubious.

First, are we really going to build a whole new system of lanes in urban areas where adding each additional lane is an environmental challenge? As head of the Colorado DOT, I often said that our upgrade of the original urban interstate system would probably be the first and last time that lanes would be added. The incremental widening of urban freeways has a social and practical limit.

Second, should we use existing HOV and HOT lanes for AVs? This idea is counterproductive. First, HOV/HOT lanes are built to encourage transit and carpooling. The concept of limiting these high-occupancy lanes to AVs, many of which could be single-occupant vehicles, is a move away from sensible roadway management focused on people movement.

In addition, this idea imagines a time in the future when just the right number of AVs would fill an exclusive lane. Obviously, early in AV deployment there won’t be enough AVs to fill even one lane. Rather later there will be more than just

### | Need to know

#### Existing functions of Vitronic Poliscan cameras

- > Traffic monitoring
- > Speed enforcement
- > Vehicle classification
- > Red-light enforcement
- > Lane enforcement
- > Live data sharing

they are used in a slightly different way, or if additional measures (e.g. interface customization) are implemented to enable a novel operating mode, or if they are digitally connected? In particular it means collecting and using traffic data captured at the sites where speed is enforced in an anonymous format so that it can be used in traffic control and then linked to, for example, environmental data. This would make it possible to have sustainable traffic management that improves traffic flow, reduces noise and air pollution, and therefore improves the quality of life in the city.

The research project will contribute to increasing the potential uses of traffic monitoring solutions. In this context, the use of additional interfaces and sensors may quickly achieve added value and bring even more potential use-cases to the table, using existing infrastructure. ○

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# Radar: the future of highways monitoring

Traffic engineers around the world are trying to answer the same questions. How densely occupied are their roads? How fast can vehicles travel while remaining safe? How can they improve traffic flow?

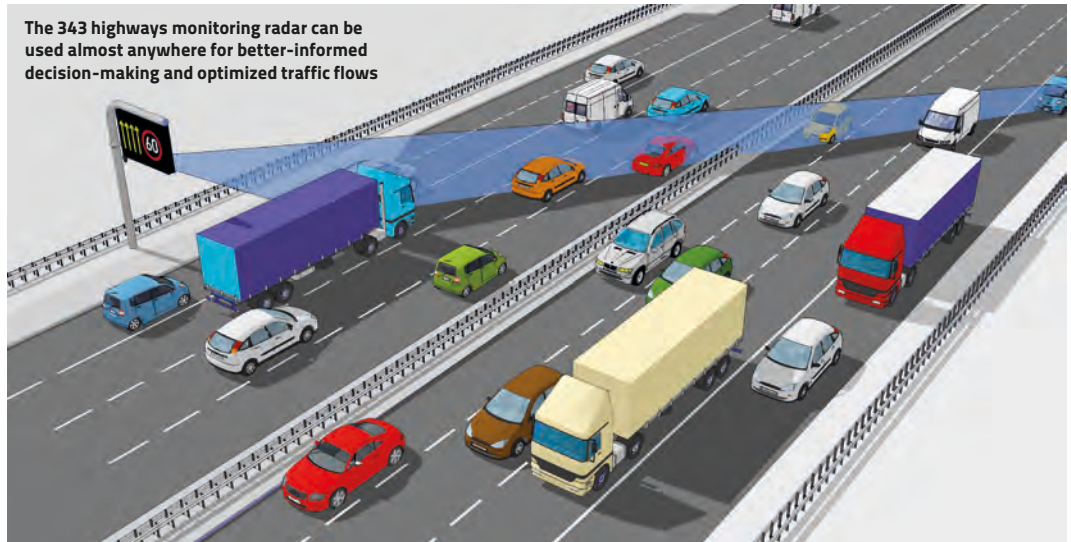
ITS can address these issues by providing data on congestion, lane occupancy, speed, and by facilitating the variable speed limits on smart highways. Yet with some road authorities insisting on loop-free detection, above-ground traffic monitoring solutions must be capable of functioning in a range of settings.

Ian Hind, commercial director for UK-based ITS solutions provider AGD Systems, explains that the layout of a highway influences the effectiveness of above-ground traffic monitoring solutions. "Most radars must be mounted between 5m and 8m [16.4-26.2ft] from the roadway," he says, "and, particularly on roads where the edge of the highway is close to buildings, there sometimes isn't that amount of space available."

This lack of space in some instances, as well as the knowledge that highway authorities are calling for a moratorium on penetration of the road surface, inspired the development of AGD's newest product: the 343 highway monitoring radar.

## A versatile solution

"The 343 radar monitors traffic flow and is a highly flexible solution that can be used almost anywhere for better-informed decision making and optimizing traffic flows," says Hind. "It combines well with other AGD enforcement solutions to offer a full product suite for both UK smart motorways and international highways."



The 343 highways monitoring radar can be used almost anywhere for better-informed decision-making and optimized traffic flows

## Need to know

### Key features of AGD Systems' 343 highway monitoring radar include:

- Identifying, tracking and measuring speed, length and lane/direction of individual vehicles
- Monitoring up to 10 lanes simultaneously while collecting data in real time
- Can be mounted as close as  $\geq 2\text{m}$  ( $\geq 6.5\text{ft}$ ) from the edge of a carriageway

The 343 can be mounted as close as 2m (6.5ft) from the inner edge of the inside lane and will still provide information for the lane immediately below the radar, as well as the lane on the farthest point of the carriageway.

"We developed the 343 in response to feedback – from the UK and internationally – that there is a need to be able to locate traffic monitoring via


radar close to the roadway," says Hind. "We worked with a design partner to develop a bespoke antenna to create the solution. The 343 is angled downward at 30°, but it can also monitor up to 10 lanes of traffic, tracking both carriageways to detect vehicles traveling in approaching and receding directions."

Road network operators are increasingly drawn to non-intrusive detection systems to gather information from highways because they are easy to install – without lane closures or destroying road surfaces – and maintain. This lack of disruption reduces operational costs and ensures that highways stay open for motorists.

## Failsafe methods

Radar technology has been proved over many decades to be extremely reliable when compared with loop detection systems. Enforcement-grade radar technology has high longevity of operation and performance – therefore lower lifetime costs, and close to 100% uptime.

The 343's sophisticated communications platform is easy to integrate into existing infrastructure, as well as adapting to the inevitable upgrades to data reporting and system infrastructure with minimal cost and risk.

"Our solutions are ultra-easy to set up, and their proven detection and measurement algorithms are widely deployed on international highways for speed enforcement," says Hind. "As well as being able to detect very close targets, the 343 can still monitor up to 10 lanes at speeds up to 250km/h [155mph]. This flexibility makes it suitable for nearly all deployment scenarios. We've already had considerable worldwide interest in the 343 and have several trial units in operation, with volume deployment to commence from early 2019." 



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# Big data collection and distribution for traffic management

## Need to know

### The main traffic management functions of Gewi's TIC software

- > Congestion monitoring and reporting
- > Incident management
- > Travel time information for managers and motorists
- > Emergency response support
- > ITS asset management
- > Radio traffic news support
- > Navigation device and website support
- > Data for connected and automated driving
- > Alternative routing advice support



Every stakeholder in the road traffic information chain shares the same requirement: accuracy. Whether it is public agencies needing to distribute traffic information to responders, repair crews, drivers or other agencies and municipalities, radio stations broadcasting to listeners, or an automobile or navigation company providing data for drivers, accurate information is critical.

The proliferation of data sources available, including roadside infrastructure, smart devices and vehicles themselves, means that staff in traffic operations centers face a stiff challenge in reviewing, verifying and distributing accurate travel information.

For public agencies, advanced software such as TIC from Gewi enables connections to be formed between road agencies and vehicles. Accurate road information generated by sensors, cameras and field devices can be distributed by the road agency directly into vehicle navigation systems. And, at the same time,

information created by the vehicles themselves, such as speed, position, road conditions and more, can be made available to the road agency to further improve the accuracy and quality of traffic data.

### Additional stakeholders

TIC software enables all stakeholders to share information, resulting in a more robust and accurate data set. This data is then available to be simultaneously distributed to broadcasters, navigation devices, applications, websites, and other systems and organizations. This higher level of accuracy provides many safety and operational benefits, including reducing emergency response times, improving navigation routing, enabling real-time location-based alerts, and advanced analytics for transportation network planning.

With the age of connected and automated vehicles upon us, this extremely precise information is critical to ensure safe operation of both manual and automated vehicles. ○

Above: A proven solution, such as speed, position, road conditions and more, can be made available to the road agency to further improve the accuracy and quality of traffic data.

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# Express lanes

Your shortcuts to some of the big stories in this issue – and beyond!

“Technology is not the primary concern – communications and public acceptance are the key issues”

*Transportation consultant Jack Opiola on the challenges of introducing road user charging projects*



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“The problem we’re trying to solve is to make the school beacons come on at the right time and to make sure they’re working”

*Bryan Mulligan, president of Applied Information, on the V2I-based smart beacons being installed in Georgia. Watch the full video at [TrafficTechnologyToday.com/beacons](http://TrafficTechnologyToday.com/beacons)*



“We are looking at a blockchain-inspired MaaS business model as a way of substantially reducing the number of cars”

*Erwin Vermassen, a senior manager in ERTICO’s connected & automated driving division on the huge potential that blockchain provides for running smart highways*

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“The biggest problem with stranded vehicles or crashes is the secondary accidents that often occur as motorists are distracted by what’s happening in the lane next to them or on the highway shoulder”

*ODOT’s chief engineer, Casey Shell, explains the importance of Oklahoma’s new vehicle-mounted VMS pilot. Read more at [TrafficTechnologyToday.com/Go-Dot](http://TrafficTechnologyToday.com/Go-Dot)*

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