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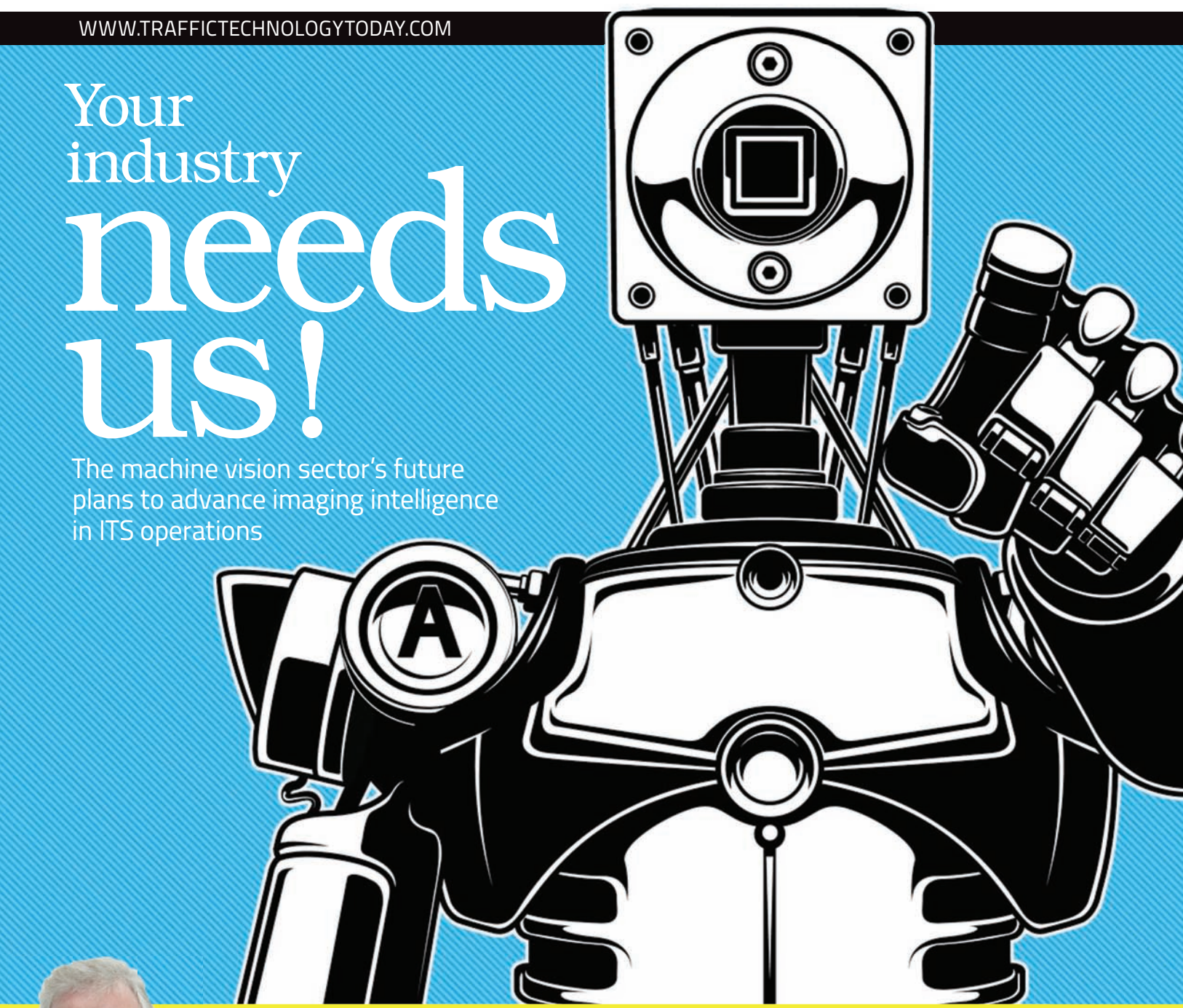

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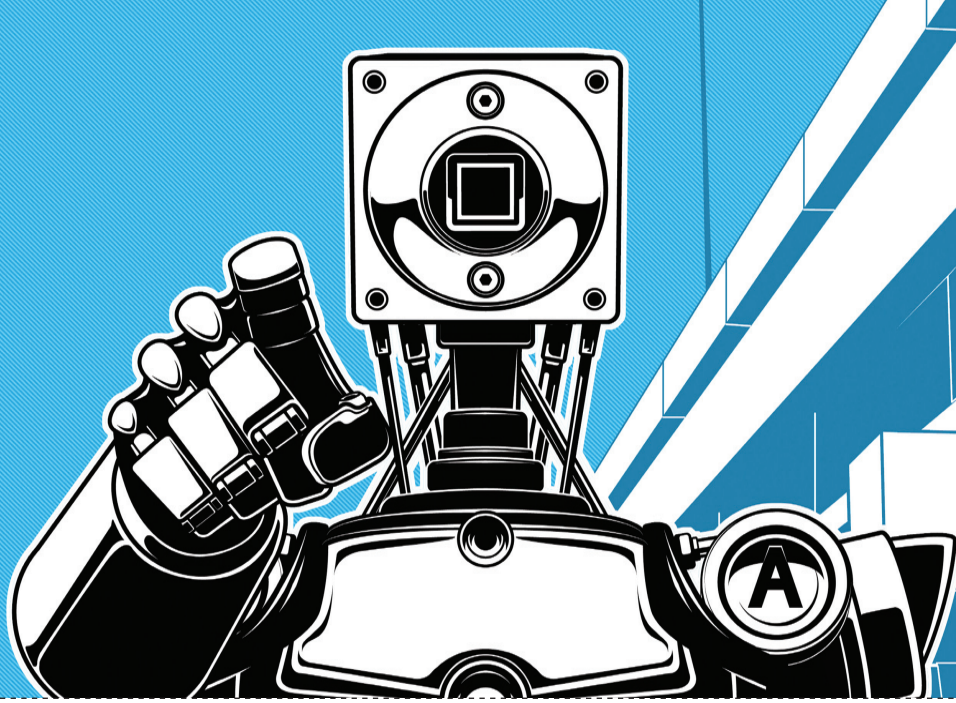

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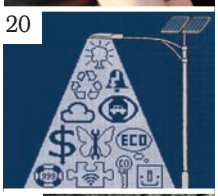

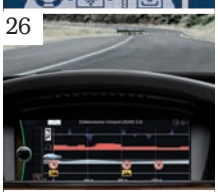

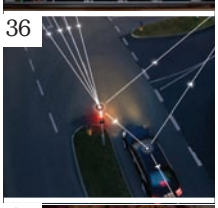

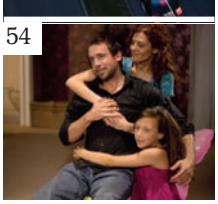

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Foreword

Somebody up there doesn't like me very much. With three magazines to get to the printer on December 3 – this January 2011 issue, *tolltrans 2011* and the massive 224-page 2011 edition of *Intertraffic World* – the last thing I wanted to open the curtains to three days before deadline was eight inches of snow, with much more predicted. There was only one thing for it: get out on the road before anyone else and brave the conditions, taking care not to wake my wife in the process, which would've been a fate worse than death. I wasn't alone in my thinking that it's better to drive on fresh snow than compacted. But the journey was manageable, if a little scary in places, and I arrived at the office safely with a sense of satisfaction. That the powers-that-be closed the offices four hours later is neither here nor there!

These days, us Brits aren't terribly used to such wintry conditions, despite this record-breaking late November snowfall being the third 'serious' dump in three consecutive years. For us, winter tires are something you amass as a result of an excess of turkey, chocolates and a bottle of Rioja every night. What's also abundantly clear is that we just don't know how to drive in these potentially treacherous conditions – which I suppose is only natural as you can only learn to do so through experience. (The number of people I overheard saying they were sliding around all over the place in first gear is a case in point.)

As in February 2010, our plight made bulletins around the world, with a colleague in Washington noting the traffic chaos with a wry sense of amusement. Those people stuck overnight in their vehicles on motorways in the southeast were perhaps not finding it as comical. Nor did some of my colleagues here, whose journey times increased ten-fold, some not even moving an inch for up to two hours.

The inability of the highways agencies to cope was evident, even though lessons should arguably have been learned from events eight months before. The 'cold snap' is reported to have cost the UK economy up to £1.2 billion a day through lost sales and extra costs, as local councils and the Highways Agency struggled to keep roads and motorways open. The question is why? In all of the bedlam, I couldn't help but recall a conversation with road weather expert Dr Lee Chapman: planners focus too much on getting enough salt supplies for the winter without giving sufficient thought to the practical difficulties posed by the snow. I'm wary of being too critical though. Unlike countries such as Germany, where you can bet your house on periods of lengthy wintry weather, the UK climate is much less predictable. We've had more snow in the past three years than I can remember in the previous 10, so building a similarly effective snow-clearing infrastructure doesn't make sense. Somehow, though, there has to be a more effective middle ground.

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car2gether is a web-based ride sharing community, arranging incoming offers and requests for lifts. Rides can be arranged via smartphones on the way or from a PC at home – almost in real time

The main difference to other car-sharing services is car2gether's focus on ad hoc ride-sharing. Users can share and negotiate their rides on the fly via smartphone through a specially developed iPhone App and website

A hitchhiker's guide to reducing congestion

Although the concept of car-sharing is not new, an explosion in smartphones and social networking is reviving a valuable way of reducing rush-hour congestion – and emissions as a result. **Lloyd Fuller** takes a look at Daimler's contribution to the movement

Illustration courtesy of Daimler

Project manager Michael Kuhn says: "Lots of users are testing the system and trying out the different functions. We are in dialog with them and are evaluating their experience."

Hitchhiking has taken a 21st century twist courtesy of Daimler's car2gether ride-sharing project, the pilot of which kicked off in UIm in Germany in September. So well received was the project that it was followed up just three weeks later with a further rollout in Aachen.

car2gether is one of Daimler's many contributions to shifting the urban mobility paradigm. An innovative, web-based ride-sharing concept, it links drivers with available occupant capacity and commuters in need of a lift. "It takes advantage of the increasing use and acceptance and the many different communication possibilities offered by the mobile internet," explains Michael Kuhn, project manager. Rides can be arranged via a smartphone on the way, or in advance from a PC at home, pretty much in real-time.

The idea has spawned out of Daimler's Business Innovation division, which pinpoints areas with future potential. "We basically identified a need for flexible, convenient and inexpensive mobility," Kuhn says. "With car2gether we offer exactly these advantages as well as simultaneously encouraging more efficient use of resources.

"Futurologists expect that as a result of the living conditions in cities, more and more people won't actually own a car at all in the years to come – so called 'zero-car households'," says the senior manager within the Business Innovation department. Daimler therefore holds high hopes for such an intelligent and contemporary ride-sharing system for urban areas, and is the first car-maker to trial such a form of mobility in a pilot.

How does it work?

Users who want to take part in the scheme and take advantage of a ride simply register on the car2gether website and create a profile with their photograph, cell phone number and other personal information. After registering, they enter their desired starting time and destination using either a smartphone or a PC. "A complex algorithm brings together rides offered with rides wanted and transfers details of suitable drivers or passengers to the users," Kuhn reveals. "Once both parties agree to the journey, they receive the details either to their phone or computer." Text message or email notifications are also available.

The ride offers and searches are also displayed in the form of what Kuhn describes as a 'live ticker' on the car2gether portal. "Similar to the microblogging service, Twitter, this displays all offers and searches in a shortened form, and is automatically updated every 15 seconds. If

car2go lifts off in Texas

A year after being introduced in Austin, Texas, Daimler's car2go appears to be going down a storm. The pre-cursor to car2gether, car2go was first announced in 2008, with operations in the USA firing up in November 2009. The program opened to the public in May 2010 and now boasts 15,000 registered members. Nicholas Cole is the president and CEO of car2go N.A., a partnership between the City of Austin and Daimler. "The numbers have exceeded our expectations and have encouraged other North American cities to look at Austin as a model when it comes to finding alternative solutions in reducing congestion and emissions," he says. In total, the 200 vehicles in the Austin scheme have driven 300,000 miles from 100,000 individual rentals since the launch. So hopeful is Daimler for continued success, a specially designed car-sharing smart fortwo has been designed, as unveiled at the Paris Motor Show in October. The car features new hardware to make the rental procedure even more convenient, simple and secure, while the wheel rims and seats are more robust than the previous edition. In future, the vehicles will feature a 100W solar roof to continually charge the battery.

Around

5.5 million Europeans will be part of a car-sharing scheme in 2016, due to low-carbon car sharing and the growth of on-demand rental services

Zipcar joins with Bloomberg

New York City's Mayor Michael R. Bloomberg has joined forces with the USA's Zipcar in a partnership with the City of New York to provide car-sharing memberships to DOT employees as a part of a pilot program. "A car-share program could help reduce the number of cars we use, cut our costs, free-up parking on our streets and reduce the congestion on our streets and the pollution in our air," Mayor Bloomberg says.

"It is becoming more evident that the 'one-car-one-driver' model is broken," adds Mark Norman, president and COO of Zipcar. "We applaud the City's commitment to find more efficient transportation solutions that will positively impact the economy, the environment and the future of urban development."

users are interested in a lift, they can obtain further details of the ride from the ticker and directly opt for it."

So car2gether is seemingly a win-win for both driver and passenger. Drivers receive a contribution to their mobility expenditure, while occupants receive a much-needed lift. The recommended charges for car2gether passengers are modeled on the simple car2go concept (*see sidebar p7*). "Costs are not based on the distance traveled, but rather on the calculated driving time with passengers charged by the minute," Kuhn says. The recommended price to be paid by passengers to the driver is 9.5 cents per minute. "During the pilot phase, passengers will pay the driver in cash, although in the future we are planning an automatic, cashless payment procedure," reveals Kuhn. Using car2gether via website and smartphone applications, or apps, will be free of charge in the pilot phase, during which the participants' acceptance of car2gether models that are subject to a charge will be evaluated more closely.

The single-occupant problem

car2gether is not the first – nor will it be the last – ride-sharing scheme, although the fact that a car-maker such as Daimler has recognized the issue of single-occupant vehicles is a significant positive step for the car-sharing movement as a whole.

One of the biggest carbon-reduction challenges faced by the transportation industry is to address single-occupancy vehicles. But it's as much about addressing the mindset as it is coming up with a suitable technological or policy strategy. There are as many reasons for the growth in car use as there are cars on the road, and every individual will offer a slightly different reason as to why their car is the best way for them to make a particular journey – cost, convenience, time, security, lack of alternatives, etc. The fact of the matter is that while our roads are congested, there are still millions of vehicles on the road with empty seats in them. According to Ali Clabburn, founder and managing director of liftshare, there could be something in the region of 10 million free seats on UK roads alone every day, which is a colossal waste of efficiency. Rocket science it may seem, but a car carrying two people is going to be nearly twice as efficient as two cars with just one person in each. Focusing on the UK for a moment, most strategies that come out of the Department for Transport (DfT) have reducing car use as the main priority, rather than aiming to reduce the actual number of cars on the road through more efficient usage of the car.

Based on research conducted in 2009, it is estimated that car-sharing has removed between 90,000 to 130,000 vehicles from the road in the USA to date

> One of the biggest carbon reduction challenges faced by the transportation industry is to address single-occupancy vehicles

Huge potential?

As the majority of congestion occurs during the rush-hour, it therefore makes perfect sense to look at trying to increase the average car occupancy for commuters, which as Clabburn says is currently 1.2 people per car in the UK – or for every 10 commuting cars on the road, just 20% has two people in them. According to Clabburn, travel surveys consistently show that typically 50% of commuters would share if they could find someone suitable to share with. Applying the same formula, for every 10 commuting cars on the road, five would have two people in them, so the average occupancy would jump by 25% to 1.5. This, Clabburn advises, would result in a reduction of approximately 21% of the number of commuting cars on the road. Such figures could also be extrapolated for school runs, business travel and leisure trips.

But is this actually feasible in the real world? Clabburn would argue it is, and cites British Gas's car-share scheme, which achieved a 68% increase in multi-occupancy car use. Although it would be challenging to say the least to replicate such achievements on the wider scale, pilots such as car2gether, liftshare, zipcar, and even the Avego model featured in the October/November edition of *Traffic Technology International*, are all signals that the issue is being taken seriously.

"Ultimately, car2gether will become part of the public mobility chain," Kuhn concludes. "The concept is an ideal addition to car ownership and other means of transport."

car2gether is a new ride-sharing service that made its debut in the German city of Ulm and was followed up in Aachen

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Predictive text

BMW Group's **Tim Lange** and **Martin Hauschild** lift the lid on two developmental strategies to bring Local Authorities and car-makers closer together to optimize traffic navigation systems

Navigation in urban areas always involves a certain amount of unknowns. It's not always easy for drivers and the satnav to find the quickest route to a destination. Not only is it necessary to take into account real-time local traffic information – for example about which routes are currently worst affected by rush-hour traffic, or what roadworks or public events are currently taking place – it also has to be remembered that what might appear at first sight to be a very short route may actually be a very time-consuming one, due to traffic light phasing. With its work on 'urban navigation' systems, the BMW Group is developing two functions that will use local 'traffic knowledge' to make navigation in large cities faster, easier and (particularly at rush-hour) more predictable – adaptive navigation and strategic routing.

One route, three arrival times

As well as the navigation function, per se, existing navigation systems also take into account traffic information and use it to avoid congestion. In large conurbations, though, this strategy is rapidly reaching its limits. As a result of high traffic volumes, the recommended detours quickly become congested, too. It is also often very difficult to predict actual traffic volumes. These two factors make it hard to accurately estimate arrival times. BMW's development engineers are therefore working on a solution – adaptive navigation – which takes into account historic traffic data when calculating arrival times, in order to make ETA predictions more reliable.

Whereas a conventional navigation system only provides one estimated time of arrival (ETA), adaptive navigation offers three – the typical, average ETA, an optimistic ETA based on the driver catching a green wave traffic lights, and a pessimistic ETA that assumes the route will be affected by disruption. A driver setting off for the airport might therefore choose to plan his journey around the latter (worst case) arrival time, whereas for his journey home from work he might assume the earlier time.

But how does adaptive navigation compute these times? To understand the basic principle, it

The use of Europe's future Galileo system in the road transport sector will deliver an estimated €43 billion in public benefits by 2030

Micro cosmic

BMW Group's microNavigation research project allows complex enclosed areas that are not covered by road maps, or are only partially covered, to be visualized in a detailed, large-scale map display. Before getting out of the vehicle, the driver would already be able to see how to get to a specific point within the destination area. His mobile device would then direct him the last part of the way on foot to the end destination – and, of course, navigate him back again to his vehicle when he wanted to return.

Drivers can check their destination in advance on a PC, and find out if a 'microMap' is available. If so, they'll automatically be offered one. A detailed destination can then be selected within the microMap. The map data plus destination is then automatically transferred to the driver's vehicle, where it is added to the existing navigation data. Naturally, it will also be possible to download microMaps spontaneously while en route, from the vehicle. By integrating camera information, GPS coordinates and map data, the researchers have also developed a lane-level vehicle positioning system. The driver is navigated to his destination – for example a vacant parking space near to the most convenient lift – with lane-level accuracy.

> The adaptive navigation system is the first system to take these variations into account in its ETA predictions, helping to make journey times, particularly in town, much more predictable and more transparent

helps to look at the factors that can cause journey times to vary. In terms of the type of road, although a journey via a winding road with poor sight distance will naturally take longer than one on a straight road with good sight distance, the variation in journey times associated with this factor is only small, as there is little variation in traffic flow on these roads. In contrast, factors that do cause a big variation in journey times are unforeseeable events such as traffic jams due to roadworks or accidents. Some types of road show a higher occurrence of such incidents than others, and thus a higher variation range. Based on a detailed historic analysis of traffic data, a variation range can be calculated for any given road. It is also possible to calculate a variation range for the quality and reliability of real-time traffic information issued by traffic information services, based on an analysis of the relevant data. The adaptive navigation system is the first system to take these variations into account in its ETA predictions, helping to make journey times, particularly in town, much more predictable and more transparent.

Research conducted by the UK's DfT in 2009 suggests satnavs increase safety as drivers can simply follow voice commands rather than look at maps

Using Local Authority information

Nobody has a better inside knowledge of traffic data and events in a given city than the city authorities themselves. It is therefore an obvious step to actively incorporate this knowledge into the navigation system's route planning and navigation functions. With strategic routing, the BMW Group is engaged in an exclusive project with a number of towns and cities to make traffic management data and information about temporary disruptions such as roadworks or special events accessible to navigation systems and to take this into account in route planning.

A digital road map alone is often unable to show which route is likely to be the quickest way of getting to a destination. To compute the fastest and most efficient route, it is necessary to supplement this data with local knowledge. Local Authorities have a fund of such knowledge at their disposal, in the form of planning data and information about active traffic management measures that may temporarily affect traffic and traffic flows. Alternative routes supplied by conventional navigation systems in some cases use roads that have only a limited traffic capacity. The result is then collectively induced congestion. The Local Authorities, on the other hand, have first-hand knowledge of which routes are most suitable for use as detours. Information about Local Authorities' active traffic management measures or traffic planning schemes is incorporated by the strategic routing system into the navigation system and used in calculating the route. Strategic routing provides clear added value in the form of significantly more predictable journey times since traffic is always free-flowing.

But it is not only BMW customers who stand to benefit from strategic routing. There is currently a lack of transparency about Local Authorities' traffic management strategies. For example, compliance with temporary signage is less than 10%. As a result, such measures are then ineffective, and congestion still occurs. By integrating such data into the navigation system, this strategic information could be circulated more quickly, and to more road users, which would significantly help to improve the success of these measures.

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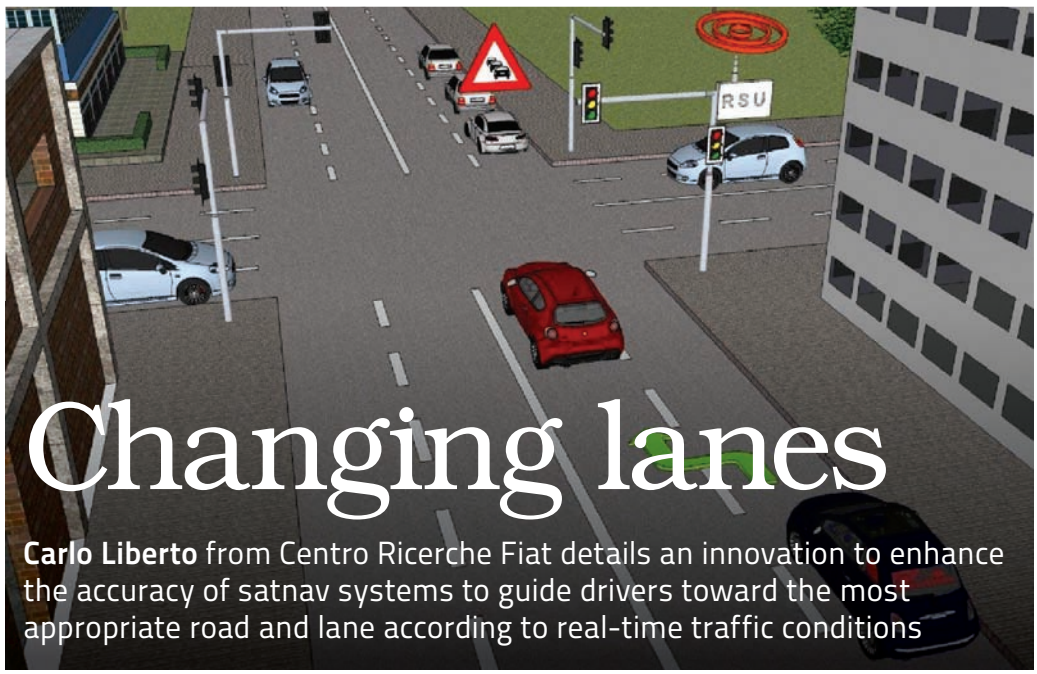


Changing lanes

Carlo Liberto from Centro Ricerche Fiat details an innovation to enhance the accuracy of satnav systems to guide drivers toward the most appropriate road and lane according to real-time traffic conditions

Navigation systems today do not have maps that are sufficiently detailed in terms of lane geometry, while position accuracy is so far unsatisfactory to distinguish the lane occupied by the vehicle. As a consequence, any suggestion related to road lane selection provided by a navigation system is merely a general indication.

There are a number of drawbacks to current solutions for vehicle localization. These relate to, for instance, GPS limitations, typical errors (e.g. troposphere and ionosphere delays), multipath in urban environments/canyons, and low-cost receivers used for automotive applications (high-precision positioning, such as RTK, not being applicable). Additional sensors are not yet in use, and an accurate lane geometry is not yet included in navigation maps, especially in urban areas.

A solution to the problem

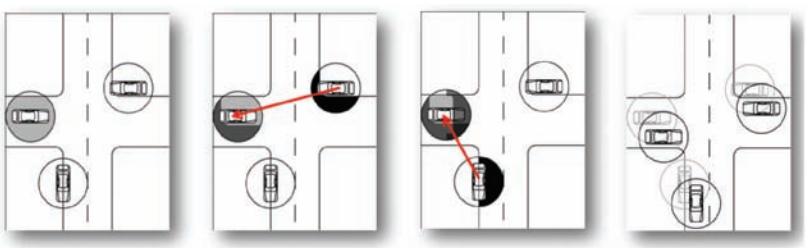
Lane-level traffic information provided to the in-vehicle navigation system combined with the opportunity for vehicles to exchange information will give drivers the chance to select the optimal road lane, even in dense traffic in urban and extra-urban areas.

Every driver maintaining the right lane will be able to know in real time a realistic estimation of the time of arrival and to perceive a reduced risk related to last-moment lane-change maneuvers.

It is therefore a must for the vehicle to be aware of its position accuracy to the lane level, as well as to receive traffic information either from a traffic control center or from surrounding vehicles and road infrastructures.

This is the reason that CoVeL, or Cooperative Vehicle Localization for Efficient Urban Mobility (funded by the European Commission under the 7th Framework Program), has developed the Lane Positioning Assistant (LPA). The output from LPA is the vehicle position with lane accuracy using satellite positioning as its primary source, data that will be augmented by correction information courtesy of the European Geostationary Navigation Overlay Service (EGNOS) system.

EGNOS is a satellite-based augmentation system (SBAS), operational since October 2009 and freely available in Europe. What the system does is improve the accuracy of GPS while providing further information about GPS reliability. Data from EGNOS can be obtained either directly via its orbiting satellites, or from EDAS (EGNOS Data



CoVeL cooperative map-matching and relative positioning: the red arrows represent the relative positioning; the cooperative map-matching will relocate the vehicles on the map

LPA benefits

LPA will provide a vehicle position with a higher level of accuracy than the GNSS mass-market receiver currently in use for navigation systems. Lane-level vehicle position enables a series of possible applications, not least the lane-level navigation system, a new generation of navigation systems in which all objects and data are referred to a lane level. Possibilities offered by the adoption of the LPA in the lane navigation system include:
Lane pre-choice: A lane navigation system will indicate to drivers the optimal lane to follow, depending on traffic conditions;
Wrong-way driver warning: A use case that is particularly useful in highways. A lane navigation system will alert the driver about the presence of a vehicle driving in the wrong direction;
Lane-level floating car data: The use of connected devices as traffic sensors is already a reality, but an LPA will allow vehicles to be utilized as traffic sensors at lane level, enabling the traffic managers to distribute traffic information with much greater precision. The lane navigation system will then be able to easily distinguish lanes with low or high traffic density.

Centro

Ricerche Fiat has presented the results of its PRE-DRIVE C2X project – the building blocks for clean, safe and efficient future mobility

The Lane Navigation Assistant inside the vehicle will suggest to the driver a lane-change maneuver

Access Service) – a new service that is currently in its test phase and offers ground-based access to EGNOS data. The availability of EDAS will allow vehicles to use EGNOS, even in urban canyons where the visibility of the EGNOS satellites can be obstructed. EDAS data will be distributed by the infrastructure using cell phone communication (GSM) or vehicle-to-infrastructure communications. Furthermore, the satellite positioning is enhanced by algorithms for cooperative localization, based on relative positioning and on cooperative map-matching. The resulting lane-level vehicle positioning will bring navigation and traffic management systems to a new level of detail and effectiveness.

The main market opportunities for Galileo will be road network management, road user charging, ADAS and safety systems and logistics

> The resulting lane-level vehicle positioning will bring navigation and traffic management systems to a new level of detail and effectiveness

Integrated technologies

The proposed LPA solution integrates a number of technologies.
EGNOS/EDAS augmentation data: The reception of GNSS error corrections, distributed via satellite and via ground systems, will improve the ego position accuracy.
Vehicle motion data: This is used to estimate the position in case of poor visibility of the GNSS.
Relative positioning (only from GNSS): This enriches the position accuracy by calculating the vehicles' relative distance vectors in the same area, so reducing the effects of common errors due to satellite distance evaluation.
Cooperative/group map-matching. As a result of the availability of the relative distance vector and the position information exchange among vehicles, the LPA will realize a group map-matching, which reduces the final position error due to the previous vehicle positions and to the precise nature of the available maps.

In addition, Galileo, the new European navigation system interoperable with GPS, will start operations in the next few years, allowing a still more accurate and reliable positioning as input to CoVeL LPA.

The LPA uses a number of technologies and data as a starting point. With highly accurate maps, for instance, the level of detail required for the maps can already be provided by the map suppliers, and the development and future deployment of the LPA will also grant the need of this additional data.

Communication through V2X or V2V communication represents a great opportunity to improve drivers' awareness of the driving environment as a result of the distribution of information among vehicles and also with the infrastructure. It is the so-called cooperative mobility network that can guarantee future safe, efficient and clean mobility, as demonstrated in March 2010 at the Cooperative Mobility Showcase in Amsterdam by the SAFESPOT, CVIS, COOPERS integrated projects.

EGNOS and EDAS (Galileo)

The expected benefit of adopting EGNOS is to reduce the horizontal error of a vehicle's position. The expected behavior of GNSS receivers in a scenario characterized by a good satellite visibility with EGNOS correction available is to reach the position accuracy of 2m.

As EGNOS has been primarily designed for aviation applications, it is sometimes difficult to constantly receive correction messages, especially in urban environments where buildings may easily block the signal emitted by the geostationary EGNOS satellites. With EDAS, though, it is possible to receive the same correction messages as provided by the EGNOS satellites via a terrestrial internet connection.

The CoVeL project is also working on bringing EGNOS/EDAS to standardization for the V2X communication channel developed for the automotive domain.

The future deployment of the LPA into vehicles will enrich drivers' awareness and reduce the risk related to frequent lane-change maneuvers. It will also enhance driving comfort due to the details provided by the navigation systems. LPA will also provide information about potentially dangerous situations, like vehicle driving in the wrong direction or the presence of a vehicle stopped on the road.

The combined deployment of the cooperative mobility network with lane-level navigation systems and the availability of the Galileo satellite constellation will draw a future in which individual mobility will become safe, efficient and clean for all European citizens: technologies are going to be ready, then all related stakeholders need to plan together sustainable deployment roadmaps to enable an effective deployment of the technological solutions in the shortest possible timeframe.

The CoVeL project was presented at the ITS World Congress in Busan in Korea and will also be presented at the ITS in Europe Congress in Lyon in 2011.

• *For more information about CoVeL, please log on to www.covel-project.eu*

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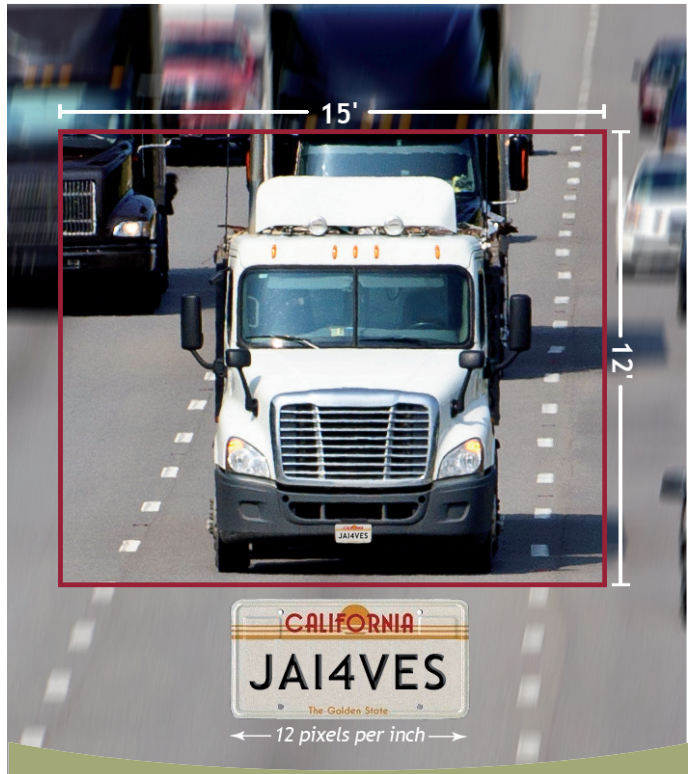

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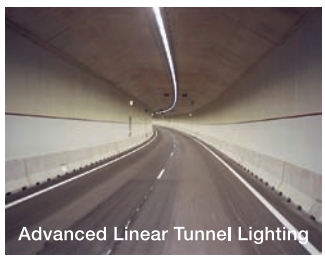
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Automagic for Chania

The aim of the AGILE project is to develop a next-generation meta-system capable of 'automagically' creating, deploying, and fine-tuning SCADA/DCS controller for UTC systems. **Enrique Gómez González** tells you how

Images courtesy of SICE

Advances in electronics, sensors, communications, and embedded systems permit the easy, cost-efficient, and rapid installation of large-scale control system (LSCS) such as urban traffic control systems (UTCs). But despite the existence of powerful solutions that permit the easy and cost-efficient installation of UTCs, much effort, time, and consequently cost is devoted to its deployment. Even with intensive efforts by engineers to optimize UTC operations, the majority operate far from their optimal level, being – in many cases – unable to efficiently cope with system variations, stochastic user behavior, and changing environmental conditions. Even worse, there are many reported cases where the UTC totally fail or collapse in case of major faults or incidents.

The EU-funded AGILE (rApidly-deployable, self-tuninG, self-reconfIgurabLE, nearly optimal control design for the large-scale non-linear system) corresponding to the 7th Framework Programme[1] has set out to satisfy this need through the development of a system that can vastly speed travel times, increase the throughput of our road network and avoid the collapse in atypical situations.

Application example

The urban traffic network in the city of Chania in Greece is a particularly large-scale system, comprising 23 junctions, more than 100 control inputs (traffic light signal settings), and around 200 sensor measurements (measuring traffic flow and occupancy at the network's links). It is subject to highly non-linear and discontinuous dynamics (mostly due to the on-off behavior of the traffic lights) as well as stochastic traffic demand patterns. It is worth noting that this particular traffic network becomes extremely congested during business hours and especially during the summer when the city's population doubles due to tourism.

A number of problems make the Chania application extremely challenging for AGILE. First, any control design has to be rapidly fault-recoverable as a significant portion of the sensors erroneously measure 'congested traffic' resulting from cars being illegally parked above them. Moreover, control designs for these systems must rapidly and efficiently be reconfigured, as a part of the traffic network frequently doesn't 'function' (mostly due to unforeseen events/incidents taking place at the city center that lead to closing these streets and having the drivers taking alternatives to the usual routes). Finally, due to significant changes in traffic demand patterns (e.g. summer versus the rest of the seasons), this particular system will have to be self-tunable so that they take care of the significant seasonal traffic demand variations.

Directly expected impacts of AGILE are reduced travel times and consequently lower fuel consumption and emissions, and overall better quality of service for that particular application. Deployment costs are expected to be minimal once developed. As there are no costs involved with the installation of new hardware or modification to existing installations, it is expected the payback period will be markedly small. And by reducing the need for operators and engineers to fine-tune and calibrate the system, operational costs will also be reduced.

The AGILE consortium is composed of eight partners in total. Led by Centre for Research and Technology – Hellas (CERTH) from Greece, AGILE brings together the experience of other well-experienced research groups and industrial partners, including Spanish company SICE.

Comprehensive evaluation

The first half of the project is mainly dedicated to the development of the AGILE system with the main involvement of the research participants. After that, it focuses on the development of interfaces and on installation, integration, and verification of the AGILE elements. These tasks are being led by the Spanish company SICE, which has a great deal of experience in the development, installation and operation of traffic control systems. Finally, the implementation and verification phase is scheduled to run over a period of nine months including a weekly alternation between the AGILE system and the resident system and simulation tests that will allow a comprehensive evaluation of the AGILE efficiency.

In terms of duration, the AGILE project is scheduled to run for three years, starting in September 2010 and running until August 2013

> Directly expected impacts of AGILE are reduced travel times and consequently lower fuel consumption and emissions, and overall better quality of service

The idea behind AGILE is to provide control designers with a systematic and automated tool capable of designing efficient, large-scale control systems

Seen the light, yet?

The world of intelligent streetlighting is advancing beyond all recognition, reaping rewards for road users, authorities, cities and ultimately the environment. As **Lloyd Fuller** discovers, however, the integration of the LED is just one part of this new smart equation

Illustration courtesy of Tim Ellis

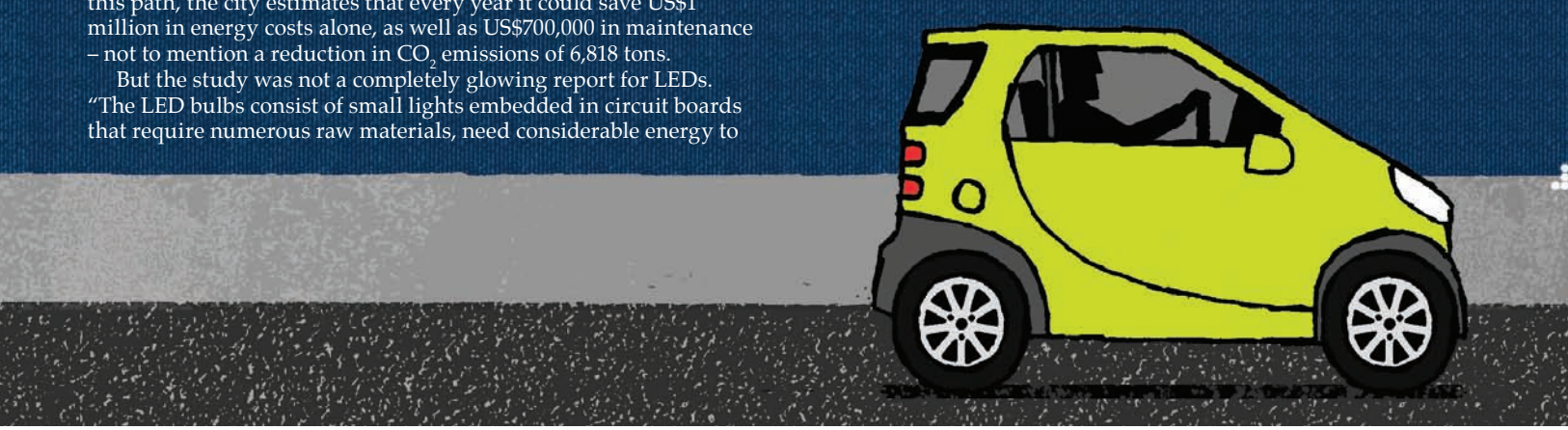
The humble streetlight has undergone something of a technical revolution over the past decade or so, with LEDs increasingly selected as a replacement to the traditional and most commonly deployed high-pressure sodium (HPS) and metal hallide variants. But as a survey of the sector shows, innovation in streetlighting doesn't merely revolve around the light source itself, important though research suggests it may be.

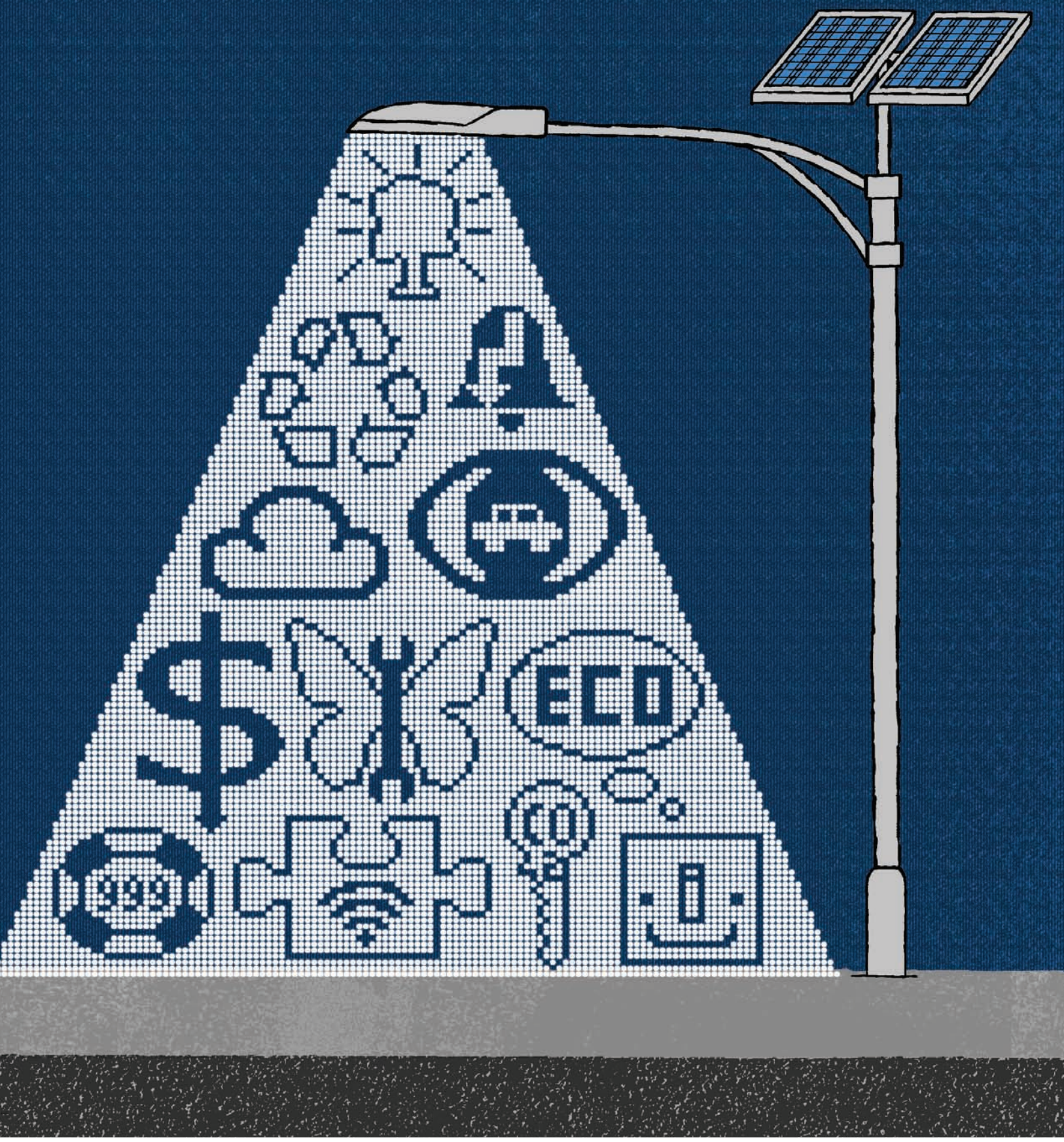
Comprehensive evaluation

One of the most comprehensive studies of LED-based streetlights was undertaken in 2010 by the University of Pittsburg at the Mascaro Center for Sustainable Innovation, based in 'Pitt's' Swanson School of Engineering. Professors Melissa Bilec and Joe Marriott were key advisors in the evaluation, *Life Cycle Assessment of Streetlight Technologies*, which didn't just analyze the products in use but over their whole lifetime – from cradle to grave. Although the study acknowledged the higher initial pricetag of LEDs, when compared to HPS and metal halide lamps, LEDs consume half the electricity, last up to five times longer, and produce more light.

The report comes on the back of many cities replacing or considering to replace what Marriott describes as "energy-guzzling" HPS lamps, known to cast a flat orange glow on the road. Indeed, the City of Pittsburg commissioned the report in advance of it retrofitting its 40,000 streetlights with LEDs. By going down this path, the city estimates that every year it could save US$1 million in energy costs alone, as well as US$700,000 in maintenance – not to mention a reduction in CO_2 emissions of 6,818 tons.

But the study was not a completely glowing report for LEDs. "The LED bulbs consist of small lights embedded in circuit boards that require numerous raw materials, need considerable energy to




LED

A first for Europe

LED-based lighting can have an equally dramatic impact in tunnels as out on the open road, as demonstrated this year when the Vlake Tunnel between Bergen op Zoom and Vlissingen reopened featuring road tunnel lighting from UK company Indal WRTL.

i-Tunnel is part of the Stela range of LED solutions so features all of the energy, cost, and light quality benefits that you would expect. Combining a flicker-free driving experience with enhanced visual guidance and color rendering, the lighting delivers what the Rijkswaterstaat feels is a more comfortable and safer driving environment overall. Such a linear lighting scheme also delivers benefits from inherent redundancy, so a failed luminaire will have little effect on the overall scheme. Following the success of this collaboration, the Dutch Ministry now plans to retrofit more tunnels in the Netherlands in order to ensure that safety levels remain guaranteed, as well as in anticipation of energy savings of up to 50% and maintenance costs being reduced by an impressive 90%.

The Vlake Tunnel installation was Europe's first for LED-based lighting solutions

produce, and can be difficult to recycle," Bilec notes. That said, their housings – composed mainly of plastic and wire – consume far less energy to manufacture than the production of heavy aluminum HPS casings. "LEDs also contain no mercury and fewer toxins, such as iodine – lead-HPS and metal hallide bulbs packed an average of 15mg of mercury in each, with induction bulbs averaging 6mg."

During the bulb's lifetime, however, electricity consumption produces up to 100 times the environmental impact than manufacture, as Marriott reveals with some data. "LEDs burn at 105W compared to a hefty 150W for HPS and 163W for metal hallide. When you extrapolate this consumption into kilograms of CO_2 produced, metal hallide would emit nearly 500 million kilograms of CO_2 during 100,000 hours of use, followed by HPS bulbs at more than 400 million, induction bulbs with 350 million, with LEDs producing slightly over 300 million.

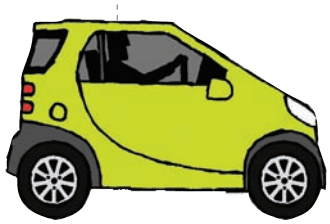
In terms of cost, both Marriott and Bilec report wide variations in the price of LED lights, ranging from US$9.20 to US$322 per fixture. "But the technology's considerably longer lifespan could mitigate this sticker shock," Bilec says. "Based on 100,000 hours of use (around 20 years), LEDs did not last as long as induction bulbs – estimated to cost US$280 per fixture – but were calculated to burn nearly three times longer than HPS lights and almost five times longer than metal hallides." To put this into context, 40,000 LED lamps would cost the City of Pittsburg as much as US$21 million versus US$9 million for metal hallide streetlights. Vitally, though, replacing metal hallides could cost as much as US$44 million before the LED lamps even needed replacing.

The quality of light

Gil Soto Tolosa is the global product manager of ONS at Philips in the Netherlands and is pleased with the findings in the Pitt report. "When we consider the design flexibility and sustainability afforded by LED-based systems, the case for solid-state streetlighting is compelling," he says. "Moreover, streetlights using today's power LEDs are fully capable of meeting standard regulations for luminance levels and uniformity." Unlike many other technologies, LEDs provide a sufficiently even light distribution to meet recommended streetlight uniformity levels, which is valuable in terms of eliminating glare, 'hot-spots' and related visibility, safety, and energy-wastage problems. "An even light distribution improves the streetlighting function and creates a better environment for motorists," Tolosa suggests. A traditional filament emits light from a single source. Shields, reflectors and/or lenses are used to point the beam in the desired direction, although engineers have limited control. Some light will spill over to neighboring buildings or bounce skyward, which wastes light and creates pollution. In addition, the light is brighter in the middle and more dim at the edges – this light concentration at the center creates the so-called hot-spots that are known to cause eye strain for drivers. "An LED allows the use of multiple light sources with individual optics; each LED can be targeted to a specific area or position, providing more uniform coverage as well as eliminating hot-spots and glare. It's the difference between having a single massive spotlight pointed at a stage and aiming multiple smaller spots at strategic locations," Tolosa says.

Color rendering is another benefit of LED when it comes to driver safety. Philips' Luxeon Rebel streetlight, as an example, boasts a color rendering index (CRI) of 75, which makes it easier for drivers to see streetsigns and other objects in the area illuminated by the fixture. "Quality of light is an important aspect and shouldn't be underestimated – if people feel safer, accidents can be prevented," Tolosa confirms.

> "An even light distribution improves the streetlighting function and creates a better environment for motorists
>
> **Gil Soto Tolosa, product manager, ONS, Philips, the Netherlands**



The safety factor

In the whole streetlight debate, safety doesn't feature highly enough, particularly when there is a raft of evidence to suggest that it should. Only 25% of all travel by car is outside of daylight hours, yet this period accounts for 40% of all fatal and serious injuries, according to the Royal Society for the Prevention of Accidents (RoSPA) in the UK. Duncan Vernon, road safety manager, feels effective streetlighting is just one of the ways to improve this scenario and cites a Cochrane Collaboration study that pored over streetlighting research from 17 separate studies. "The results indicated that streetlighting can prevent road traffic crashes, injuries, and fatalities," Vernon says, "which might be of interest to low- and middle-income countries where the policy

on streetlighting is less developed and the installation of suitable lighting systems less common than in high-income countries."

A more recent study, *Road traffic accidents: the impact of lighting*, conducted by Dr Sotiris Plainis from the Institute of Vision and Optics (IVO), School of Health Sciences, at the University of Crete also analyzed the effect that lighting has on the likelihood of fatal injury. He found that on motorways, 2.6% of accidents are fatal where streetlighting is present, compared to 4.3% of accidents where it is not. On built-up roads, 1.3% of fatal accidents were fatal without streetlighting as compared to 1.9% of accidents where it was not, while on non-built-up roads, 3.1% of accidents were fatal in lit conditions, rising to 4.9% in areas without streetlights. According to Vernon, the study cited an increase in thinking and stopping distances in non-optimal night-time conditions as to the reason why the rate increases. In statistical terms, the average presence of streetlighting reduces the severity of injuries by a factor of three.

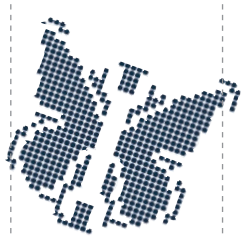
Environmental awareness

Such research is valuable as many Local Authorities consider switching off streetlights altogether, or dimming them to conserve energy and reduce costs. Hence why many of the advances in intelligent streetlighting hone in on systems that can automatically illuminate lights when nearby motion is detected. Similarly to E-Street (featured in the January 2010 edition of *Traffic Technology International*), the LITES project – funded as part of the EC's Seventh Framework Programme – is looking at spreading the concept of automatic dimming of the LED light depending on the environment.

Bruno Zuga from the Riga Technical University in Latvia – which is one of the four test sites for LITES – predicts the implementation of such a scheme could save up to 80% in energy consumption, while still delivering the safety and security benefits of illuminated streets when they're needed. "Streetlighting is an area where considerable savings can be made," Zuga feels. "If you look at many cities, their main streets, secondary streets, and pedestrian areas are lit continuously all night, consuming a lot of energy and draining municipal budgets at a rate of about 1% a year." The LITES project provides the opportunity to save energy by using LED-based, motion-sensitive streetlighting.

The embedded sensors detect motion and adjust light intensity accordingly – for instance to just 10% of intensity when there are no cars or pedestrians around, or 100% when there are. "A typical Latvian town spends about 1% of its annual budget on streetlighting energy costs," Zuga continues. "And because the energy is imported from outside producers, this only adds to the vulnerability of cost increases. Based on a survey of Latvian municipalities, the total luminary count of 83,000 units consumes 41,000MWh, costing €3.4 million a year. One of our key objectives is to develop LITES technology at an affordable price, which will be attractive enough for municipalities to transform their public lighting systems."

LEDs offer up to eight times more brightness than incandescent lamps without harmful emissions to the environment



Adaptive lighting

Zuga and his LITES team are not the only ones experimenting with such adaptive systems. Intel's concept is based on advanced processors that would give utilities flexible control over lighting levels at each pole to match actual local requirements, such as vehicle and pedestrian traffic volume, ambient light levels and weather conditions. The system will also enable the monitoring of individual streetlights to anticipate lamp and photocell failures before they occur.

Wirelessly connected sensors, one on each light pole, connect through a self-configuring Mesh Network to access gateway devices powered by Intel's Atom processors. Each gateway device can support hundreds of sensors, and then securely transmit real-time data to a protected server. Access points can also be programmed to adjust light output to traffic or weather conditions to save electricity. An added benefit is the ability of wireless

Lighting up Kolkata

The Climate Group is working with the world's most influential business and government leaders to make clean technologies commercially viable. One of its programs, Lightsavers, is looking at how to transform the way we light our world. With lighting accounting for nearly 10% of global CO_2 emissions – more than cars worldwide – the program focuses on advancing the deployment of LED combined with smart controls, which it feels can cut CO_2 emissions by 50-70%.

In November 2010, Kolkata launched India's largest LED pilot program, trialing 270 streetlights installed on several of the city's arterial roads. The 12-month monitoring project will measure performance, including illuminence, uniformity, color temperature, and energy savings. It is hoped that the project will help the Kolkata Municipal Corporation understand practical ways it could make substantial cuts in urban emissions and savings on energy-related costs from streetlighting over the next few years. The insight will be shared internationally.

> Based on a survey of Latvian municipalities, the total luminary count of 83,000 units consumes 41,000MWh, costing €3.4 million a year
>
> **Bruno Zuga, Riga Technical University/LITES, Latvia**

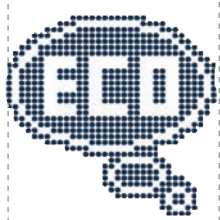
gateways to support cellular network connectivity, enabling direct control of street lights by authorized personnel using a cell phone.

In addition to adaptive lighting and performance monitoring, intelligent streetlights connected over Mesh Networks provide a variety of new control capabilities, such as measuring and analyzing power consumption, turning on flashing streetlights in emergency situations, and controlling programmable electronic signage mounted on light poles. In combination with LEDs, intelligent streetlights can provide real-time data that has previously never been available to cities and power utilities to help reduce electric power consumption and maintenance costs.

With similar goals in mind, the now NXP Semiconductors-owned Jennic manufactures wireless microcontrollers, and has developed what it calls JenNet networking software to handle all network traffic and manage network faults with a self-healing mechanism. Streetlights are ideal such communication as they have the height to enable wireless service coverage of 350m or more, while their spacing means that many lights are in range of each other. Hence, if a node fails, an alternative route could be found.

Jennic feels there could potentially be many more value-added features from such an intelligent system. For example, light performance auditing could reduce a city's liability exposure: in the event of a lawsuit brought against a city for an accident, the system could accurately report the status and light output of any area by date and time of day. Also, data collected from traffic sensors could also feed into the traffic management system, while data collected from temperature sensors could feed into highway maintenance operations during cold weather to provide a real-time thermal mapping of the network. Moreover, if GPS location data was entered into the database for each streetlight, by integrating into a mapping system or an authority's own asset management system, the most efficient routes for predictive lamp maintenance could be developed. And if power usage is monitored at the street lamp then this data can be used for billing of the electricity usage.

Further opportunities for such a network exist also. If the system featured traffic speed sensors, the information could be used to manage traffic speed via the dimming of the streetlights. If the average traffic speed was deemed too fast during evening and night hours, this could be used to trigger a slight dimming of the streetlights, which would be imperceptible to motorists but they would slow down regardless. A 5% light reduction slows traffic but is not noticeable to motorists.

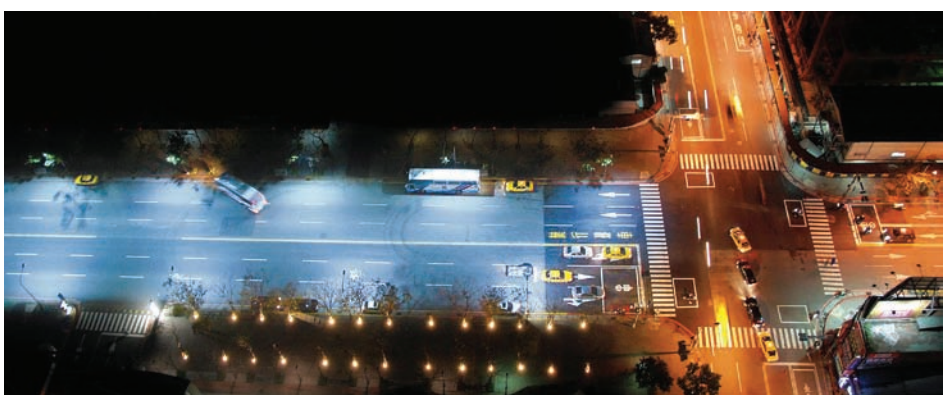


LED has a unique color index providing bright, true colors during night-time hours

Tree-mendous discovery

Such advances all point to increasing IQ in the streetlighting sector, delivering cost, safety and environmental benefits that will be felt by all. In the future, though, a much more natural solution could come to the fore. Researchers from the Academia Sinica and the National Cheng Kung University in Taipei and Tainan have implanted glowing, sea urchin-shaped gold nanoparticles, known as bio-light emitting diodes (or bio-LEDs) within the leaves of a *Bacopa Caroliniana* tree. "Bio-LED could be used to make roadside trees luminescent at night," Dr Yen-Hsun Su told *Chemistry World* in a recent interview. "This will save energy and absorb CO_2 as the bio LED luminescence will cause the chloroplast to conduct photosynthesis." Chlorophyll – the photosynthetic pigment that gives leaves their characteristic green color – is widely known for its ability to absorb certain wavelengths of light. But under certain circumstances, such as being exposed to violet light, it can also produce a light of its own. When exposed to light with a wavelengths of about 400nm, the normally green-colored chlorophyll will glow red.

Professor Wei-Min Zhang and Assistant Professor Shih-Hui Chang from Shih-Hui Chang Institute of Electro-Optical Science and Engineering are certain this discovery will become the pioneering luminescence idea of our time – turning ordinary trees at the roadside into self-sustaining streetlights. We'll have to wait and see…



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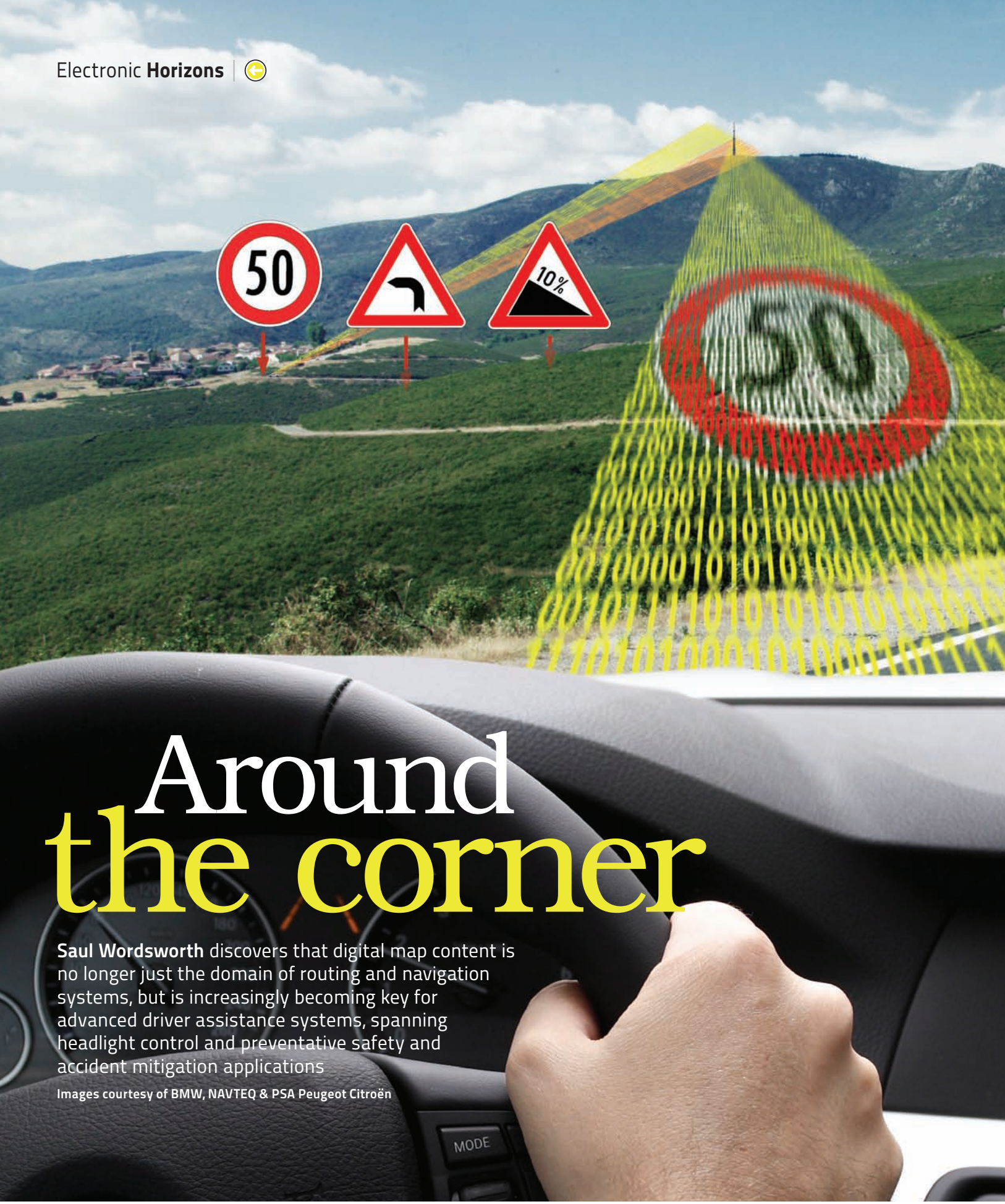

Around the corner

Saul Wordsworth discovers that digital map content is no longer just the domain of routing and navigation systems, but is increasingly becoming key for advanced driver assistance systems, spanning headlight control and preventative safety and accident mitigation applications

Images courtesy of BMW, NAVTEQ & PSA Peugeot Citroën


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Fringe benefits

"If we can solve the problem of aggregating data and allow companies to look at the data, we are going to come to understand that there are stretches of road that for whatever reasons seem to experience a disproportionate number of accidents," says Bob Denaro of NAVTEQ.

"When we start seeing clusters of crashes at particular intersections or on particular roads, for instance, we may not know why these areas are dangerous but this information is still extremely valuable as it can be used to warn vehicles of potential accident black spots.

The application of this kind of information could, for example, also be useful for insurance companies as well as for law enforcement agencies."

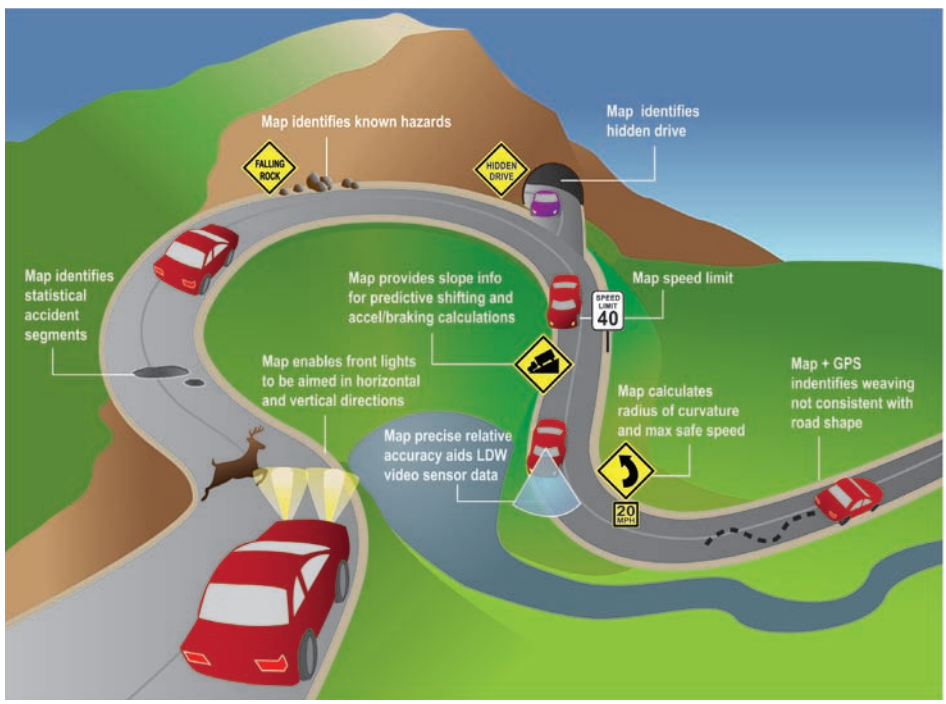
Over the course of the past 15 years, advanced driver assistance systems (ADAS) have revolutionized vehicle safety. The likes of adaptive cruise control (ACC), lane departure warning (LDW) and electronic stability control (ESC) have all incontrovertibly enhanced road safety and many are now standard in new vehicles. Another automotive revolution from this period has been the mass-introduction of in-vehicle navigation systems, providing drivers with support in the difficult task of wayfinding through unfamiliar road networks. These systems work well independently – but what of their integration?

The ADAS Interface Specification (ADASIS) Forum was first established in 2002 as an industry platform for ADAS suppliers, vehicle manufacturers, navigation system suppliers and map data providers to work together on developing what has been termed the ADAS Horizon Concept or 'Electronic Horizon'.

Vincent Blervaque is director of Development and Deployment for ERTICO, and coordinator of the Forum that forms part of the EC-funded PReVENT project. "Sensors deployed in ADAS technology enhance safety by improving relevant contextual information to the vehicle," he says. "However, their range is generally confined to the vehicle's immediate proximity. With the use of enhanced mapping data, the vehicle can know in advance the sharpness of an upcoming corner, the gradient of the next hill or a change in the speed limit. Electronic Horizons inform the driver about the next stretch of road before he reaches it. All of this added information can further assist auto manufacturers in their quest for safety."

Chicago-based firm NAVTEQ develops the most widely accessed GPS navigation maps in Europe and North America. Bob Denaro is vice-president of ADAS for NAVTEQ. "Electronic Horizons bring an extra layer of predictability to driving," he says. "You've got sensors on the vehicle operating the likes of ABS and ESC, and another class of sensor such as radar and video looking down the road. With an Electronic Horizon your 'view' is extended further. Your car can see beyond the line of sight – around a bend for example, or over the brow of a hill – based on enhanced mapping data which is streamed seamlessly to the in-vehicle display."

> "Sensors deployed in ADAS technology enhance safety by improving relevant contextual information to the vehicle"
>
> **Vincent Blervaque, director of Development & Deployment, ERTICO**



Digital map-enabled and -enhanced ADAS applications

Practical application

"The loss of control on a sharp bend is not an insubstantial part of the accident picture," explains Oliver Carsten, Professor of Transport Safety at the University of Leeds. "Many of these kinds of accidents take place on rural roads at night, possibly in foggy conditions. With the benefit of Electronic Horizons, the advanced mapping information can not only inform the driver of the sharpness of an upcoming bend but compare the speed of the vehicle with the maximum recommended speed for that particular bend and if necessary automatically slow the vehicle."

In an LDW scenario, Denaro cites the fact that this particular ADAS uses video cameras to detect the sides of the road. "Unfortunately sensors can be fooled by obscured lines at the side of road or the sun shining into the camera," he says. "Enhanced mapping data can extend the capability of those sensors and warn the driver if necessary."

Progress report

The consortium partners on the Forum, including the likes of Tele Atlas, NAVTEQ, Volvo, Ford, BMW and ERTICO, are working together to drive the broad adoption of a standardized interface between in-vehicle

ADAS applications and map data sources. This is achieved by aligning OEM requirements, delivering specifications and supporting implementation.

"As a result of the delivery of a standardized interface, we will be able to have different applications accessing the same data, as well as systems from different suppliers," says Blervaque. The advantages of this members-only forum include an acceleration in time-to-market, a reduction of development costs, and broader options for OEM and supplier cooperation and uniformity. "We are hopeful that we can create the interface within two years – that is our motivation," Blervaque says.

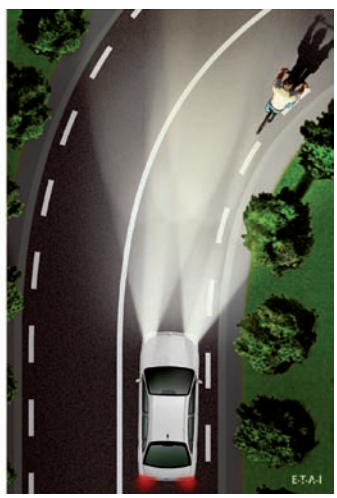
In existence

This is not to say that solutions do not already exist. The current BMW 5 Series and previous series have both featured the technology. The new Audi A8, meanwhile, features a limited version of Electronic Horizons, including a map-based headlamp control, while a number of Toyotas and Nissans in Japan also include these features. It is also fair to say that nearly all automotive manufacturers have such solutions in development. But for now, at least, nothing is standard and the Electronic Horizon concept is yet to spread beyond a small number of luxury vehicles.

"It's a patchy market," agrees John Craig, automotive product manager for Intermap Technologies, a leading mapping and data company. "The future of the Electronic Horizon market could be big but for now it is far from clear."

"The creation of a perfect Electronic Horizon solution will not be easy," adds Professor Carsten. "The more information that is required, the more responsibility there is to make sure it is accurate and precise. Such road data can be hard to collect and must be verified by teams of highly trained individuals. Road layouts change and bends are realigned so the mapping companies have to keep their information up to date. No one wants to provide duff data. Such companies will only collect data if they see a market for it. Mapping for ordinary navigation is not too demanding. But it's far more demanding for applications such as Electronic Horizons."

> I only wish it would happen more quickly but I am sure that within five years, there will be many cars enjoying the safety benefits of Electronic Horizons
>
> **Bob Denaro, vice president of ADAS, NAVTEQ, USA**



An Adaptive Front Lighting System function improves visibility on corners and can be linked with map-based information for advanced safety

NAVTEQ is one company that does see a market and has already created its own solution, simply known as 'Electronic Horizon'. "Unlike most other companies, we have always systematically collected much of the information required to enhance ADAS systems, including road geometry, speed limits and exit lanes. More recently we have gone back out and mapped with great precision curvature values and included the additional parameters of height and slope. Beyond that, the super-elevation of the bank of the road would be useful. This information will be gathered in due course." Denaro's desire is to make Electronic Horizon an affordable, standard feature in all vehicles. As such NAVTEQ has developed a scaled-down solution with limited road attributes – only those essential to ADAS.

"It's a printed circuit board the size of a business card," he says. "That's the entire hardware, software and data in there. Hopefully this simple, cost-effective solution can go some way to introducing ADAS to the masses."

Unlocking the potential

Regardless of NAVTEQ's own solutions, Denaro believes that hidden within Electronic Horizons lies the key that could unlock

Testing, testing

In 2006, a large-scale trial was undertaken by the University of Michigan Transportation Research Institute in the USA to measure a number of vehicle safety features, including the effectiveness of curve-speed warning systems. This system alerted volunteer drivers to their speed and recommended they slow down if it deemed they were approaching a curve too quickly.

When asked at the end of the trial whether the curve speed warning system would prevent drivers from driving into curves too fast, only a small number of participants agreed this was the case. Many voiced concerns about the system's reliability and felt that such a system would only be useful when approaching an unfamiliar curve. In addition, some stated that as a result of false alarms or situations when the system did not warn when a warning was expected, some drivers might begin to ignore the system. Overall the data could not confirm a change in a driver's curve-taking behavior.

Although this is not a like-for-like experiment, it does underline the value of Electronic Horizons operating in unknown surroundings and the importance of ensuring any system on the market is as accurate and reliable as possible.

this potentially life-saving advancement to a wider audience. "An excellent use of ADAS will be improved fuel economy," he says. "If the vehicle knows about an upcoming slope it can adjust the powertrain via its ACC to drive more optimally. This could prove very popular – but may also be the way Electronic Horizons become standard. Once any solution is in situ it can be used in conjunction with all ADAS safety systems."

It is likely to be smaller vehicles rather than the luxury end of the market that will generate greatest interest in improved fuel economy. A genuinely marked improvement is an attribute that would add sufficient consumer value.

"Fuel economy will typically go up by between 10-15%," Denaro concludes. "That could well be incentive enough for such a system to become standard. It is my belief that through improved fuel economy, the Electronic Horizon concept will catch on. I only wish it would happen more quickly but I am sure that within five years, there will be many cars enjoying the safety benefits of Electronic Horizons. ○

In BMW's 'ILENA', or Intelligent Learning Navigation concept, the navigation system generates an electronic horizon which helps in energy management

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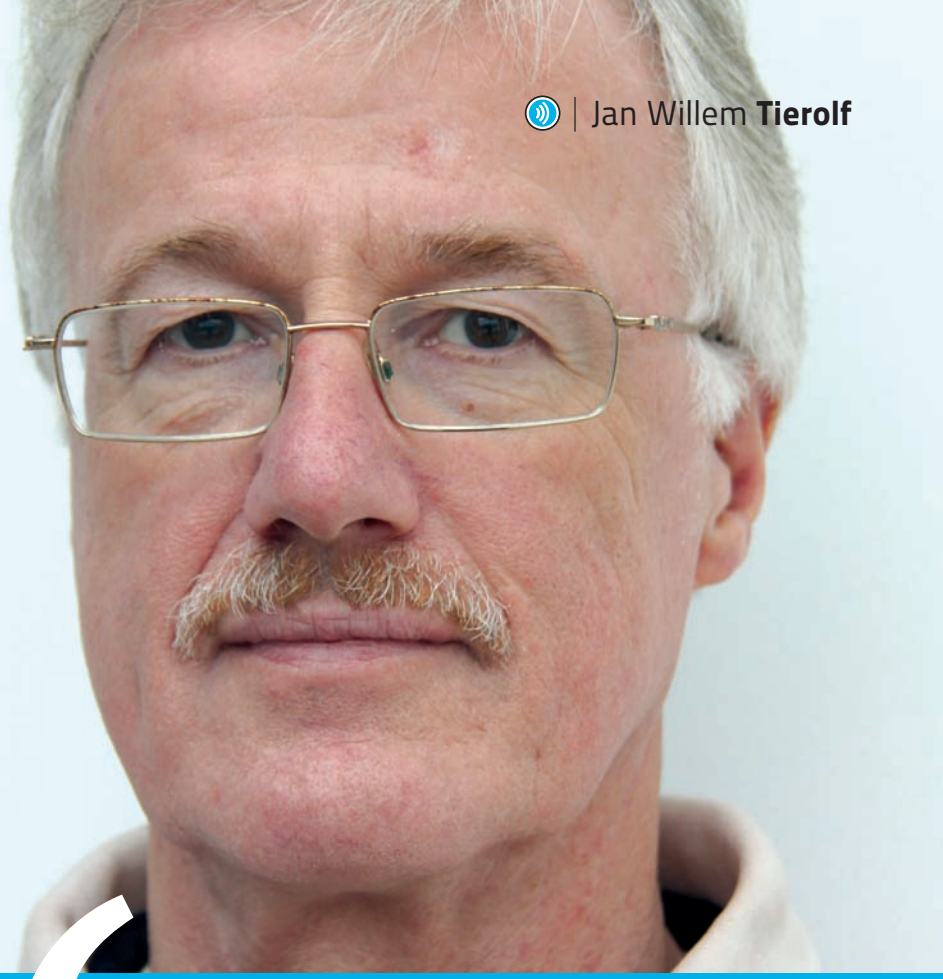
After years of banging his head against the EETS brick wall, can **Jan Willem Tierolf** at last see the debate turning into action?

Interviewed by Louise Smyth



> My first impression is that there are wide differences between the various statements – and this is one of the things causing problems regarding the official deadlines

The 'interoperable tolling' drum has worn a bit thin after so many years of banging. Few have made as much noise in this arena as Jan Willem Tierolf. When the Dutchman joined the Rijkswaterstaat as ICT Strategist in 1990, he threw himself into ITS and very quickly realized that while collaborations between, for instance, the UK and Greece, may be worthwhile for research purposes, the key to success in implementing real-world systems was in encouraging cross-border cooperations between neighboring countries. In the mid-1990s he took this strategy to the EC, which led to the creation of the eight EU-Regional projects (including the UK's STREETWISE scheme) now joined in the EasyWay program and designed to harmonize the deployment of ITS across the trans-European road network.

Around this time, Tierolf also became heavily involved in tolling, advising his ministry and others on various projects. In 2002, he founded the Stockholm Group, of which he remains chairman today. "Back then, the UK was thinking about lorry RUC, Germany was in the tendering process for its Maut, the Netherlands was trying to get to the tendering stage, and Austria was also working on introducing a national system. I noted there was a lot of overlap, so we started this informal group between these four ministries and today the Stockholm Group has 12 countries – 11 from the EU, plus Switzerland."

The introduction of EETS

Running parallel to this was the growing formal momentum to bring to life the European Electronic Toll Service (EETS) – an interoperable tolling system for the whole of the EU, which came into force officially in October 2009. "EETS will be available within three years for all road vehicles above 3.5 [metric] tonnes or allowed to carry more than nine passengers, including the driver," the Directive states. "It will be available for all other vehicles within five years."

This decision prompted a number of milestones, as Tierolf explains: "First was that the Commission would start a coordination group of certification institutes by April 2010. The first meeting of this coordination group took place on October 20, 2010. They will start to think about how to establish the CE-marking process for EETS equipment."

Member states were also tasked with deciding which toll domains in their respective countries would be EETS domains. On July 7, 2010, they all had to publish their national registers and three months later, on October 7 2010, their toll chargers had to publish their (more detailed) toll domain statements.

It all sounds like a fairly straightforward process, although Tierolf reluctantly shatters any such illusions: "We have seen a number of the statements – not all of them have been written yet and not all of the existing ones are easily accessible. Some countries only published them in their own language, others didn't publish them publicly. Some consist of brief but adequate information, while others have gone into vast detail or have very specific requirements. My first impression is that there are wide differences between the various statements – and this is one of the things causing problems regarding the official deadlines."

This, Tierolf cites, is a prime example of a situation where the formal obligation has been met by most toll domains, but in very diverse ways. Any improved harmonization can now be done only on a voluntary, informal basis.

In April 2011 the EC will publish its 18-month report, effectively a half-time review on the progress of the implementation of EETS. "What Stockholm Group has been stressing over past couple of months at events such as the Comité Télépéage and ASECAP meetings is that while the formal side of things seems to be going alright, there's a big 'but' – and that's the technical and business implementation," Tierolf says. "The Commission has proclaimed repeatedly at these events that everything is fine because formal legislation was in place and the market would take care of the rest.

"One director put forward the telecoms sector as an example of this and I challenged him that the comparison with the telecom sector was completely flawed, most of all because interoperability in telecoms means a market of tens of billions of Euros. As it stands, interoperability in tolling would be maybe a few hundred thousand trucks that might be interested in joining the EETS and paying for the OBUs and services. The revenue volume in the first couple of years might be below €100 million. Plus we might have as many as 150 toll domains and if they all have completely different requirements – as they have the right to – if nothing is harmonized and they all insist on having individual field tests, it's not hard to see that the cost side of implementing it could be quite considerable and not be proportional with the expected revenue."

Tierolf has written, spoken and canvassed on the issue of the business case for the EETS for years. At times, he's felt like he's banging his head against a brick wall, which has prompted him to take an approach of less talking, more action. "The Commission is of the opinion that the market will solve it but we are putting the heat on a bit more now. I see four major stakeholders, with possibly a fifth. There's the member states, organized in the Stockholm Group and the concessionnaires in ASECAP, plus you've got the service providers, which have just established their own platform called AETIS. You've then got the Commission, and maybe at a distance, the equipment manufacturers.

> If the Italian, French and German toll domains agree that they would operate nationally as one for the EETS, that would dramatically reduce the number of different requirements in play

"ASECAP was cooperating with Stockholm Group but for internal reasons decided last year that they would no longer cooperate on the EETS – because they were not having a formal platform with the Commission and felt they weren't fully recognized, although this was repaired recently. Service providers were willing to cooperate but they are in a weak position: they have to start up a new business and the conditions for this are far beyond their control. So they're desperately looking for links to decision-makers and looking to the Stockholm Group for help. We have decided that we will continue to cooperate with them, certainly now they have established their platform, which makes life a bit easier. We'll be meeting soon, mainly to look at the business case issues from both sides – to see if we're all singing the same song."

Trust and security

Tierolf is optimistic that this side of things holds some promise, but in such a fragmented undertaking as the EETS, as one obstacle is successfully negotiated, another appears. He predicts the next big issue will be related to trust and security.

"Without good specifications or standards for security and enforcement, member states and toll chargers will be anxious about being forced to do business with service providers that they cannot refuse to work with. If you have billions of Euros in tax revenues being collected by tolls – which in theory could all be collected by those few service providers – then you'd like to have some security that your money is safe and you will get 100% of it. At the moment that is lacking."

Believing that these type of issues won't be solved shortly by the formal route, the Stockholm Group has embarked on a program to address them. Tierolf certainly doesn't claim to have all the answers, but he does at least want to throw some potential solutions out there to encourage better working methods. He sees several possible ways around some of these problems already. One is to see what the EETS can take from private initiatives such as the Scandinavian EasyGo system, which is currently being extended to Austria. "So for DSRC charging for trucks you would have a number of countries where you can have interoperable service already or in the next year. It is not fully up to the EETS standard, but it is a real business – and since that's one of the big problems, I am interested to see how things like that develop. Such schemes could close the gap between an impossible business scenario and how things work in practice in the market."

Also relating to the business case is the idea to promote clustering between authorities: "For instance, if the Italian, French and German toll domains agree that they would operate nationally as one for the EETS: that would dramatically reduce the number of different requirements in play."

Tierolf is now looking to see what can be done from an informal perspective with regard to the service providers, too. "I've heard from some of them that they'd like to pilot some EETS services. Now, to do so formally is not possible because the CE-marking process is not in existence yet. However, they have said 'well what we have really could be EETS equipment and we want to demonstrate that, we just wouldn't be able to call it EETS equipment'."

The coming year will certainly be interesting – and with a bit of luck, more productive than previous years. And when the EETS does finally come into operation, let's hope the importance of the work conducted by Tierolf and his gang of 'informal' pioneers will be acknowledged.

The EETS will allow drivers who wish to do so to drive on a wide range of tolled infrastructure across Europe using a single payment account and one OBU

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Safety net

V2V concepts, such as IntelliDrive, bring connectivity to surface transportation through the application of powerful advanced wireless technologies. **Sridhar Reddy, Ravi Puvvala** and **David Gurevich** reveal how it could enhance the safety, mobility and quality of life of all

Images courtesy of Daimler & USDOT

Can you imagine a car that's capable of communicating with other vehicles in the vicinity; analyzing pertinent information and then providing feedback to the driver on any potential safety-related information to prevent accidents. Such a scenario is soon poised to become reality.

Organizations around the world are working on technologies, initiatives and new standards to greatly enhance safety. In the USA, the USDOT and others are involved in IntelliDrive – an initiative that involves connectivity between vehicles as well as vehicles to infrastructure.

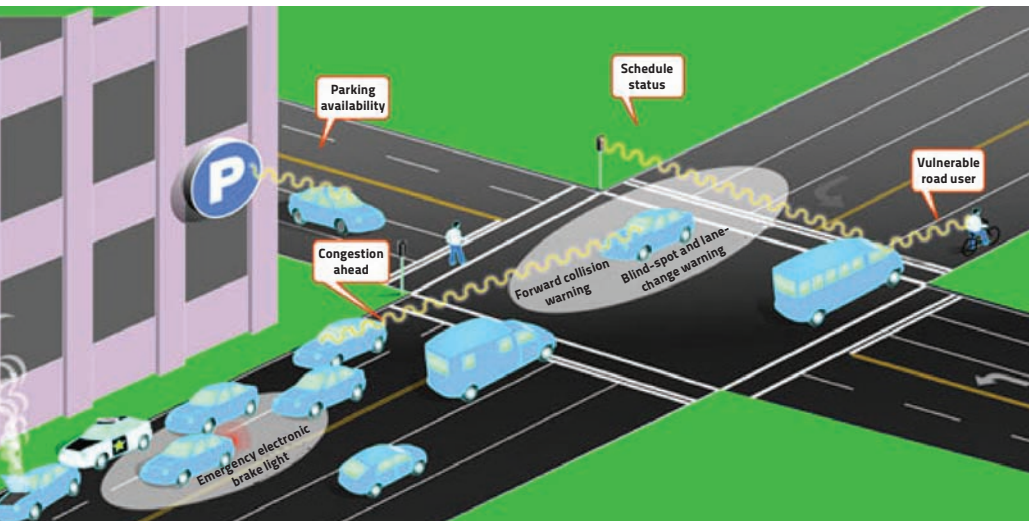
Currently, vehicles feed back little to no information regarding situational awareness on any potential traffic hazards. The bulk of the mechanisms are limited to warnings in the form of lane departure for large vehicles and radar-based warning systems. Vehicles do not exchange any information among other vehicles. If it were possible for each vehicle to adequately communicate with another vehicle within its vicinity and exchange pertinent information, it would then be possible to provide a range of information and feedback to drivers and greatly reduce accidents.

In research conducted by Daimler, car-to-car and car-to-roadside information is collected and then displayed to the driver so that proper precautions can be taken to avoid or safely navigate other vehicles

In the USA alone, around half of the road accident deaths are caused by roadway departures and intersection-related accidents. Now, with Vehicle to Vehicle communications, or V2V, information can be exchanged among vehicles that intend to depart a particular lane and other vehicles in the vicinity. Similarly, cars arriving at an intersection can transmit warning messages to other cars near that intersection. Feedback to the driver can be given in the form of mechanical stimuli (haptic), or audio warnings or visual (displays), or a combination of all the above. It won't be too long in the future before cars can make co-operative decisions to avoid accidents.

The V2V communication capability, GPS-based location processing, and access to the vehicle information – which includes the travel speed, acceleration, and direction of travel – are combined in an on-board-unit, the OBU. This system is used to acquire information from the vehicle, the GPS, receive wireless messages from other vehicles, process it and send its own updates over the wireless link to other vehicles.

The wireless link is implemented with Dedicated Short-Range Communications (DSRC) – a family of standards that encompass



communication between Vehicle to Infrastructure (V2I) and V2V. DSRC resembles WiFi communications and operates in an environment wherein fast communication between speeding vehicles, deterministic latency/delays, minimal use of transmission power and privacy of users is important. The mode within 802.11p is based on a simple transaction mechanism, which is independent of standard infrastructure or ad hoc mode in standard WiFi and 5.9GHz was chosen as the universal spectrum for the means of communication. Information exchange within the V2X framework is based on SAE J2735 standard. These messages range from basic safety messages to emergency vehicle alert messages to probe messages. Of these various types of messages, the basic safety message is used to exchange vehicle specific information, such as velocity, hard braking, emergency lights, etc.

Basic safety message BSM

The Basic Safety Message (BSM) is used in multiple safety applications in each vehicle. Each vehicle is responsible for broadcast of BSM data as well as receiving and decoding of other BSMs from multiple vehicles. The OBU is then responsible for providing the required stimuli/response to the driver, which may be in the form of visual displays, audible warnings, vibration alerts or even a preventive measure. Typically, the BSM is sent 10 times a second, or once every 100ms. This periodicity is variable.

The BSM consists of two general parts. The first contains information describing vehicle position, universal time, motion and general status of the vehicle. Part I information is always sent. Part II is sent on a need-basis and the contents may vary. This flexibility allows for multiple optional data items to be included (as needed) as well as added in the future. Part II could have data such as vehicle path history, vehicle lights status, wiper status, etc.

Wireless connectivity would enable roadway users to receive information to provide 360° situational awareness. In unsafe situations, IntelliDrive applications provide alerts and advisories, or take action to help roadway users avoid or mitigate crashes

Security

DSRC provides for a secure communications channel, which requires the use of smart algorithms, encryption, generation and verification of certificates. Given the real-time nature needed to perform all these functions at rates within a fraction of a second, the computational power required will be significant. This capability typically calls for the use of high-speed processors, which also means increased cost. This is the reason there has been an increase in popularity to use on-demand-based certificate verification of the messages. BSM messages that result in real warning to the driver are the only ones that are verified for proper authenticity of the certificate.

Privacy: For private vehicles, there are no data elements in the BSM field that can directly identify either a vehicle or a driver, nor any built-in means to track vehicles.

GPS: For meaningful exchange of real-time information the two important parameters are absolute vehicle position as well as a standard reference time. The OBU will acquire and maintain timing information using the time-service provided by GPS. In conjunction, the entire system will also be responsible for correcting any timing wander or other corrections that would need to be made. Real-time GPS correction providers need to get involved in maintaining the accurate positioning corrections to the vehicles.

Deployment timeline, progress and challenges

Unlike some technologies that may be left to the automotive manufacturers or users to adopt, V2V will need to be mandatory as it requires universal adoption (at least within a country or region) for maximum

Use cases for V2V and V2I

Lane merge assist: A vehicle is continuously receiving and monitoring the position of other vehicles in the vicinity. Based on a turn signal, the OBU can now check whether the lane change would be deemed safe based on proximity of other vehicles and available gaps between vehicles in the next lane. Determining safety based on proximity is a function of transmitting,

receiving and analyzing vehicle information such as speed, position and predicted path. If the OBU deems the lane change is not appropriate, a warning can be provided to the driver.

Pre-crash sensing: It is assumed that a crash is imminent and unavoidable. The OBU can then send the required responses to other units in the car, which in turn can be used as a precursor to mitigate damage/injury. These could include, pre-tightening of seatbelts, pre-arming airbags, bumper extensions, etc.

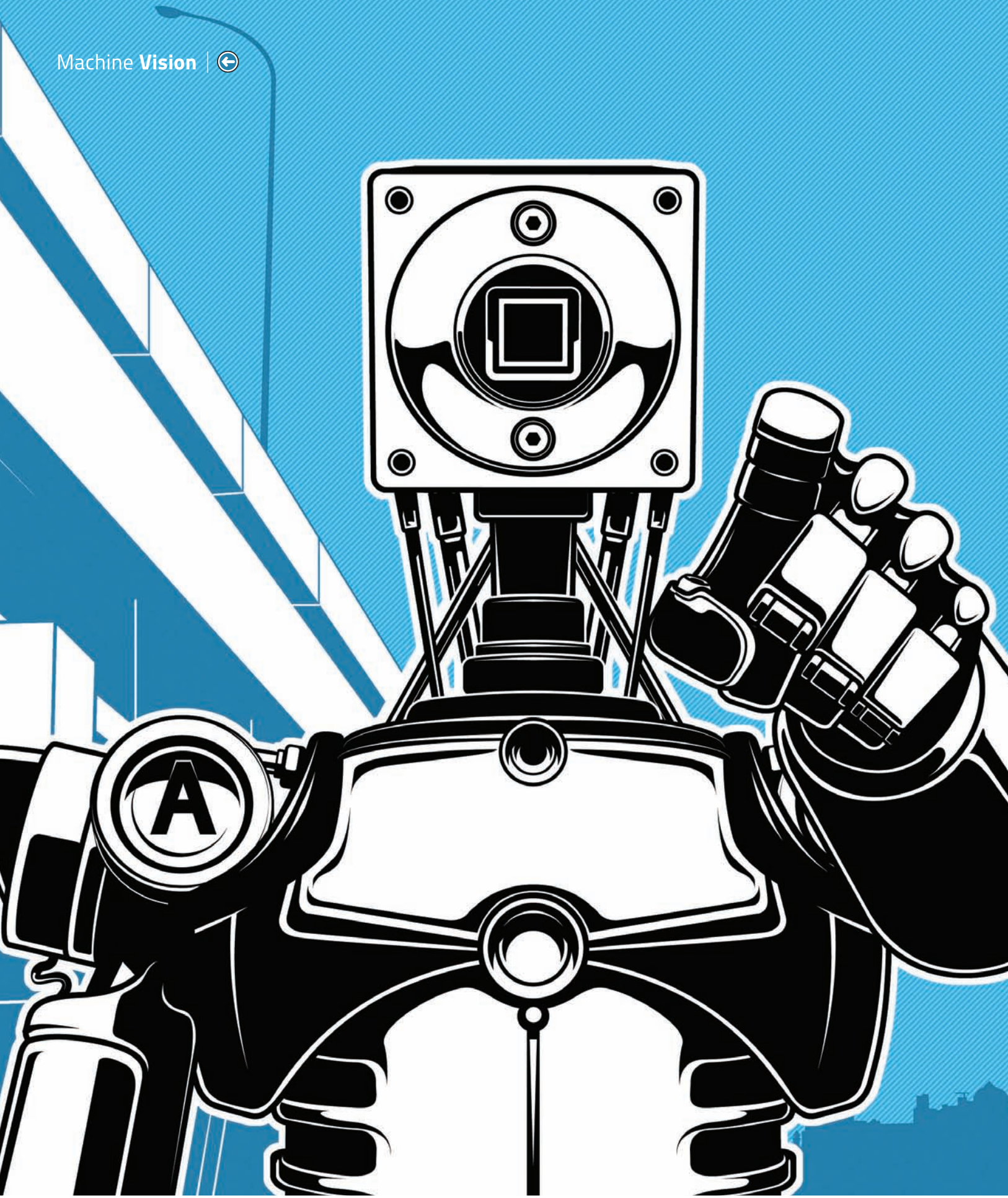
Emergency vehicle warning: In this scenario, emergency vehicles can continuously broadcast their presence to other vehicles in their vicinity. Here, the absolute position and predicted path may not be as crucial. Approaching vehicles can be notified in advance so that they can reduce speed, change lanes if needed and drive cautiously.

effectiveness. In the USA, the National Highway Traffic Safety Administration (NHTSA) has the congressional authority to establish Federal Motor Vehicle Safety Standards (FMVSS). The NHTSA plans to support the 2013 regulatory V2V decision, provided that the benefits can be demonstrated in real-world implementations. As one part of this study, the Crash Avoidance Metrics Partnership (CAMP) – a consortium consisting of USDOT and the automotive manufacturers – are currently involved in demonstrating interoperability between various V2V equipment manufacturers. Similarly, other groups are involved in live test beds and measuring driver acceptance.

A V2V regulatory mandate cannot be applicable only to new vehicles – it needs to be applicable to existing vehicles as well. The USDOT has recently awarded multiple contracts to vendors for purchasing V2V devices, similar to an aftermarket device that can be fitted into existing motor vehicles. USDOT plans to conduct a safety pilot test using motor vehicles equipped with V2V-based integrated cooperative collision warning systems, along with vehicles carrying aftermarket DSRC devices, in two stages. While, Stage one consists of studies in testbeds, stage two will include real-world model deployments. Although the initial deployments will include a limited number of applications, the V2V systems are expected to be software-upgradeable, enabling easy introduction of new applications and features. Unlike many of the current crash-avoidance technologies based on millimeter wavelength radar, the new V2V-based safety systems use off-the-shelf hardware technologies. As a result of this, the cost of these systems is potentially an order of magnitude smaller. By using proven, mass-produced silicone and board designs, the engineering and production costs can be reduced. In addition, the development of high-performance, small-footprint CPUs have made it possible to focus the development of the core platform and applications in software. All of these developments make is feasible to deploy safety V2V systems in all vehicles, not just a few high-end models.

> Unlike many of the current crash-avoidance technologies based on millimeter wavelength radar, the new V2V-based safety systems use off-the-shelf hardware technologies

The ubiquitous adoption of security-oriented V2V systems and applications will pave the way for commercial applications and services, such as navigation, location-based services, ETC, parking, insurance telematics services such as PAYD, traffic information, congestion avoidance, etc. New business models will emerge and be feasible based on the availability of the infrastructure being designed and put in place as a part of the V2V safety initiatives.



Rise of the machines

Increasing intelligence in vision- and imaging-based technologies will ultimately filter through to the benefit of ITS. **Andrew Lee** goes behind the lens to discover how it could impact upon traffic management

Illustration courtesy of Magictorch

Ask people working at the leading edge of machine vision and image processing what traffic means to them and a common theme soon emerges. They all rate the ITS sector as one of the most demanding they serve, and those demands are growing by the year.

For its most challenging applications, ITS already needs high-quality images of objects moving at rapid speeds, often in poor lighting conditions. Traffic systems deployers increasingly want to capture and process more data on a vehicle than simply its license plate, for example. Its color, model and size would be useful, too. And while we're about it, could image processing please help us get rid of some of those buried loops, radars and other triggering devices that traffic systems often require to get the job done?

The demands of ITS

Unlike users of machine vision in factories – who can carefully control their environment to ensure the best possible image quality – ITS can do anything but. The systems face rain or snow, fog or bright sunshine, all of which can affect image capture. On the

Dalsa's Genie cameras are based on high-quality, highly sensitive CCD and CMOS sensors; enforcement is a huge market for machine vision companies

subject of the environment, it's also clear that the demands on vision technologies are changing in ways that have nothing to do with resolution or contrast, but the conditions in which they must operate.

As fast-growing economies, notably China, look to deploy more ITS systems to manage their burgeoning transport networks, many in the machine vision sector report a new level of demands on the ruggedness of their products in the face of temperature swings almost unheard of in their more traditional markets.

The challenges may be considerable, but Yvon Bouchard, director of technology for Dalsa, a major developer of imaging products and systems, is confident that relentless technical innovation in the vision sector will enable it to meet many of them. Bouchard pinpointed several headline developments that he says will shape the role of machine vision in ITS over the coming years. Color systems will continue their inroads into ITS while multi-megapixel cameras will become ubiquitous in the sector within four years, he believes.

Multi-megapixels on the way

"You're going to see multi-megapixel cameras used everywhere," Bouchard says. The driver for this will be the development of high-quality, affordable CMOS sensors. CMOS (complementary metal-oxide semiconductor) sensors and CCD (charged couple device) sensors have long been the two dominant forces in digital imaging technology, with each offering advantages and disadvantages, with CCD generally favored for the most demanding applications.

Bouchard says CMOS sensors offer unique capabilities to integrate greater functionality into less complex systems, and the evolution of devices that can compete with CCD will significantly

> Instead of having many different devices to make a functional ITS system, you're going to have just a camera and some kind of strobe illumination
>
> **Yvon Bouchard, director of technology, Dalsa, Germany**

How ITS is driving machine vision ahead

Arndt Bake is Basler's general manager of the camera business (Right) Basler's Aviator series of camera with integrated GigE

Customers in the ITS domain are increasingly asking more of camera manufacturers, according to Arndt Bake, general manager of Basler's camera business. And as ITS has now taken over from factory automation as the major growth area for intelligent machine vision technologies, they're demands he is taking seriously. "This is a really interesting time," Bake reveals. "ITS is the first industry after factory automation where there has been a strong demand for machine vision."

As a manufacturer of both machine vision and digital IP-based surveillance systems, the German imaging specialist is in a pretty special position. "Very few companies offer both, but what we're seeing from the traffic market is a demand for a hybrid concept featuring the benefits of machine vision and surveillance," Bake says. "Such a product doesn't really exist currently – it's something we're all working toward.

But customers want this product for the price of a surveillance system, which is a big challenge.

"With machine vision you get higher resolution, speed and image quality, all of which are features being requested for live streams. High dynamic range is another topic – capturing high-quality pictures from low light to bright sunlight. The bigger the range of the sensor, the better it will be for the customer. This is one of the biggest tasks for camera manufacturers – to merge these products and address HDR."

Basler's IP cameras are already widely used in traffic flow and intersection monitoring, where the need for acute detail such as license plate is not so high. Its machine vision cameras, however, are in demand for various enforcement, tolling and access control applications, where image quality as well as integration of ALPR software is a prerequisite. "We don't have a specific ITS line, as many of the requirements of ITS have already been integrated into our existing ranges," Bake says.

"We are seeing a big move from Firewire or CameraLink interfaces to GigE," he adds. "We've been shipping these since 2006, but ITS really switched on to GigE in 2009."

Basler's GigE-equipped aviator camera, which starts shipping in early 2011, features Kodak's latest CCD sensor generation with four-tap readout technology. Up to four times faster than standard CCD sensors of the same resolution, the aviator is perfect for ITS applications, and offers excellent tap balancing and homogenous imaging results.

boost their use in ITS. "We are at the stage where the transition to CMOS sensors is now possible, and that is important."

According to Bouchard, these advances mean that ITS cameras will become increasingly specialized with capabilities that will reduce the amount of hardware around it. "Instead of having many devices to make a functional ITS system, you're going to have just a camera and some kind of strobe illumination. We haven't seen that yet but it's coming," he predicts.

"Ultimately they [those deploying ITS] want the capability at camera level to always deliver the perfect image under all conditions, and that includes variations in illumination due to night or day, cloudy versus sunny," Bouchard adds.

The great outdoors

Indeed, the demands of the outdoor environment and the weather – as much as the technical problems of image capture – are what he believes makes ITS such a unique challenge for companies involved in vision technology, a challenge by no means limited to lighting conditions.

As ITS systems are deployed at mass scale in new markets such as China, Bouchard says system developers must face up to some new realities regarding demands on product ruggedness. "In some locations, for example in the south of China, the system is by the side of the road in an environment of 60° Celsius. The equipment has to endure a temperature range unheard of in machine vision-type applications. In winter, it can go down to sub-zero. It has to be able to withstand those large swings."

GridSmart from Aldis Inc couples an ultra-wide-angle camera for panoramic imaging of the entire intersection with advanced algorithms for real-time tracking of vehicle

Growing demands on equipment durability is one example of how future ITS applications of machine vision will not solely be defined by higher resolutions or frame rates, crucial though they will be. Another is the ability of advanced image processing to use camera data in ways that reduce the requirement for physical infrastructure, and associated installation and maintenance costs.

An all-round view on imaging

Aldis, based in Tennessee, USA, has developed an intersection signal management system based on innovations at camera and software level to achieve what it claims is a unique set of capabilities, eliminating the need for buried induction loops and offering real-time safety applications. For its camera element, Aldis's Gridsmart system uses a single, ultra-wide-angle lens that gives a 360° view of the intersection, rather than the multiple camera units usually deployed. The Gridsmart camera's processor performs onboard image stabilization to compensate for the high winds that can affect the performance of cameras mounted in high, exposed locations at traffic junctions. The stabilized, compressed data is processed using the company's proprietary algorithms to offer optimum signal control based on the location, direction and speed of vehicles approaching the intersection from up to 100m away.

> They don't like to dig up those traditional cobblestone roads to install traditional sensors. They are looking for machine vision capabilities, but there is definitely an aesthetic dimension, too
>
> **Brian Shockley, vice president of marketing and brand management, Aldis, USA**

As the system is tracking both speed and distance from the intersection, Aldis is now planning to introduce a new software feature for red light enforcement, sending an additional call to extend signal timing if a vehicle approaching at speed is poised to cut through a stop light.

The company's development of the image-stabilization techniques and its algorithms was helped by its links with the renowned machine vision department at nearby Oak Ridge National Laboratory, with two senior Oak Ridge engineers on its team.

Aldis has around 150 installations of its technology, many in the USA. However, the company said it is seeing a significant increase in deployments elsewhere. Taicang, a 'model city' in China, has installed Gridsmart for intersection management and plans to integrate it with an enforcement system. Brian Shockley, a vice-president at Aldis, said several "historic cities" are also poised to take the system. Shockley says the motivation for the latter is cultural as well as operational. "They don't like to dig up those traditional cobblestone roads to install traditional sensors. They are

A uEye on range

The huge contrasts in brightness that camera systems have to cope with in ITS poses one of its biggest challenges for image technology developers. In a traffic environment, images will often cover a high dynamic range, meaning they contain extremes of light and dark at the same time – for example a vehicle's blazing headlights and its gloomy interior.

The response to this has been the development of HDR imaging techniques that can deal with these fluctuations, which are measured in decibels.

German group IDS has developed a new approach to HDR based on solar cell technology, which it says enables the capture of ultra-high contrast images.

The company's FX4 HDR sensor, used in its uEye family of industrial Gigabit Ethernet cameras, is designed to offer a dynamic range of 120dB. IDS says that this is equivalent to a thousand times greater brightness ratio than is offered by conventional CCD sensors, which typically exhibit a dynamic range in the region of 60dB.

Get more vision

DALSA GigE Vision Cameras are ideal for Color and Mono applications such as:

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- Print Inspection
- Electronics Inspection
- Textile Inspection
- Traffic Monitoring
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DALSA GigE Vision Cameras are specifically engineered for industrial imaging applications and are based on high quality, highly sensitive area and line scan sensors in both color and monochrome formats. DALSA continues to lead the deployment of Gigabit Ethernet technology with the evolution of such products as the versatile Genie and the power of next generation GigE Vision v1.2.

Genie GigE Area Scan

Active Resolution from 640 x 480 to 1600 x 1400

Industrial RJ-45 Connector

Frame Rates of up to 300 fps

MODEL	RESOLUTION	PIXEL SIZE	FRAME RATE
Genie Color series	640 x 480 to 1600 x 1200	3.75 to 9.9 µm	Up to 64 fps
Genie Monochrome series	640 x 480 to 1600 x 1200	3.75 to 9.9 µm	Up to 64 fps
Genie HM series	640 x 480 to 1400 x 1024	7.4 µm	Up to 300 fps
Genie HC series	640 x 480 to 1400 x 1024	7.4 µm	Up to 300 fps

Capture the power of DALSA

Download product specifications and white paper: "**The Power of Next Generation GigE Vision v1.2**"
www.dalsa.com/genie/itt12

DALSA

Inspector gadgets

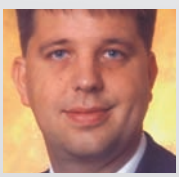
Based on preparatory work by **Technical University Dresden** and imaging solutions from **Stemmer Imaging**, a variety of new measuring mechanisms are now heading for Germany's highways network to analyze road conditions much faster and more accurately than ever before

How severe is the road damage left behind by a harsh winter? Which sections of roads are most at risk? What's the best plan for roadworks to ensure they remain danger-free? Is the width of the road still sufficient considering the planned narrowing? Thanks to machine vision, such questions can now be answered using office-based IT systems based on optical systems and recorded image sequences.

Whereas some municipalities send out staff with measuring sticks and metering wheels, others (especially larger cities) enlist surveying companies, many of which will use high-tech imaging for data acquisition. Hence the reason you'll not only see cars out on the road taking images for Google Street View, but also vehicles owned by engineering companies. These high-tech vehicles are equipped with complex roof installations: triggered based on the location, views of the road are taken from various angles from a distance of just a few meters using modern vision systems. Position determination is achieved with an accuracy of 0.5m using GPS data and information from a position-measuring system, as well as an inertial platform that allows a highly precise measurement of the angle and the acceleration on all three axes.

Several cameras deliver image data from the driver's view, documenting the road condition, roadway width, road markings, marginal strips, crash barriers, and pedestrian tracks. The PCs inside the vehicle are optimized for long-term sequence recording of several camera channels, with image analysis subsequently conducted in the office, depending on customer needs.

"The Technical University of Dresden conducted its first tests in this field in 2002 with a simple system for front image acquisition, based on two Marlin Firewire color cameras from Allied Vision," reveals Dr Dirk Ebersbach. Back then, he and his team produced its first prototype in partnership with the engineering consultancy, Ulf Neubert, a sales partner of Stemmer Imaging in the east of Germany for the past 20 or so years.



> "Our solution passed all tests … the cameras worked reliably and provided a very good resolution"
>
> **Dr Dirk Ebersbach, Lehmann + Partner, Germany**

The experience gained from this first model (which ran for around 200,000km with just one breakdown) proved valuable several years later when adopting GigE. This development featured two additional rear cameras and was able to document complete road conditions (potholes, breaks, ruts, etc). "Here, we used the TM-2040 CCD camera from JAI, featuring a fast dual-tap mode, which allowed us for the first time to acquire images at the required speed from a distance of just 1m," Ebersbach recalls.

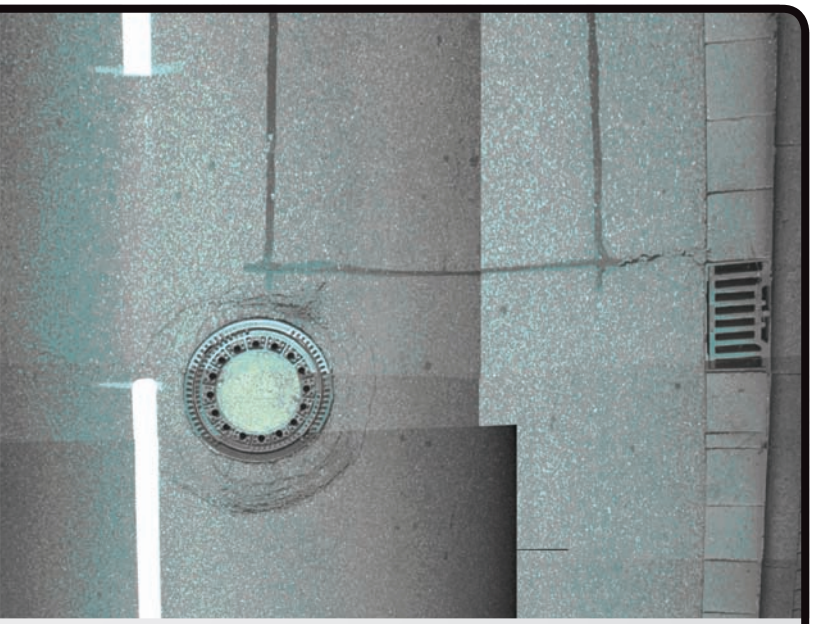
The knowledge gained at TU Dresden has since been advanced further by several other companies. The proven rear-camera system, for instance, was installed on a road condition inspection vehicle from Lehmann + Partner, at which Ebersbach now works. Using these cameras and a special illumination system, thousands of road kilometers in Germany have been captured.

An important precondition for the practical use of image acquisition is authorization by the German Federal Road Research Institute. "Our solution passed all tests without problems," Ebersbach states. "The cameras worked reliably and provided a very good resolution."

Another challenge arose for a very different project in 2009, for which the single-image technology had to be adapted to 12 cameras on an inspection vehicle from Germany's eagle eye technologies. The system also had to be adapted to a highly precise in-house navigation solution. In addition to the handling of incoming data, the PC and power supply had to be adapted. "We first thought about using CameraLink, but then selected GigE – and we've had no problems so far during operations. When we started developing our third system, GigE was not yet widely used in imaging," Ebersbach continues. "We benefited greatly from the advice of Stemmer Imaging."

The use of weatherproof and fully integrated camera housings for the roof of the vehicle was a big advantage. These IP 66 camera heads can be removed individually and mounted onto different vehicles as necessary. This was important for eagle eye technologies, as its fleet also includes an all-terrain narrow-gauge vehicle for pedestrian tracks, forest roads and dirt tracks.

Images are taken of various road features, such as lane markings, to check for deterioration and thus aiding decision-makers to implement maintenance



Machine vision systems are being successfully applied for the automated inspection of road conditions

All of the above vehicles enable acquisition of image sequences up to 130km/h. The incoming data volume is immense and required an elaborate concept for storing of image information. For this reason, only sensor raw data is stored: a conversion to RGB for video reasons is conducted afterwards, if required.

The images and relevant geo-referencing are stored, while photogrammetric software allows the coordinates of the different objects to be determined during later analysis. Traditionally, these had to be registered by a surveyor on-site, which took a great deal of time, but with the software solution developed by Ebersbach and his colleagues, the effort is reduced to just a few minutes. The end result enables direct visualization in a GIS environment – Google Earth, for instance. Data can then be transferred quickly and effectively and is often the basis for decision-makers relating to infrastructure improvements.

This inspection vehicle is a good basis for further development. Indeed, Ebersbach can imagine using similar systems for tunnels, rail tracks, route planning of freight transport, and even for the design of more accessible infrastructure for mobility-impaired travelers.

A number of the imaging components used are proven in industrial applications. But the trend toward non-industrial imaging applications will increase – as confirmed by a recent VDMA survey. The percentage of turnover from non-industrial applications raised from 10% in 2008 to 16.2% in 2009, according to the survey. VDMA predicts the importance of non-industrial imaging applications will increase further.

(Clockwise from above) **The Prosilica GX from Allied Vision Technologies; miniaturization in action with Basler's Ace range of camera; and Kria's T-EXSPEED, which incorporates Allied Vision's AVT camera series**

looking for machine vision capabilities, but there is definitely an aesthetic dimension, too." He believes applications for machine vision and vision processing will penetrate further into the realm of safety, for both drivers and pedestrians.

Stereoscopy and 3D imaging

Paul Kozik, product marketing manager at Allied Vision Technologies (AVT), a major developer of machine vision camera systems, also flags up the trend for ITS deployers to look for innovative ways to remove third-party trigger mechanisms and get image processing to do their work instead.

Kozik highlights the emergence of stereoscopy, or 3D imaging, as an example, and points in particular to Italian company Kria's novel application of AVT's cameras in its speed enforcement system. Kria's T-EXSPEED system uses twin AVT GB 1380 monochrome cameras and a third color unit to enable the tracking of vehicle speed and trajectories and 3D data extraction across several lanes directly from the high-definition images, doing away with the need for other sensors such as lasers or radar. "It's a very sophisticated and precise application, and one that I think a lot of people will watch with interest," Kozik says.

> "It's a very sophisticated and precise application, and one that I think a lot of people will watch with interest"
>
> **Paul Kozik, product marketing manager, Allied Vision Technologies, USA**

In terms of advances in sensors, Kozik notes the appearance of the Sony ICX674, adding the company's ExView HAD technology, which improves light efficiency and is popular in tolling, to a higher resolution sensor. AVT is using the new

sensor in its GX 1920, 2.8 megapixel camera operating at up to 40 frames per second.

Like Bouchard, Kozik refers to growing demand for cameras with what he refers to as a high temperature range on the minus and the plus side – "Especially on the plus side, and China is a big driver for this." And he predicts that as technology opens up new possibilities, ITS will face some interesting choices as it ponders how much functionality to deploy in a camera itself.

"How much intelligence do you put up in the gantry and how much of it do you leave in the control box below? A control box is very easy to access; you can swap PCs down there without any service interruption. Whereas if you put all smart stuff in the camera you're putting a lot of risks into a very fragile component," Kozik points out.

A bigger role to play

Some people in the vision industry predict a growing role in ITS applications for IP (internet protocol) camera systems more usually associated with security and surveillance. Gerrit Schreiber of Basler, for example, believes IP camera technology is set to play more of a part in ITS, especially for lower-end surveillance tasks where it may increasingly be used in conjunction with more conventional machine vision systems.

(Main) **An advanced imaging solution from Vitronic is at the heart of the vehicle classification and identification system on Brisbane's new Freeflow Tolling Project.** (Inset) **Basler's new IP camera generation will include new CCD camera models with resolutions from VGA to two megapixels and frame rates of up to 100fps**

Schreiber claims the flexibility of IP systems, for example in networking and their ability to work in conjunction with standard, mainstream web tools such as browsers, is increasingly attracting the interest of the traffic sector.

In future, Schreiber expects to see a greater level of technology transfer between the worlds of IP and machine vision cameras, with each taking the most useful facets of the other to meet specific needs in ITS. The company's latest generation of IP cameras, the BIP2 series, sees the introduction of elements such as an ultra-fast CCD sensor and real-time trigger functionality, which Schreiber says marks a significant move towards addressing ITS. "In more general terms, we see several trends in the ITS market," Schreiber adds. "Further miniaturization is one, for example if you are looking at mobile applications where cameras have to be deployed in police cars. Low power consumption is another important factor."

It is clear, then, that although traffic may ask a lot of vision technology, the expert engineers at the sharp end of imaging believe we ain't seen nothing yet – the best is yet to come.

Broad appeal

Sony is another big name in imaging that is expending considerable efforts to develop systems that can meet the many and changing needs of ITS.

Andrew Buttress, product manager for visual imaging products at Sony Electronics in the USA, says: "We are seeing an evolving industry where the needs are different not just across applications but across regions. The requirements of North America are often different from Europe, and different again in China or Japan. It would be difficult to come up with one generic solution."

Faced with such a diverse market, Sony is introducing products that can meet the challenges of ITS across a broad range of platforms, especially through the introduction of more GigE-based systems with traffic applications in mind. Buttress singles out the SX99E, the latest addition to the XCG series of GigE cameras, which was designed to offer an improved frame rate that is better suited to ITS applications.

A solution to high dynamic range

The fast flash rates and dynamic control of Gardasoft's VTR high-brightness LED strobe lights enable a new set of solutions to ITS lighting problems. They have precise control of intensity and pulse timing which can be used in systems that need to cope with varying ambient conditions. At night, for example, the lighting can pulse at high brightness for full pulse length and during the day this can be dynamically reduced to one 2,000th of the energy or turned off when not needed. Some systems take multiple images at different lighting intensities and then choose the best image for processing. The advantage of this is that different images can be processed for different items. A reflective license plate can be viewed from a low intensity image and the body shape from a brighter one. The VTR controllers can output a sequence of one strobe per 60Hz frame for up to five frames from a single trigger. Each strobe has a different pulse width, giving up to 2000:1 variation in output energy for each frame.

The VTR also helps reduce system complexity. With trigger rates of 60Hz and higher, it allows continuous camera images to be taken, so that the vehicle sensing can be performed by the image processing instead of radar or other secondary sensors.

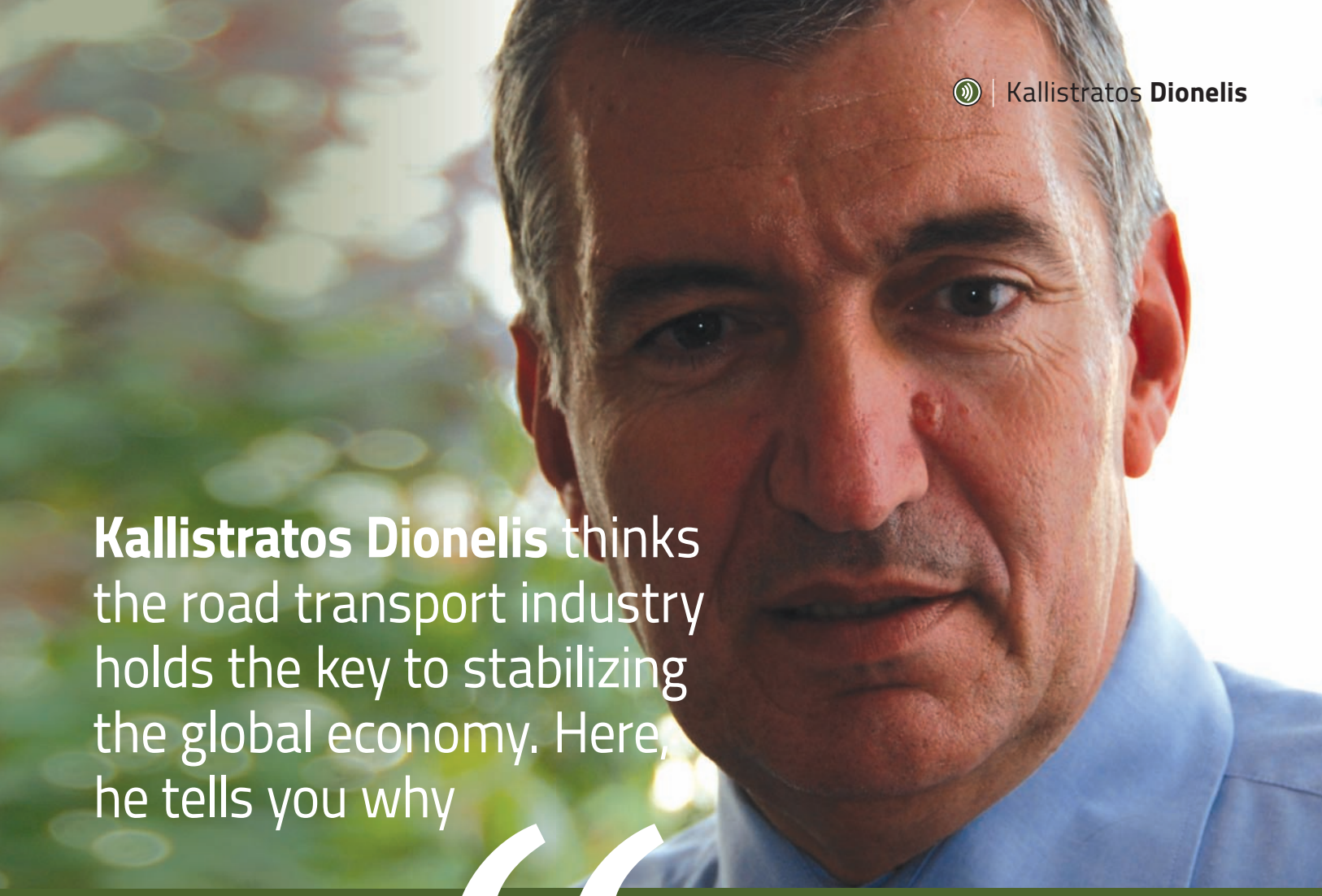
There are advanced trigger functions built in, so that it can synchronise its light output with a camera, provide a regular trigger to a camera and clean up trigger signals from sensors.

These Gardasoft lights are available in a range of wavelengths from infra-red to blue and white. With Ethernet and GigE camera solutions becoming ever more popular, the VTR high intensity LED strobe lights offer a perfect solution for illumination control.

Rock it

You can really rock this groundbreaking **Prosilica GX** camera from AVT. Blast 240 MB/s through the dual link aggregate GigE interface. Capture up to 8MP of crystal clear resolution from the latest quad-tap Kodak KAI sensors. Command your lens with three-axis motorized control. All within a compact, thermally managed package. It's the perfect balance of speed, resolution, and functionality to launch your next traffic control system off the drawing board. So go ahead, grab a GX and rock. Learn more at **www.AlliedVisionTec.com/RockIt**

S E E I N G I S B E L I E V I N G



Kallistratos Dionelis thinks the road transport industry holds the key to stabilizing the global economy. Here, he tells you why

> We should remember that we are in deep crisis, we have no time for mistakes and misplaced policies will extend the problem and postpone recovery

The world is not organized for innovation. Systems are designed to make incremental improvements – doing what we are doing already, but better. As a result, some advocates of bold, ambitious strategies and visions prefer to remain on the sidelines to avoid being labeled as failures, and rewards go to the more prudent ones who are skilled at working within the system and modifying it marginally. These prudent ones often make the decisions and regulate.

But the world has changed. Systems have reached the end of life and are at crisis point. The EU needs to do its part to restore strong growth, reduce economic imbalances, and calm markets, and to prioritize the creation of jobs and therefore income and spending. An efficient EU repair plan must outline the work to be done to repair the EU's social and financial systems and to enact reforms, which will be a big step toward helping the global recovery.

Brussels' preaching priests

The transport world is part of the general EU socio-economic reality. Transport White Papers keep proposing long-term untested scenarios with short-term visions, targets, and action plans. Every few years these White Papers are amended, so in the past 10 years we have already received three versions, with contradicting policies under various names. Anything that contains the word 'modal' is a sacred cow, with Brussels' 'priests' preaching the word of inter-modality, co-modality, trans-modality, super-modality, modal shift, etc. It is a fact that times of calm and prosperity can cope with a lack of direction, naivety, and mistakes, but the present period of scarcity demands clarity. Unfortunately, in the absence of reliable transport data, the distinction between scientific analysis and political propaganda is lost.

Beyond the narcissistic world of the big visionaries, inland transport is an extremely simple domain. There are two focal points that politicians, markets, societies, and finance institutions need to tackle and solve: how to strike the right balance between the road and rail networks, and how to stop theoretical exercises (drawing colored lines that we call infrastructure TENs) and to find the money to finance the real investments.

When addressing these two points we should remember that we are in deep crisis, we have no time for mistakes and misplaced policies will extend the problem and postpone recovery. A White Paper will not sustain the unsustainable. It's time to understand that the longer it takes to recognize mistakes, the larger the repercussions – economic, societal, environmental – of these mistakes become.

States have no money, banks are reluctant to lend, and investors sit on the sidelines disappointed with poor returns. There is some movement, although investors remain cautious, showing interest only in certain types of infrastructure assets, namely social ones such as hospitals, prisons, and schools. Generally, government-backed infrastructure assets appear to be safer than

toll roads, airports, and ports, all necessary to secure future socio-economic growth.

On paper, infrastructure networks keep expanding, but in reality no new infrastructures appear. Transport infrastructure is a product that someone chooses to supply at a certain cost, after judging the balance of risk and return. Although governments and markets evaluate the risk and return differently, managers are needed in both sectors to spot the right infrastructure assets.

Rail isn't the solution

Somehow, it became fashionable to think that rail infrastructure and trains connecting major cities and regions in the EU would help to save the planet. Now business thinking must be applied. Trains will not save the planet; they cannot. With a limited number of exceptions, they are a perfect example of wasteful spending masquerading as a respectable social cause. People are prisoners of economic geography, and suburbanization has made most rail travel impractical. Freedom to move led to job changes, which has resulted in highly dispersed trip origins and destinations, so rail services are therefore unable to support and feed many people's needs. If trains shut down tomorrow, no one except the directly affected passengers would notice.

Let's suppose the EU administrations get their wish to build EU priority rail corridors. How much money has the administration already committed just as a token down-payment? Constructing basic rail corridors could easily cost over €200 billion. In the current economic environment and with the high risk involved, most (or all) of that amount would have to come from governments. What would Europe get for this huge investment? Not much really. No notable reduction in traffic congestion, greenhouse gas emissions, air travel, road transport, or oil consumption. Nothing. If we know basic mathematics, we can understand why.

Rail concessions hardly exist, and the road concessions are the rule. The road concessions model was adopted in the past (through a corridor-building program) to unite regions, to develop regions, to lead to socio-economic growth. Building the backbone of a road infrastructure appeared to be at the heart of the wise choice of a benevolent state targeting a sustainable social growth. Public and private sectors commonly used the term 'profit', translating it under a socio-economic umbrella and under a financial and economic umbrella respectively. Motorways were built as the main pan-European infrastructure corridors and around them a supporting road network was developed to serve

> Roads are a living structure, symbol of freedom of individual choice and if proper consideration is not given to them they will punish us, they'll degrade, die and with them will disappear any hope to recover and grow

harmoniously the regional needs of the local societies.

The efficient road infrastructure system of main, secondary and urban infrastructure networks led societies to a period of abundance, to higher living standards, higher GDP, and faster growth. Rich societies always have to deal with the consequences of road development, such as 'green' considerations, energy consumption, and congestion. With high rates of growth come questions about how to manage with the waste that results from higher levels of production and consumption. So 'fair tolling for the use of infrastructure' became the motto of the motorways and smart pricing is now the instrument for successful motorway management, without congestion and with high safety levels and respect for the environment.

Pioneering in infrastructure

The tolled road network (around 20% of the total infrastructure network in Europe) has been the pioneer for the development of European regions. The road concessions policy has remained the same for years, so they sign a contract with the state and – based on its terms – they manage their roads for a certain agreed period and offer a road service to the users who choose to buy it. The revenues are redirected to the same infrastructures to maintain and upgrade them in order to keep offering an excellent service to the users. Making their free decision to use the modern, well-managed motorways, the citizens become consumers, deciding to pay-as-they-drive for the high degree of safety, the appropriate speed, the information they receive, the time they save, a free traffic flow, the comfort, and so many other added-value services. When choosing to use a motorway, consumers evaluate the service, value it and accept they have to pay.

Economies run in circles. We are currently in a downturn and this is always accompanied by lower productivity, higher unemployment, less money in the national budgets and the need for austerity measures. The challenge is either to provide short-term blind answers while sweeping the real problems under the carpet, or be serious and examine more painful long-term solutions. Infrastructure building in these periods is an issue that is locked away while other urgent needs push the policymakers to apply austerity programs, cut expenses and increase revenues for the national budgets to serve other priorities.

Within the tolled motorway network drivers choose to buy a road service. However politicians have discovered thousands of kilometers of free road infrastructure where they think that they can 'milk the road users', asking them to pay-as-they-drive for no additional service and without offering any alternative choice. Politicians always raise the sensitive issues of environment protection, congestion-fighting and energy-saving, making themselves appear eco-conscious. I have a naive question for the policymakers. Are they really concerned purely about the environment, or is their main objective to fill the national budgets with 'easy' cash?

The question is, how long will the monolithic approach disguised as 'policy' remain valid and how long will it take for road users to revolt against unilateralism and demand to receive a service for the fees they pay wherever they drive? It is a matter of 'when' rather than 'if' the user role and choice will enter the mainstream. Traffic problems cannot be cured by miracles nor by the 25km/h so-called green trains circulating empty in Europe and fighting to survive. Roads are a living structure, symbol of freedom of individual choice and if proper consideration is not given to them they will punish us, they'll degrade, die and with them will disappear any hope to recover and grow. ○

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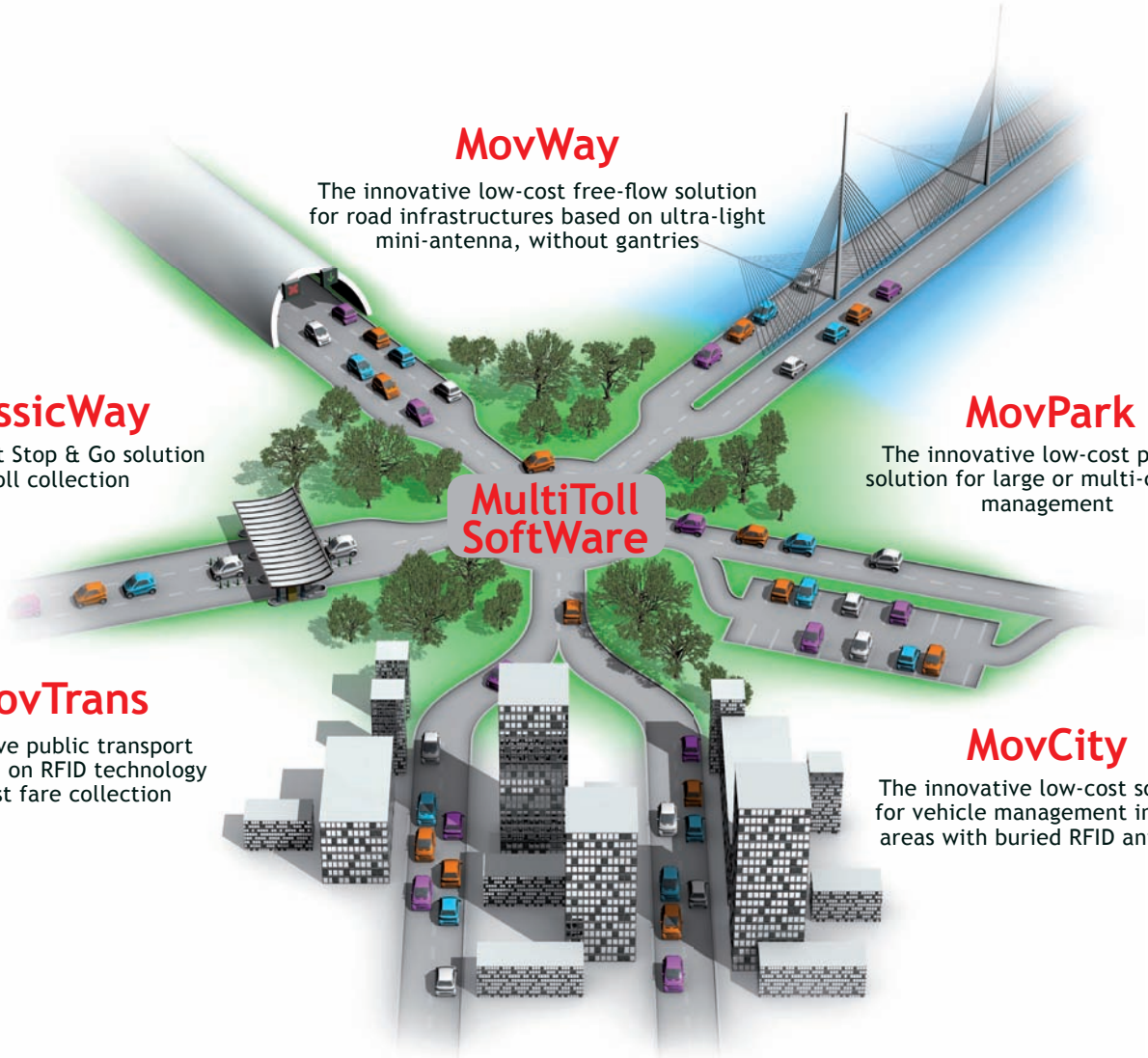

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Campaign trail

Road safety campaigns have evolved from the gory TV ads of the past, but has their effectiveness increased? **Louise Smyth** showcases some modern initiatives designed to tackle a variety of bad behaviors

Main image courtesy of Sussex Safer Roads Partnership

The effectiveness of road safety campaigns has long been a cause for research, debate and controversy. In 1993, for instance, Max Cameron and his colleagues at Monash University's Accident Research Centre in Victoria, Australia, engaged in one of the most comprehensive evaluations of the issue. This came on the back of a major television advertising campaign from the Transport Accident Commission (TAC) that had been running in Victoria since 1989 and had undoubtedly captured the public's attention. But did it help to change behavior and was it cost-effective?

Positive influence?

The broad answer to these questions is 'yes'; such campaigns do make a positive difference that justifies their expense. But this effect is dependent on what type of behavior you are targeting. "The research indicates clear links between levels of TAC publicity supporting the speed and alcohol enforcement programs and reductions in casualty crashes when other major factors are held constant," Cameron's report found. "For levels of advertising at the point of diminishing returns, the estimated benefits in terms of reduced TAC payments were respectively 3.9 and 7.9 times the costs of advertising supporting the speed and alcohol enforcement programs.

"The road safety effects of TAC publicity with themes not related to enforcement (i.e. concentration) is less clear. The 'Concentrate or Kill' advertisements appear to raise awareness of the issue, but there is no conclusive evidence at this stage that they have reduced the crash involvement of the specific target group of the advertisements, namely young drivers on country roads."

Although the trend for hard-hitting campaigns has become a worldwide phenomenon, Australia's state of Victoria remains a pioneer in the field. One recent campaign against using phones while driving was simply called 'Don't be a dickhead'. But in a disturbing backlash to such shock tactics, one of the state's famous campaigns has become manipulated into the antithesis of the behavior it was attempting to prevent. The 'If you drink, then drive, you're a bloody idiot' campaign has been running since 1989. In October 2010, local Australian media was shocked to report that 20,000 fans had joined a Facebook page called 'If u drink n drive ur a bloody idiot, if u make it home ur a f***ing legend'.

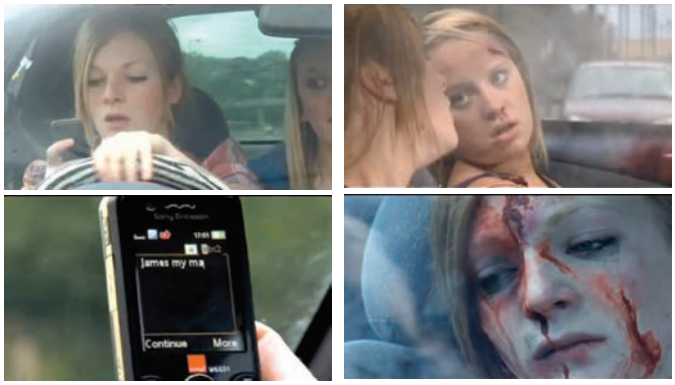
If, as such illiterate nonsense suggests, people are becoming immune to hard-hitting, serious campaigns, has the time come to think of new ways of getting the hammer the message home? Or is it the behaviors themselves that need to be better reflected in the campaigns? Perhaps younger drivers have had the anti-drink-driving message drummed into them so thoroughly they now treat campaigns on the topic as a joke. In which case, new campaigns need to address the behaviors that this generation is more likely to indulge in – drug driving or texting while driving, for instance.

A number of organizations are indeed shying away from the bloody, brutal campaigns of the past in favor of more innovative approaches that are equally effective at getting people's attention. For every idiotic Facebook page, there are road safety campaigns going viral elsewhere on the internet, new ideas being deployed to encourage safer behavior and more dialog about such strategies. Small, local safety organizations are finding themselves global stars as their clever campaigns spread across the internet, giving their ideas a far wider audience than the local one they are aimed at.

Over the course of the next few pages, we showcase a few of the latest road safety campaigns that are having a positive effect on a variety of negative driving behaviors.

Embrace Life was created to raise awareness of the importance of wearing a seatbelt, and deliberately developed to provide a counter-point to the hard-hitting 'shock and awe' advertising so common to road safety

The text message



As well as being more likely to be involved in drug-driving, there's another behavior that tends to be more youth-orientated and that's the use of cell phones for texting while driving. Far more dangerous than just talking on the phone, anything that requires the driver to take their eyes from the road is obviously a behavior that needs to be eliminated by whatever means possible.

Gwent Police in Wales created the COW film in 2009 to highlight the dangers of this reckless behavior. It features a young girl called Cassie COWan, whom the campaign describes as "a nice girl from a nice Gwent valley family – who kills four people on the road because she used her mobile and lost her concentration for a few seconds".

The graphically shocking film depicts the devastating consequences of texting while behind the wheel. There is a crash, with a correspondingly horrific aftermath that shows how quickly this 'nice' girl can destroy her life and that of others.

Gwent Police intended the film to be shown in schools across Wales (and eventually elsewhere), but needless to say, it 'went viral', was a YouTube hit and has now been seen across the world.

Safety in 3D

Taking campaigns out of TV screens and onto the streets themselves is a smart way of reminding drivers how to behave responsibly while behind the wheel.

BCAA Traffic Safety Foundation in Vancouver worked with Preventable – a safety advocacy group – to carry out a remarkable campaign to improve driver safety.

In September 2010, a 3D image was installed for a week on a road in a school zone. From a distance, it was simply an indistinguishable mark, but as drivers approached, it appeared to rise from the road surface to reveal an image of a little girl chasing a ball into the road.

The BCAA Traffic Foundation's David Dunne explains how the idea came to life: "Wasserman + Partners Advertising manages advertising for Preventable," he says. "The 3D illusion was developed and implemented by their team. It's actually a long decal that is applied with heat. Measuring 42ft long by 3ft wide, the image of the girl appears to rise as motorists drive over it. Note that the rising appears gradually and in no way do you think you're literally driving over a child."

Dunne reports an overwhelmingly positive reaction to the project: "Motorists, the community and parents have been very supportive," he insists. "If it means safer roads for them, and especially their kids around school, they welcome it. It's a unique, innovative idea."

Although it is currently only a pilot project, Dunne has received inquiries from cities around the world wanting to bring the idea to their streets.

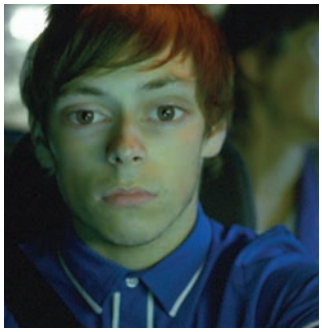
Embrace Life

Tackling the ongoing issue of getting people to wear seatbelts, the UK's Sussex Safer Roads Partnership's *Embrace Life* film illustrates the enormous potential of social networking.

Released on 20 January 2010, initially only in the local Sussex area, the film swiftly became an web phenomenon. It received more than one million views in its first two weeks and by 13 February 2010 had reached 129 different countries, was the fifth top-rated video that month on YouTube, as well as the top-rated YouTube film of all time in the education category. By July-end, it had received almost 10.5 million views.

What sets this film apart is its beautiful imagery. It is no gory shock-fest. Instead, writer and director Daniel Cox had a more gentle but nonetheless effective idea in mind. "Key to the film's creation was to focus on a message that didn't take a conventional route to shock and scare the audience," he explains. "Rather, it was my intention to bring the audience in on the conversation of road safety, specifically seatbelts, and the best way to do this was to make a film that could engage the viewer purely visually and could be seen and understood by all, whoever they are and wherever they lived." If you have not yet seen the film, visit www.embracethis.co.uk to check it out…

Your eyes will give you away



The UK's first national drug-driving campaign hit TV screens in August 2009. Featuring a group of youngsters returning from a night out, the Department for Transport's advert doesn't feature gruesome scenes of accidents or anything traditionally shocking. It simply shows some teenagers chatting in a car – but there's one thing about these youngsters that's plain weird: their eyes. The transcript of the campaign says, "Their eyes are creepily huge, unnatural, the pupils obviously and visibly dilated."

The voiceover explains that drugs have an involuntary effect on the eyes that you cannot control. It warns, "The police can spot this and the penalties are exactly the same as those for drink-driving."

The advertisement is eerily mesmerizing and the overall message a stark reminder that it is not acceptable to drive under the influence of any type of drug. Although in the UK, at least, drink-driving is widely frowned upon across all age groups, the dangers of drug-driving are not as well known – particularly among the younger age groups that are more likely to engage in such behavior.

At the time the campaign was launched, the DfT said one in 10 young male drivers admitted to drug-driving. Let's hope this advertisement got through to some of them.

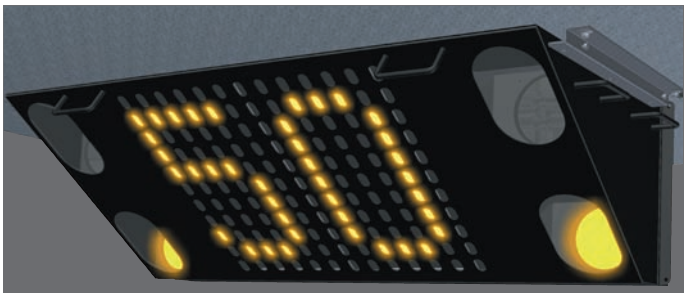
Slow down for workers

As with the wearing of seatbelts, excessive speed is a behavior that remains a priority to be tackled. WorkSafeBC in Vancouver, Canada, has a long-running campaign called Slow Down. A recent part of the campaign was directed at getting drivers to reduce their speeds in workzones. More than 70 traffic control personnel have been injured in British Columbia over the past five years and three have been killed.

In September 2010, WorkSafeBC launched its educational film featuring Jennifer Beauregard, a young woman who worked as a traffic controller.

On 25 September 2009, the 23-year old Beauregard was managing traffic flow through a construction zone in Delta. That morning, she was hit by an SUV with such force that she was propelled out of her boots, flew 5m in the air and landed on her head more than 30m from where she had been standing holding a sign. She suffered brain damage, facial injuries, a shattered pelvis and many other injuries, and wasn't expected to live. That Beauregard is here today to tell her horrific story – and to ask drivers to slow down at work zones – is a positive ending to a heartbreaking and completely avoidable tale.

The film also follows WorkSafeBC's human interest angle, which is a recurring theme of its campaign. Various roadside Slow Down signs have been made that feature road workers. One pictures a mother with her children, the request being 'Slow down, our mommy works here'.



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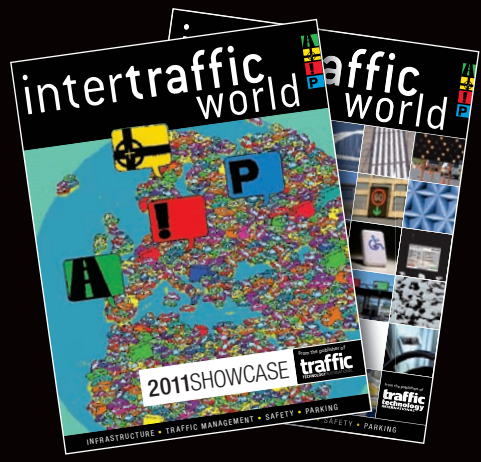

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Leading the way

The latest advances in electronic signage offer a guiding light to motorists through toll roads, motorways and urban facilities such as parking lots

As with a number of sectors in the ITS market, the relentless rise of the LED is a recurring theme when it comes to VMS, signs, and signals. "It's pretty much the only big trend right now!" says Roger Stainforth, chairman of British company VMS Limited (VMSL). Stainforth is not surprised at the success of LEDs in this sector and he recalls being one of the pioneers of the technology way back in 1996: "When we launched our Rigel technology it was significantly more power-efficient than anything else on the market. But I think people are taking that side of things more seriously now, particularly with the growing need for towns and cities to reduce their electricity bills."

More environmentally friendly signs, such as those powered by LEDs, also tap into the trend for green ITS. And, as Stainforth explains, suppliers now have to take responsibility for environmental issues even after a sign's lifetime: "We have to factor in consideration of what happens to a product at the end of its lifetime into its design. As well as our general responsibility toward the environment, specifications are now demanding this. A very high percentage of our sign components can be recycled. The posts are steel, the enclosures are aluminum, and some of the plastic content can also be recycled."

Siemens' Elektra signs come in a range of enclosure sizes

VMSL's latest product is the Pegasus MS4, which launched in 2010 at Parkex in London. Stainforth says: "This is a high-resolution dual color sign and post system for urban applications. It's more aesthetically pleasing than traditional designs, which means it's far more suited to the streetscape that local authorities are trying to create." Pegasus signs have already been installed in the TfL region.

URBAN INSTALLATIONS

The trend for VMS moving out of their traditional motorway environment and into urban areas is something that has been covered in these pages before, and Stainforth freely admits that manufacturers such as VMSL have to keep up with what the market is demanding. "Customers are looking for more flexibility; so by giving them a dual-color high resolution matrix they're able to display both text and graphics (in the form of pictograms) on the same sign – in exactly the same way as the full-size VMS deployed on the motorway network. For the urban signs, it's not only about

the optical flexibility: we've concentrated a lot of design effort on the post itself and in the ability for the sign to be mounted in both landscape and portrait configurations. A lot of streets are quite restricted in terms of width of the pavement, footpath access and so on, and the onus is on suppliers to provide suitable products for such scenes."

ELECTRIC AVENUE

Another example of a UK vendor that's offering VMS suitable for use in urban areas is Siemens. Its new Elektra VMS family was launched in May 2010 and the company has already received several contracts for the range including one installation in Portsmouth that's gone live and another project due for completion in Southend.

As Siemens is well versed in the intricacies of UTMC, it makes sense that its sign products are easy to integrate with such systems. The Elektra signs can be used for a variety of applications, including parking lot guidance and driver information. They are offered in a range of enclosure sizes with display sizes from 100mm to 320mm. For parking lot applications, there is the option of dual color red/green displays. To make life easier for operators, all signs in the Elektra family provide individual pixel monitoring.

Siemens' Mark Bodger has noticed a growing demand for solutions that use less energy. He says: "Lower power is becoming more and more of an issue with the greater awareness of carbon emissions. Solar power is very good for remote, unattended warning signs and for temporary installations that have simpler power, communications, and monitoring requirements. For normal car parking and traffic information VMS (which are "always on"), the latest generation of LED displays have helped reduce power consumption of the VMS." He adds: "However, this is only one part of the power consumption of the sign: communications, monitoring, and heaters are all issues that have to be considered."

The tolling industry is using dynamic message signs for a growing list of applications

Bodger, being heavily involved in the ITS market himself, has witnessed an evolution with regard to what information is actually displayed on VMS. "As far as real-time information is concerned, any VMS is only as good as the control system that is providing the information – whether that is automated or has an operator 'in the loop'. I believe the key issue is timeliness and reliability: this relates to getting an accurate message quickly on the sign and – equally as quickly – clearing the message down when it is no longer relevant. This is an area where VMS on the motorway got a bad name in the past due to 'old' messages remaining on the signs. From Siemens' perspective in both traffic management and ITS, future development will likely be driven in the main by the desire to provide information as efficiently as possible – almost certainly reflecting the overall costs of ownership in terms of maintenance, communications, and power."

> "Although LEDs have helped reduce power consumption, communications, monitoring and heaters are all issues to be considered too

VMS Limited's Pegasus sign has been tailored to meet the demands of urban deployment

As technology evolves, so do the number of applications for electronic signs. In the USA, Daktronics is seeing a growing demand from the tolling industry. Jason Morrison explains the momentum behind this trend: "Although affordable displays serve motorists on the tollway itself, why not utilize them to promote the tollway on other roads – after all, that's where potential customers will be driving? By strategically placing LED message displays (DDMS or traditional DMS) to show the tollway and non-tollway travel times together, drivers will begin to appreciate the value of the tollway."

Traffic speeds can be controlled with variable speed limit signs (VSLS), which can be easily changed with the fluctuation in traffic volume. "Traffic congestion can also be controlled with smooth toll collection and/or VSLS," Morrison adds. " Many toll booths use LED-based DMS to help tollway users find their respective lanes. Not only does this help the tollway organize its patrons for efficient toll collection, it also creates a safer driving environment with much less driver confusion. Any agency can look to innovative applications using today's LED display technology to draw more motorists to the tollway and to give them the service they expect."

Intelligent streetlighting

READER ENQUIRY NO. 501

Streetlights are among a city's most important assets, providing safe roads, inviting public areas and enhanced security in homes, businesses and city centers. But they're costly to operate, and use a lot of energy – almost 40% of a city's electricity spending. Most streetlight operators haven't leveraged technology to address these issues, but as the cost of electricity continues to rise, it's becoming crucial that they do so.

Cities that create managed streetlight networks can save vast amounts of energy (up to 70%) and reduce their maintenance budgets, while offering increased safety and additional services such as pollution monitoring and traffic guidance. By applying control networking technology to streetlights, cities can increase their value as municipal assets and decrease operating costs.

Need to know?

The pressure is mounting on cities to deliver energy-efficient streetlighting solutions

- Budget cuts, rising energy costs and environmental pressure are driving cities to implement energy-saving streetlight solutions
- Control networking technology enables remote monitoring and control of streetlights, parking lot lights, tunnel lights and more
- Cities can save up to 70% in energy costs with monitored lighting technology

(Above) **Echelon technology lights up Oslo** (Below) **Smart lighting creates a more inviting lansscape in Oslo** (Bottom) **Traffic guidance system at the Elbe Tunnel in Hamburg**

Lighting the way

Creator of the LonWorks open platform standard for smart grid and energy management systems and products, Silicon Valley-based Echelon Corporation is at the forefront of the monitored lighting market. Echelon's control technology is used in a wide range of monitored lighting projects worldwide, including projects in Canada, China, France, Italy, New Zealand, Norway, Spain, the UK, the USA and other countries.

Streetlights embedded with control technology provide a rich stream of data that enables cities to pinpoint lamp failures or malfunctions, leading to lower maintenance costs, higher levels of customer service, increased safety, inventory reductions, and city beautification.

An additional benefit of this data is the ability to predict lamp failures before they occur, allowing maintenance crews to proactively replace lamps before they fail. Because monitored streetlight systems record the status and light output of any lamp by date and time of day, more detailed reports and performance auditing can reduce a city's liability exposure in the event of a lawsuit brought against the city for an accident.

Reducing energy demands

Good for 20 years, LED streetlights are said to be much more energy efficient – 50% more – than the high-intensity discharge (HID) and high-pressure sodium (HPS) streetlights currently in use in most cities, municipalities and roads worldwide. Adding control technology to remotely monitor them and link them to a smart grid adds another 20% efficiency gain.

Future-proof technology

Since streetlighting assets have such a long field life and the lighting needs across a city vary

dramatically, it is almost always the case that cities will need to utilize multiple lighting technologies over time. Echelon's proven, reliable communications technology is an ISO standard, and can be used with current and emerging lighting technologies from HPS lamps to LEDs to induction. Lighting ballast manufacturers worldwide provide products embedded with Echelon's control technology, allowing cities to choose products from an ecosystem of providers and use them on the same network. Market-leading streetlight solutions such as Philips StarSense rely on Echelon's technology as part of their offering. This variety of vendors, the ability to mix and match lighting technology, and an ISO standard control protocol ensures that a city will not be locked in to one solution provider, which significantly increases costs over the life of the system.

A green future

Older, inefficient mechanical ballasts are replaced with electronic ballasts that include Echelon's power line communication technology. Data from the streetlights is sent over existing power lines, which significantly reduces installation time and costs. Lamp data is collected by segment controllers, which manage the streetlights and use a wireless data network to communicate with the city's monitoring center. The segment controllers log and report energy consumption and running hours, collect information from traffic and weather sensors, and calculate the availability of natural light from the sun and the moon using an internal astronomical clock. This data is used to automatically dim some or all of the streetlights based on the time of day, season, local weather, or traffic density.

Significant energy savings result from this highly efficient method of controlling light levels, which has a secondary benefit of extending lamp life, thereby reducing replacement costs by avoiding unnecessary lamp operation. Enterprise monitoring software provides the end user with a web portal through which the lamps can be remotely controlled, while identifying lamp failures and displaying energy consumption.

Real-world results

The city of Oslo, Norway uses Echelon's technology in its monitored streetlights to cut energy use by 70% compared with the previous streetlights. The system reduces greenhouse gas emissions, improves lighting quality, and saves on maintenance costs.

10,000 smart streetlights were deployed in the project, which began operations in 2004. The city has seen a US$614,000 per year reduction in operating costs, as well saving 1,440 tons of CO_2 emissions per year.

"Echelon's technology and products in the Oslo project have proven to provide a very stable infrastructure for streetlighting management. The system gives us all the flexibility we need as a service provider to maximize energy savings and maintain safety while fulfilling all our customers' needs," says Eirik Bjelland, a senior advisor on the project.

Bjelland continues, "Streetlighting systems are expensive to maintain, due in part to their large geographic size. Echelon's technology allows lamp failures to be identified remotely and, in many instances, fixed before being noticed by residents, where previously these failures had to be reported by residents or roving maintenance trucks on the lookout for failed lamps. The reduction in downtime can have a big impact on driver and pedestrian safety. It also allows repair crews to be more efficient by providing predictive failure analyses based on a comparison of actual running hours versus expected lamp life."

LED streetlights

The city of San Jose, California, chose LED streetlights with Echelon's technology in order to upgrade to a cleaner, more energy-efficient and less costly means of lighting public streets and open spaces. The LED streetlights can be remotely turned off or dimmed depending on time, weather and traffic, and can also offer assistance in case of emergencies, flashing to alert emergency crews when they've arrived at the correct address. The management console is also available as a web service, so streetlights could be managed over the internet using mobile devices such as the iPhone.

Guiding traffic to the fast lane

The Elbe Tunnel in Hamburg, Germany, connects Germany's Autobahn 7 on either side of the Elbe River. It is 3.2km long and has eight lanes running through four bores. Up to 150,000 vehicles use the tunnel each day. To ease congestion, the tunnel features reversible lanes that switch direction to accommodate traffic flow. For many years, tunnel operators relied on a mechanical system of red-and-white marker beacons to guide drivers to the correct lanes. The tunnel's manual traffic guidance system was replaced with an automated system based on Echelon's technology that uses LED surface lights to direct vehicles as they approach the tunnel, optimizing traffic flow and reducing pollution.

Cities are today investing in new lighting technologies to update infrastructure. Adding an intelligent network to control those lights is even smarter, reducing energy costs by 70% or more. And the extra benefits of this network – streamlined operations, lower maintenance costs, improved safety, less light pollution, and enhanced urban environments – may end up being even greater than the energy savings.

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Aesthetics and savings from gantry-free system

READER ENQUIRY NO. 502

Current free-flow toll systems employ either 5.8GHz DSRC or 860-960MHz RFID technologies. Such systems are deployed on motorways or at city entries and more often than not require heavy-duty overhead gantries or infrastructure at each point of payment to accommodate tag detection cameras, and vehicle identification and classification equipment. However, these imposing and unaesthetic structures ruin landscapes and urban environments, not to mention the very high investment for civil engineering and maintenance. Furthermore, there are a great number of complaints relating to the technical limitations of such existing facilities.

It was for these reasons that France's MultiToll Solutions began investigating a technical solution that would not only offer lower cost and completely do away with the heavy metallic structures yet still offer a high-accuracy free-flow system with classification abilities. The company's research led it to develop an innovative, extremely lightweight and high-performance mini-antenna for tag detection, MovWay, which meets all relevant DSRC and RFID standards. As a result of its weight not exceeding 1kg, the mini antenna can be placed on a thin roadside pole overhanging part of the lane. The pole can even accommodate MultiToll's light and compact digital camera for violation enforcement, which reads vehicle license plates and recognizes the dimensions of the vehicles passing in the lanes.

The MovWay system is being demonstrated at a pilot site in Montlhéry, France

Moreover, following requests from prospective customers, a solution for heavy truck classification was also developed, which allows axle-counting without using mechanical components such as treadles. This electronic concept also requires no maintenance when in the lane. To obtain high-level classification results, vehicles must remain in the lane while passing the toll collection area. For an optimized service, the solution can even be complemented by an in-lane automatic vehicle weighing system.

(Left) **MovWay solution operating without gantries** (Below) **Traditional free-flow gantries**

Need to know?

Technical solution to a number of demands in the traffic management, enforcement and tolling arena

- An accurate free-flow system with classification capabilities
- High performance and miniaturized antenna for tag detection
- Heavy truck classification is also available
- Pole-based solution for free-flow, embedded solution for urban tolling and traffic management–including parking reservation, low-emission zones and priority vehicle access
- Designed to help reduce infrastructure costs

After two years of developmental efforts and collaboration with the Grenoble Institute of Technology, intensive high-speed tests over the past months have proved the high precision and viability of the system. These results have backed up the company's original sentiments to look for a more aesthetic alternative. A pilot site in Montlhéry, France, has been set up to demonstrate the system to prospective and existing customers.

Urban vehicle management

Based on the success of this first MovWay development, simultaneously MultiToll looked into an equivalent pole-based

tolling solution, MovCity, for city environments and traffic management applications such as parking reservation, low-emission zones, priority vehicle access, and even road pricing or urban toll schemes designed to resolve a city's congestion problems.

Despite the fact that the poles do not impact adversely on the environment, some cities – notably those with a rich architectural heritage – nevertheless requested a solution without any visible infrastructure at all. Responding to this demand, MultiToll engineers found a way to embed a metallic RFID antenna within a small, tubular housing in the pavement that is buried across the road. To identify authorized vehicles, they are fitted with an RFID tag either placed on the license plate or beneath the vehicle itself.

With the buried RFID antennae placed at strategic points, it is possible to implement a vehicle management and control system that is totally invisible to a city's residents, with no adverse damage to the surrounding environment.

Both of these two patented technical innovations respond to the increasing need for substantial cost reductions, while at the same time solving the problem of environmental pollution. And after two years in the making, they are available today for operators in the field of toll collection and traffic management.

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Eric **Sampson**

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I recently went to the ITS World Congress in Busan and was very surprised by the large number of countries (sadly the UK had only one representative) presenting papers on Cooperative Vehicle-Highway System (CVHS) trials. Their motives were one or more of the following: better driver support and assistance equals fewer accidents; better prediction and management of traffic flow equals less congestion; better management of traffic equals reduced emissions and energy consumption; and new products/services for automakers and the ITS industry.

In fact, CVHS – or shall we say 'Active Road Management' as distinct from building new infrastructure and letting it manage itself – can deliver simultaneously every benefit listed. We know vehicle emissions per kilometer on motorways increase by a factor of three in congested areas – a vehicle traveling at 60km/h emits 40% less CO_2 than one traveling at 20km/h and we know smoother traffic flows from speed management reduce congestion, accident severity and give more consistent journey times. More than any approach, CVHS delivers solutions that recognize the complex interdependencies of transport.

So in the current straightened circumstances, how do we introduce more of these schemes? The answer is that we need a bonfire of the current economic assessment rules, which were designed essentially for single-function projects: a road widening, a new bus station, a tram line. They cope well with selecting the best way to take forward any one initiative but cannot deal with multiple functionality. They're the equivalent of doing something we stopped doing 25 years ago: buying a word processor when the more sensible solution is investment in a platform – a PC – capable of running not just word processing software but spreadsheets, databases etc.

There is a more powerful approach to procurement that fits well with the Osborne Tests for Government Department spending, and which would handle transport project selection in a new way. The current approach is to choose the individual projects with the highest benefit/cost ratio until the budget runs out – 10, say. This may have worked well in the past but it is obsolete. Local Authorities should stop thinking in terms of a string of single-function projects such as a road, safety, or environmental scheme and instead consider transport improvements in the round using a common platform. Build a series of 'mix-and-match' packages of eight or so activities that can be delivered from a common technology open standards framework and be managed by the sorts of active techniques described, in order to extract maximum productivity, safety, environmental and social gains.

This would represent a major move toward an integrated transport management environment and would sit very well with DfT's Business Plan vision where transport is the engine of economic growth while being greener, safer and improving quality of life. A world of connectivity would mean shared quality information for all travelers, more consistent journey times, reduced emissions, reduced congestion, enhanced safety, cheaper and more consistent public transport. What's not to like?

What's the barrier? There's isn't one apart from the fact that we haven't really done anything like this before and it seems to require an enormous amount of Ministerial nerve to run an experiment. Strange that: if an experiment doesn't work, you have the evidence to stop doing it again; and if it does you've successfully tested a way to do more for less. I'm sure Jim Hacker would have approved!

> LAs should stop thinking in terms of a string of single-function projects … and consider transport improvements in the round using a common platform
>
> **Professor Eric Sampson, Newcastle University/ITS-UK, UK**

Intelligent cameras as deputies

They don't sleep, don't get bored or distracted, and they can remember everything they see, so vision systems can serve as ideal deputies for traffic law enforcement. It is essential that the camera 'eyes' for such systems have the right optical performance. With a few 'brains' in the camera, however, vision systems can provide more capability and simplify installations in traffic applications.

Cameras for traffic enforcement systems have many requirements in common. The primary need is to capture an automobile image without motion blur, with enough resolution that license plate details are visible, and with a wide enough field-of-view to provide legal proof of the specific automobile's presence at a specific location. This legal proof also demands that vision systems provide time-stamping of the images they capture.

Cameras for traffic enforcement also have to be both rugged and reliable. Because they are nearly always in an outdoor environment, they need to be either weatherproof or mounted in a protective enclosure. Further, they should be vibration resistant and able to operate over a wide temperature range. The vision system must also have a long lifetime to be cost-effective, so cameras should function for many years with little or no maintenance.

Basic cameras meeting these requirements are already widely used for traffic enforcement applications that have relatively simple needs. Toll monitoring, for instance, is typically installed in lane areas that are well lit and have restricted vehicle speeds, so image capture is straightforward. Red-light violation camera systems need higher capture speeds to freeze faster vehicles, but still often have sufficient lighting available. In both applications, there is no need for real-time image processing. The cameras can simply capture images and send them to a PC for handling.

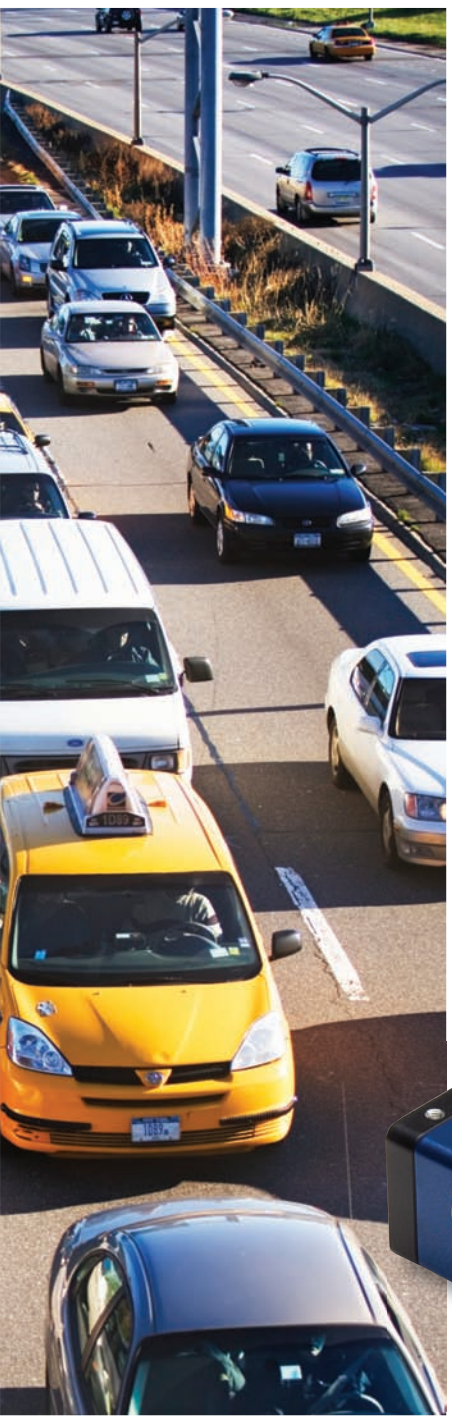
Need to know?

The role of intelligent, networked cameras in traffic management applications

- The advantages that smarter cameras can bring to traffic law enforcement
- Bringing intelligence to the camera unit itself
- The benefits achieved by networking cameras
- How the extended reach of networked cameras opens up a greater number of traffic management applications
- Cameras with built-in license plate recognition algorithms help enforcement officers to detect vehicles of interest

Expanding options

More advanced cameras with built-in functionality and networking capability, however, can greatly expand the range of traffic enforcement applications that a vision system can handle. Networking, for instance, can give a bank of cameras high-bandwidth access to a server that provides image processing for pattern recognition and data extraction – such as recognizing license plate numbers. This turns vision systems from passive image capture devices to real-time intelligence providers. The networked camera bank and server can provide coordinated counting and measurement tasks over an



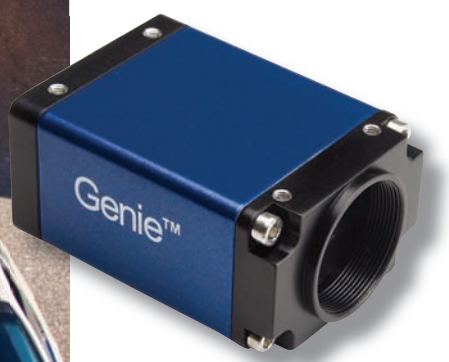
Intelligent cameras contain processing engines that help manage tasks efficiently

area rather than at isolated points. With fiber-based connections, the cameras can even be located more than a kilometer from that server, allowing wide area coverage.

The extended reach that networked cameras give a vision system design opens many additional applications. Traffic flow monitoring, for instance, can operate on a city-wide basis. Cameras use their built-in intelligence to recognize and count vehicles passing by them in each lane, then relay that count to a central database. That information, in turn, can inform decisions to activate and control metering lights, information signage, and the like for city-wide traffic coordination.

With a little more intelligence, cameras monitoring traffic flow can also provide speed law enforcement by performing license plate recognition (LPR). By using the license number and time-of-capture from cameras at several points along a roadway, for instance, the monitoring system can determine each vehicle's average speed and determine if there has been a speeding violation. With even more intelligence, an individual camera can even make such a determination. It would need to capture multiple images of the vehicle, extract reference points on the vehicle, then measure the movement of those points each frame to calculate speed.

A camera with LPR algorithms built in can also be mounted in patrol cars to perform passive 'fishing expeditions' to determine if vehicles of interest are in the vicinity. Such cameras would automatically detect and recognize plate numbers as the patrol car cruises and compare them to a database in a laptop computer carried in the vehicle. This system would then alert the officer to match-ups such as stolen vehicles, outstanding warrants for the vehicle's owner, suspect cars, and the like.



Dalsa's Genie cameras are suitable for ITS

Simplified installation

In addition to offering expanded applicability, network-ready cameras with built-in intelligence simplify their installation and use in such uncontrolled environments as highway and in-car monitoring. One area of simplification involves lighting. A basic camera such as those used in toll monitoring and red-light violation needs relatively well-controlled lighting to capture usable images. A highway-monitoring system, however, may not have such lighting available, and use of high-intensity floodlights or flashes on an open freeway could create a safety hazard by interfering with driver night vision.

Cameras with low-light sensitivity can take advantage of standard roadside and other ambient lighting. But high sensitivity for night-time results in over exposure during daylight operation. Basic cameras are hard pressed to accommodate such wide lighting variations.

Advanced cameras can avoid this problem. Networking capability allows the central server to adjust camera settings to accommodate changing lighting conditions. An intelligent camera can go a step further, providing automatic gain control and built-in contrast enhancement to compensate for lighting variations on its own.

Built-in camera functionality can also lower other system costs. Rather than passively capturing image frames at a scheduled rate, which creates significant overhead at the server and clogs the network, the camera can use its image-processing capability to determine for itself whether or not there is something worth capturing. This allows the cameras to avoid generating excessive image data, lowering server performance demands (and cost) as well as allowing more cameras per server to keep network costs down. The ability to self-trigger can also eliminate the need for external hardware such as in-road vehicle sensors.

Networking capability in intelligent cameras allows for simple synchronization of multi-camera systems such as color/monochrome camera pairs. The monochrome camera can provide the image processing that detects the violation and license plate, and then trigger a color camera to capture the additional context information such as car make and color. The network also ensures that the two camera time-stamps are synchronized. Ethernet is capable of delivering timing information to the cameras on the network with great accuracy. Using the Network Time Protocol, systems can achieve millisecond synchronization. With the Precision Time Protocol, available on cameras such as Dalsa's Genie range for ITS, sub-microsecond accuracy is possible.

The use of smarter, networked cameras can thus expand the role of vision systems in transportation law enforcement. Built-in image processing and feature extraction, automated responses to lighting variations, and the ability to perform scene analysis for self-triggering of image capture all contribute to system functionality. At the same time, these attributes simplify installation, lower data rates, and reduce server requirements to reduce such system costs.

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Bright idea for improved safety

With the current squeeze on expenditure for highways signage and lighting, and the pressure to reduce both street clutter and energy costs, designers and engineers can be stuck between a rock and a hard place when it comes to aesthetic and effective road signage while managing energy consumption and maintenance bills.

Internally illuminated road signage has always looked tidier and been visually cleaner and clearer in the street scene than the more ubiquitous post-mounted luminaires. However, before the recent advances in materials technology and LED performance, old fashioned bulb or strip-lit signs had comparable or higher running costs in both energy and maintenance and so have previously been difficult to justify in many areas.

LEDs have evolved over the years and are now able to achieve much higher junction temperatures and far better quality of light. Coupled with massively reduced running and maintenance costs, the possibilities for achieving an attractive, evenly illuminated and visibly safer roadside scene are now much more of a reality.

The Elumin8 range of ultra-slimline edge-lit LED road signs has recently been launched into the market. With low energy consumption, incredible uniformity of light distribution and a range of power options to give the lowest possible installation costs, these represent a new generation of internally illuminated sign.

Need to know?

The latest advances in internally lit LED road signs that consume less power than before

- Balancing the demand for roadsigns that are aesthetically pleasing, perform well and are cost-effective
- How the latest generation of LEDs is enabling progress in the roadsign sector
- Edge lighting is used to reduce the profile of these new signs
- Slim profile, high uniformity and reliability of light, and interchangeable power supply – all in one sign

READER ENQUIRY NO. 504

Because the range was effectively designed from a blank sheet of paper, the manufacturer has been able to start from scratch with no preconceptions and a clear design brief: to design a competitively priced, slimline, illuminated sign to meet and outperform the requirements of BS EN 12899.1-2007.

The latest generation of LED signs offer far greater visibility

Family history

Originally from an advertising and promotional background, Elumin8's parent company, Luminous Media, had a long history of producing electro-luminescent materials and found that although the technology stands up well on the high street for advertising campaigns, it is simply not robust enough for use as a road sign. So the decision to use LEDs was immediate.

The next hurdle was light distribution. Having developed an effective LED sign for the advertising industry, Elumin8 was able to further advance its light distributing plastic sheet by use of precision etched light distributing channels. This meant that edge lighting became possible and, after testing, was adopted so the sign's profile could be reduced to just 14mm.

With quality and uniformity of light dealt with, the next question was installation; what do the installers actually face? Research showed that one of the major costs of installation, both in money and time, is the requirement to trench a 240v cable to supply new installations. Elumin8 signs use a 12v supply and the decision was taken to offer a detachable transformer unit. Not only does this mean that a different voltage can be used depending on the most convenient supply, but also that a 240v current can be transformed down to 24v on the nearside before being installed under the road surface to an island or roundabout sign. This enables the installation team to slot-cut into the road surface, rather than trenching and ducting. The cost savings in

road closure time, manpower, machinery time and the overall time saving make this option into something of real and measurable benefit to end users.

With the key elements of slim profile, high-quality uniformity, and reliability of light and interchangeable power supply achieved, the inundation protection, durability and testing were focused on. The sign meets and exceeds the requirements to be rated IP67 inundation resistance and IK10 impact resistance.

The elimination of over-lighting means that the signs are fully visible and clear to drivers at any height, even in a lorry cab – where there is no obstruction.

In addition, the signs have improved visibility and the use of 3M Diamond Grade translucent films makes them fully compliant to BS EN 12899.1-2007 (Class L2).

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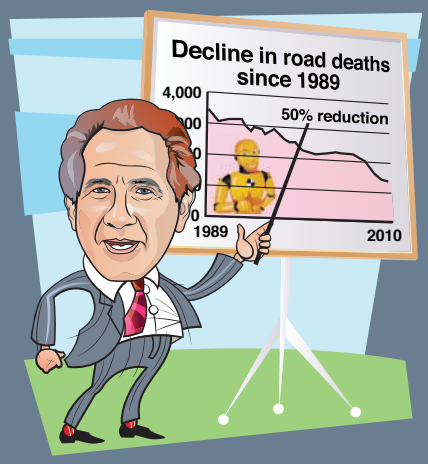
Adrian **Walsh**



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The automotive industry's contribution to road safety is enormous. Industry-led innovation – which is frequently followed by legislation – has helped reduce the number of UK road casualties by more than half in the past 20 years. Since 1989, vehicle occupant deaths alone have fallen by 56%. This incredible achievement has now been recognised by a Prince Michael International Road Safety Award, presented to the industry in December.

Now with crash-avoidance systems widely available, the potential to save even more lives over the course of the next decade and beyond is an essential pillar of new road safety strategies across the world.

Many governments acknowledge the important contribution that improved vehicle safety makes but this positive story is often not well understood. It is all-too easy to overlook the technology now available in all new cars when we use them day-to-day, but we should not ignore it…

Twenty years ago, it was said that 'safety doesn't sell'. But this is far from the truth these days – now most customer research will rate safety among the top three factors affecting customer purchase decisions. Price, too, is always an important factor, but now there is no need to sacrifice safety for price. It is not just the top-end cars that have the latest safety systems, the volumes are available across the range.

eSafety technologies save lives. Devices such as electronic stability control (ESC) have the potential to save 4,000 lives and 100,000 injuries in Europe alone. Recent studies in Germany have shown that as much as €330 million could be saved by preventing small rear-impact accidents – and that more than three out of four accidents with severe injuries could be avoided with the 100% introduction of warning and emergency braking systems.

It is not governments that are leading here but the manufacturers. They are acting with great responsibility, making safety widely available, but all too often customers simply do not know what they are buying – worse still, many dealers do not know what they are selling!

Even across fleets where we should expect those making a purchase decision to rate safety highly, fitment rates for key eSafety technologies are still alarmingly low. A recent survey published by RoadSafe showed that 28% of all respondents only had ESC fitted on less than half of their fleet, and a further 21% did not have it fitted on any of their vehicles. Results for the other technologies are even more worrying. Over half (55%) said they did not have advanced emergency braking on their fleet, 59% did not have blind-spot monitoring, while 66% did not have lane support.

It's good news that ESC is to be mandated in Europe by 2012, but surely we must expect dealers to sell it to customers, and fleet managers to demand it for their drivers long before that?

> They [car-makers] are acting with great responsibility, making safety widely available, but all too often customers simply do not know what they are buying – worse still, many dealers do not know what they are selling!
>
> **Adrian Walsh, director, Roadsafe, UK**

Coming of age in highway safety

READER ENQUIRY NO. 505

CCR is one of the largest private infrastructure groups in the world, involved in the highway concession, passenger transportation, and environmental vehicular inspection sectors. CCR is currently responsible for several thousand miles of highways in Brazil that are under concession in the States of São Paulo, Rio de Janeiro and Paraná.

In terms of highway safety, CCR had some challenges related to a monitoring system that covers seven highways that stretch thousands of miles (from Rio all the way south to Paraná) and in some cases are thousands of miles apart. One of the big problems was the decentralized system in place and the need to share more highway video and related information (such as incidents, objects on highways, etc) with other monitoring staff. Under the old system, images were limited to a local monitoring facility, which meant one person had to copy tapes and send them to other relevant staff in various locations. Recording video was also an issue as there was lots of recording failure, which is a very big issue in terms of overall safety and legal issues.

Another challenge was the need to integrate all the different highway monitoring systems onto one management system. CCR needed a system that could easily deliver video information internally as well as externally (such as to TV stations and websites).

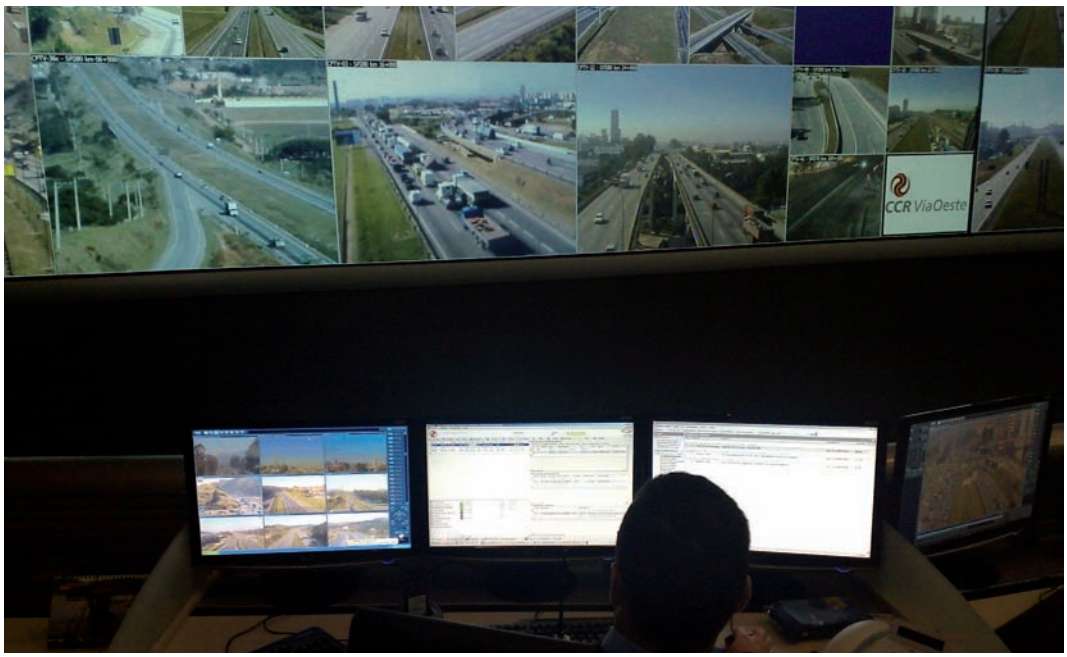
Open platform technology was a key issue here, as a lot of customization was needed. CCR found that some of the players in the industry had a 'take it or leave it' approach in regard to their software. However, with Intelligent Security Systems (ISS), CCR found a company whose software platform offered true open architecture and professional staff who were more than willing to custom fit a solution for their needs.

Need to know?

The numerous benefits of a smarter, open-protocol based approach to highway management

- The advantages of moving from an old decentralized system to a centralized one
- Open architecture and collaboration between technology vendors
- Integrating various traffic applications to one management system
- Intelligent and accurate license plate recognition
- Addressing the security issues associated with managing our road transport infrastructure

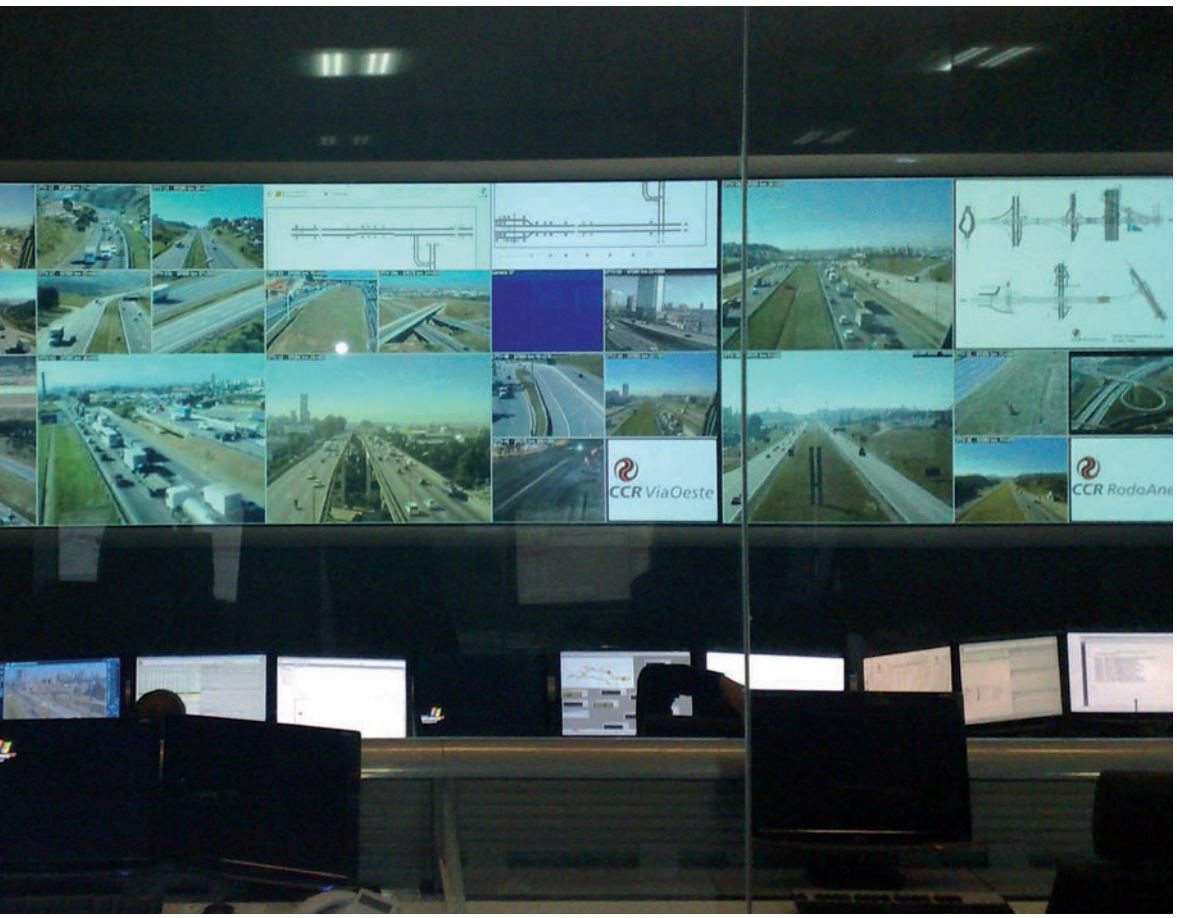
(Below) **Operators have a real-time view of what's happening on their roads, which enables more proactive and efficient traffic management**



The solutions

CCR found its optimum solutions working with three main companies: ISS, IBM, and Barco. With ISS, CCR was able to work on a one-on-one basis to address the specifics of their video management and software challenges. Due to the fact that this involved a very large deployment with hundreds of cameras and thousands of miles of highways, they wanted to be very careful with how they proceeded and what technology they adopted.

"We did not want to find ourselves a prisoner of software," says Wanderlei Ramos Jorge, manager of technology and innovation for CCR. "The ability of ISS to proceed meticulously and methodically to build the software platform, and to address all of our needs and concerns, was crucial to the overall success. We found that ISS could truly work with any



CCR is responsible for managing a huge network of roads in Brazil

system and create interfaces for any number of applications, including road signs and emergency phones. ISS was able to provide built-in solutions for license plate recognition (LPR) and a multitude of traffic monitoring capabilities, including traffic incidents, traffic counting, distance and time between vehicles, driving on the wrong side, and exceeding the speed limit."

ISS collaborated with IBM (for storage, servers, and workstations) and Barco (for the videowall) to create the overall system.

"The ISS team worked with our team to find the best solution for us, and this resulted in a system in which they were able to integrate all the different highways and our diverse security infrastructure into one monitoring platform," says Jorge. "This was a complex undertaking that took several months of careful planning, and which involved surveillance cameras, LPR systems, and in some cases switching from analog systems to IP or digitizing analog to have IP capabilities, and a wide array of different camera software systems."

In addition to the thousands of miles of highways, it was necessary to have surveillance and LPR in place for 13 toll plazas on the Rodoanel highway and nine plazas on the Via Oeste highway.

Intelligent storage was also a high priority, with a need to manage and provide access to three tiers of stored video images: short-term, long term, and exported incidents.

The results

CCR has experienced a quantum change for the better in its overall monitoring and management capabilities. From a situation where images were only available at local monitoring stations, and copies had to be shipped to other outlets, to the current mode where users can easily access video from the central monitoring station. Users can manually log-in in the event of an incident and easily access video information. While each highway has its own infrastructure, operators can view any of the highways from central headquarters.

The ability to easily monitor traffic from any location has increased automation and means less overall need for hands-on staff. This in turn has lowered overall expenditures.

ISS's advanced video management features have allowed CCR to easily deliver video both internally and externally (to websites and TV stations). The ability to provide live video has resulted in additional revenue for CCR as it is able to sell this footage to TV stations. Because of the built-in video analytics of ISS's SecurOS Traffic Monitoring, there is no need for additional hardware, such as road sensors, to detect incidents or objects on the roadway. The advanced algorithms, which have their roots in space technology, also translate into highly intelligent LPR, with a high accuracy and where the system clearly identifies rules, so that, for example, a 'B' is not mistaken for an '8' when the plates start with letters, and where plates can be read horizontally as well as vertically, and in the most trying of environmental conditions.

Intelligent storage handled by IBM includes three tiers, which are short term/high frame rate, long term/low frame rate and exported incidents that must be bookmarked and stored for five years. ISS supports the overall management of these videos, particularly related to bookmarking key events.

Customer feedback

"The difference between then and now," explains Jorge, "is that the centralization that ISS has provided has increased our overall efficiency and security, which in turn helps our bottom line. More specifically, the complex security needs of all these various highway systems have been addressed in a comprehensive way that would not have been possible without a true open platform and the ability to customize all the various features."

CCR's future plans with ISS include an unattended toll plaza, integration with optical character recognition (OCR) and RFID tags, and expansion to monitoring of more than 60 toll plazas.

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Energy savings and better light

(Above and below) **Residents will feel safer when walking down previously poorly lit streets as the LED lights are brighter**

Birmingham City Council, the largest local authority in Europe, has initiated an ambitious multi-year program to replace almost its entire streetlighting stock with what public services provider Amey describes as one of the most advanced lighting systems around. In what represents the world's first private finance initiative (PFI), LED lighting will now be incorporated as the main residential light source, with Indal WRTL selected to supply its Stela LED streetlights.

The overhaul is part of Birmingham Council's £2.7 billion (US$4.1 billion) highways maintenance and management contract with Amey to upgrade and maintain the city's road network over the next 25 years. Around 50% of the streetlights will be replaced over the next five years, with all residential areas incorporating the fully remote-controllable LED lighting.

With Amey wanting to keep Birmingham at the forefront of the lighting sphere, the remainder of the streetlights will be replaced or upgraded throughout the contract period.

Need to know?

How Birmingham City Council will reap the rewards of deploying advanced LED-based streetlighting

- Achieves energy savings of more than 40% in comparison with traditional solutions
- Functions of optics and protection renders a very precise light distribution
- COO-LED technology allows the LEDs to produce the maximum amount of light
- No lamp replacement, so no costs for lamps and no replacement costs

READER ENQUIRY NO. 506

The city currently has more than 95,000 streetlights in total – primarily high-pressure sodium, mercury vapor and low-pressure sodium variants. There are also a small number of metal-halide and fluorescent light sources. The adoption of LED as the standard across the PFI is seen to be a signal that traditional discharge lighting has been replaced by a solution able to exceed expectations in terms of performance, energy savings and cost-effectiveness. Indeed, it is highly probable that all future PFI proposals will only be considered 'best value' if LED forms the majority of the scheme.

Stela LED streetlights will be installed in all residential areas being upgraded, while traffic routes will be replaced with Indal WRTL's Airtrace 2 luminaire, which includes SON lighting with dimmable electronic controls. Amey expects that during the course of the initial investment period Stela will also be incorporated into traffic routes as well. In addition, tunnel lighting and signs will include LED fixtures.

The advantages of Stela are numerous, according to Amey. The range presently incorporates CREE LEDs, which greatly reduce energy consumption and carbon emissions, while the long life and minimal maintenance requirements will immediately cut operating costs. The fully dimmable Stela streetlights also provide excellent optical control, meaning a reduction of light pollution and obtrusive light. The City of Birmingham is expected to see an increase in personal safety levels and a reduction in the fear of crime as a result of the improved illumination and color rendering.

Indal WRTL's Stela luminaire was specifically designed to utilise LEDs as a light source, and there have been no failures in the +2,000 fixtures installed by Amey to date.

With the rollout of the Stela streetlights, fixtures will no longer be controlled by photo-electric cells or timers. Birmingham's entire lighting system will be remotely controlled and managed, allowing for switching or dimming on demand. The central management system (Telensa PLANet) can control the lights individually or in groups, such as road-by-road, by geographical area, or by road hierarchy. The system will also enable varying lighting levels to match traffic conditions. If needed, light levels can be raised above normal to respond to an accident or major event.

The energy savings, carbon reduction and virtual elimination of light pollution will have a dramatic effect ecologically as well as economically. Stela can reduce CO_2 emissions by up to 78% against some of the lighting systems it replaces, and have been installed by more than 80 local authorities.

"Together with Amey, Indal's multi-national design and development team have driven through a number of innovations in optical design, energy efficiency and photometric performance that really do make a significant contribution to the overall benefits being delivered," says Anthony Stubbs, Indal WRTL managing director. "The result is substantial energy reductions across the city streetlighting infrastructure."

"Amey is working with Indal WRTL and Birmingham City Council to deliver a solution that will halve the energy consumption for streetlighting and help the council meet its carbon reduction target," concludes Mike Notman, Amey project director.

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The history of road tolling can be seen to parallel the history of civilization. A couple thousand years ago, in the Stone Age of tolling, the emperor would set some trusted tax collectors at the side of the road to block passage and collect a toll. Much later in the Bronze Age of tolling, local lords erected small huts that evolved into the toll booth and coin counters of the Iron Age of tolling. Then passing through the Dark Ages of fuel taxes and the Renaissance of microwave and video cameras, we arrive, finally, at the Modern Age infrastructure-free satellite tolling.

Throughout this history – as in many facets of human development – we cling to the past, afraid to abandon old habits. In fact, like adherents of ancient religions suitable for darker times of plague and crusades, far more vehicles today slow or stop to pay tolls at booths or coin counters or have their plates read by cameras, than enjoy free-flow satellite tolling.

Less than 0.1% of all the vehicles on the planet have thus far made the leap from the Renaissance to the Modern Age, and these are the million trucks so equipped in Germany, Switzerland and Slovakia.

Until a few months ago, the Dutch were poised to push this figure to almost 1% – an enormous leap, if you think about it.

But all that changed, presumably because of the USA's war in Afghanistan. Early in 2010, the Dutch government collapsed over an Obama-requested reversal regarding Dutch troop withdrawal. That halted the *Kilometerheffing* system, which was to be based on Modern Age satellite technology.

The proposal of the new, minority government is to increase fuel taxes, which is known to have no lasting effect on congestion. Even newer proposals call for privacy-invasive video cameras instead of privacy-protecting GNSS OBUs, which were designed to keep personal location data personal.

Does this mean the USA has bombed the Dutch transportation reform juggernaut back to the Middle Ages? I originally thought that, but now I don't. The real reason is in the way humans prefer risk. We are more willing to gamble when it comes to losses, but we are risk averse when it comes to gains. And in this politicians are no special case. Drivers prefer to risk continuing to lose more time to congestion than risk the promised gains of congestion pricing. Politicians prefer to risk the failing efficacy of fuel taxes to risking the potentially greater gains of road-use charging.

Professor Jens Schade (Dresden University) specializes in acceptability of transport pricing strategies. He shows that losses are psychologically at least twice as powerful as equivalent gains. This means that for the new Dutch politicians to continue their predecessors' programming, they need to perceive that the potential gains of GNSS-based road-user tolling (both in terms of transport efficiency and job retention) are more than twice as great as the potential losses resulting from raising fuel taxes and putting in a few video cameras.

Clearly they don't…

> Drivers prefer to risk continuing to lose more time to congestion than risk the promised gains of congestion pricing. Politicians prefer to risk the failing efficacy of fuel taxes to risking the potentially greater gains of road-use charging
>
> **Bern Grush, chief scientist, Skymeter Corporation, Canada**

READER ENQUIRY NO. 507

Need to know?

How machine vision technology is enabling improved traffic law enforcement

- The growing use of machine vision cameras and how they are superior to standard consumer cameras
- The traffic law enforcement solutions that one vendor is achieving via the use of the latest generation of machine vision cameras
- ALPR, speed detection, vehicle tracking and more: all from one camera system

Machine vision technology for traffic enforcement

(Above) **T-EXSPEED in situ** (Above right) **Kria's 3D vehicle classification**

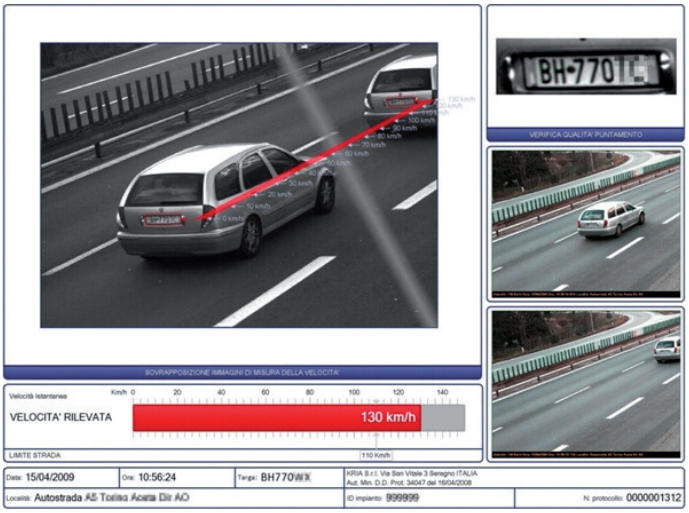
Traditional traffic enforcement devices require laser, radar or inductive loop sensors to detect vehicles and measure their speed, as well as a camera (usually a high-resolution consumer SLR camera) to provide documentation of traffic violations. These systems are limited to speed measurement, one vehicle at a time.

Traffic control company Kria developed T-EXSPEED, a fully automated system that entirely relies on digital machine vision cameras and computational stereo software algorithms to track and detect traffic violations. T-EXSPEED operates without the use of external sensors and is able to detect multiple traffic violations such as excessive speed, red-light running or forbidden left or right turns directly from images taken by high-resolution digital industrial cameras that repeat the real-time stereo process 24/7. It can measure vehicle speed up to 300km/h and track many vehicles in parallel (up to three lanes), in both directions.

Stereo camera set-up

T-EXSPEED relies on three Prosilica GB cameras from Allied Vision Technologies and is composed of three parts: the acquisition unit, the processing unit and the central unit.

The acquisition unit consists of an 84cm tall weatherproof IP66 housing that holds two five megapixel monochrome Prosilica GB2450 cameras, one 1.4 megapixel color Prosilica GB1380C camera, as well as an infrared lighting system for night-time license plate detection. The supporting and housing structure is made out of more than 200 carbon fiber,



(Above) **Image data for speed violation** (Left) **Close-up of combined image data**

alloy and polycarbonate components and is designed to guarantee the internal rigidity of the system and provide external isolation in a wide range of temperatures and weather conditions for quality insurance and reliability.

The cameras are fitted with rugged, high quality 15-35mm OEM lenses for a flawless stereovision process and mounted in a 70cm-tall stereo set-up inside the housing, with the two monochrome cameras on either side of the color camera. The device is placed on a vertical pole mount at a slight angle from traffic, 15-25m behind or ahead of the monitored area. The stereoscopic set-up allows the two GB2450 camera sensors to compute the speed and trajectory of each passing vehicle by simulating depth perception and analyzing the distance between the sensors and the vehicle. The two monochrome cameras are synchronized to run 15fps per second in continuous shooting mode. The color camera is programmed to capture a shot of a vehicle when a defined traffic violation occurs. The color image is automatically associated with the traffic data to provide the necessary legal documentation for the traffic violation file requirements. Parameters such as shutter speed, gain and binning are dynamically controlled by the processing unit in closed-loop to adapt to any lighting or weather conditions. T-EXSPEED can also be mounted horizontally on top of police cars for static or dynamic speed enforcement.

The acquisition unit links to the processing unit via CAT6 cable or fiber optics, depending on its location (either on-site or up to 20km away). It consists of an industrial PC running a Windows operating system that powers Kria's proprietary T-EXSPEED software for traffic violation detection. In addition, the processing unit manages and stores video and image data that is transmitted to the central unit in real time via a TCP/IP network.

The central unit, usually located at the police control room, is a server with an encrypted database that receives selected compressed data from the processing unit and allows clients and authorized users to retrieve all traffic violation records and documentation.

System installation is non-intrusive and does not require any civil works or on-site reconfiguration and is achieved without needing to close lanes and stop traffic.

Speed detection

The image on the previous page shows an example of the image data collected by T-EXSPEED for a speed violation. The image on the top left shows two views of the same vehicle captured at different times and combined into a single image with the red line showing the 3D distance computed by stereometry. The box on the top right, given by the overlap of the two stereo images cropped around the license plate, certifies the device calibration. The two color images on the bottom right complete the violation report with a panoramic view of the vehicle environment. Complex software algorithms are used to automatically calculate the speed based on the image data received. Kria's proprietary software was developed using C++ programming language and relies on image processing and computational geometry algorithms to locate vehicles, pedestrians, and any other moving target within the area of interest and extract 3D locations for each meaningful pixel making up that object. The close-up of the vehicle's license plate on the top-right and the license plate recognition (LPR) software helps the police operator during the speed infringement procedure. Additional data includes location, date, and time of the infraction. The second image (below the first) shows a close-up of the combined image data during track tests. The vehicle is clearly seen accelerating until it breaks the speed limit (when the green line turns red).

Self-Diagnostic Feature

The system is calibrated during production to ensure micron-level mounting accuracy for overall system stability and reliability in the long run. In addition, the system performs a self-diagnostic procedure during each detected violation. This feature allows the device to check if the internal structure is accurately calibrated and automatically detects any modifications that may affect its precision. The self-check output is automatically added to the violation documentation for legal purposes. The average error rate is less than 1% on speed in the 20-240km/h range.

T-EXSPEED incorporates a handful of useful features such as the LPR engine and 3D vehicle classification. The real-time LPR engine reads domestic and international license plates and matches them to a user-defined blacklist to detect vehicles carrying dangerous goods, for instance.

Already approved by the Italian Ministry of Transportation, Kria is currently looking to expand the commercialization of its system to international markets.

Contact

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Lufft's IRS21 passive sensor to monitor road surface temperature, freezing temperature, road condition, and water film level

How to overcome the unpredictability of weather

Unpredictable weather poses great danger to the traffic on our roads, especially during winter, representing a logistical challenge to winter road maintenance services. Ice, snow, sleet and changing temperatures are all conditions that can bring traffic to a standstill and threaten road users with increased risk of accidents.

However, there have been great strides in developing environmental data-collection facilities to make such conditions more predictable, in doing so enabling winter maintenance services to take specific precautionary steps before Mother Nature turns our roads into dangerous ice-skating rinks. Today's advances in technology – especially in modern data communications – facilitate data-transmission methods and real-time monitoring networks that until recently were unthinkable.

Inside story

But how does an RWIS system work and what data is required? To make a prediction about road conditions (especially the danger of black ice), all existing weather conditions have to be recorded and analyzed. A road weather monitoring station (RWIS) consists of several electronic sensors to measure and collect local parameters, such as wind speed and direction, precipitation type and intensity, air temperature and relative humidity, road conditions and road temperature, which are then transmitted and analyzed with the aid of a database.

Need to know?

Uncovering the predictive secrets of the road weather information system

- > The key electronic meteorological components for an advanced RWIS
- > Keeping winter roads safe in German state of Schleswig-Holstein
- > How RWIS plays a significant part in the decision-making process
- > Help to determine the window of application for anti- and de-icing chemicals to be applied
- > Sophisticated outstation arrangements including sensors that measure road condition, present weather and visibility

READER ENQUIRY NO. 508

The German federal state of Schleswig-Holstein is just one example to have specified and implemented such an advanced technology in recent times.

But how can we capture and analyze 'weather'? It's difficult to imagine that the size and properties of a rain droplet in flight can be measured. Yet with the help of a capacitive component, relative humidity and air temperature can be detected with an accurate NTC sensing element. Precipitation is analyzed using a 24GHz Doppler radar, which measures the velocity of each individual droplet (of rain or snow) – while it's actually falling! Based on the correlation between droplet size and velocity, precipitation volume and intensity can then be calculated. The type of precipitation (rain or snow) is determined by the difference in falling velocity. Wind measurement is performed with the aid of ultrasonic sensors. The built-in microcomputer measures the wind data 16 times a second, counts each drop of rain, and then measures its speed. Ambient temperature and relative humidity, meanwhile, are measured simultaneously.

Lufft's R2S-UMB 24GHz Doppler radar precipitation sensor

A non-invasive road sensor with optional surface temperature measurement

To make a reliable prediction, the condition of the road is also required. A sensor is thus embedded in the road to collect parameters such as the temperature of the road surface, water-film height up to 4 mm, freezing temperature for the use of de-icing agents (salt), and the current road conditions, such as dry, damp, wet, ice or snow, as well as any residual salt.

By networking all RWIS components, it is also possible to remotely upload software updates, thereby keeping the system permanently up to date. As the highest standards of availability are required, especially during the winter months, this type of technology is also essential to keep potential failures (downtime) to an absolute minimum.

All data collected by the sensors converges in the bus modules located within the RWIS control cabinet. An industrial PC (communicator) including operating system is

in-built as well and provides the interface to the RWIS central computer (RCC).

How is the data analyzed?

At the Operations Service Center in Schleswig-Holstein (Neumünster), all data is analyzed and displayed by the RWIS central computer. Remote data transmission takes place in part via the state-owned telecommunication cables, which run parallel to the state highway but is also guaranteed via GPRS/GSM transmission. The measurement data is updated and transmitted every two minutes, although it first goes through a plausibility check. Not only is individual sensor data from the RWIS cross-checked – all air temperatures in a climate zone are also critically examined. In doing this, rogue data has no chance of getting through and is automatically flagged.

After passing the plausibility checks, the actual data is used for the prediction. A calculation is then made as to whether a critical road condition is likely to occur in the vicinity of an RWIS within the next hour. At the same time, the weather reports provided for the winter maintenance services by the German Weather Service are also consulted.

A sophisticated alarm system forms the central point of the whole system. The permanently manned operational service center in Neumünster acts as a central information hub for the road maintenance depots, with alerts issued immediately by voice mail or fax. A special service is also provided on the website. Under the heading *Reisewetter* (Travel Weather), certain data from the RWIS can be viewed. This data is updated every 10 minutes.

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We're so tired of all the darkness
Get into a car and drive
To the other side
Chorus: *Freeway*

(Lyrics by Joe Jackson, *Steppin' Out, Night and Day*, 1982). It's rare that your erstwhile Smart Car columnist has an epiphany, but this one has seen the light – twice. And no, they weren't headlights bearing down on me. They were distant enough that the Rayleigh resolution criterion made them seem as one. But I digress. Or maybe not.

The first revelation occurred at a symposium in San Francisco as I was sitting on a panel alongside Dr Chris Borroni-Bird, hearing him extol tenets of a book he co-wrote with Larry Burns and William Mitchell, *Reinventing the Automobile*. The second occurred while I was visiting Japan with a delegation from ITS America, when Toyota demonstrated for us a future mode of transport.

This is where the Rayleigh criterion enters. At a distance, the dual revelations are remarkably convergent, as if they are one. The crux is that a smart, future car is prognosticated by many to be electric. We've heard the electric car will enable us to shed the yoke of fossil fuels, and given use of best practices in energy generation, transmission and delivery, it will usher an era of sustainable personal transportation. The problem with all this yoke-shedding is two-fold: energy storage capacity in even the highest tech Lithium Ion batteries; and the dearth of recharging stations. These translate into the pragmatic shortcomings of limited range per charge (on the order of 150km) and few recharging stations (coupled with long charge cycles).

And there are elegant and not-so-elegant ideas to overcome these problems – i.e. stations that change electric car battery packs, a plethora of rapid charging stations. But GM and Toyota are two OEMs with a different idea, again similar at a distance but different upon closer inspection. Two shining points of light…

The common question is what if the 'car' is redefined? If it becomes smaller and smarter it may therefore become lighter and maybe, just maybe as safe. Therefore, one may redefine a smart car as a personal and therefore personalized conveyance. Depending on preferences, the weight of this personalized, limited conveyance could be dramatically reduced, allowing long range. Plus the 'car' could transform into new, niche modes to fit different lifestyles. GM calls its smart car the EN-V. It looks and acts like a stylish small car. Toyota's Winglet and i-REAL – which personalize transportation to short trips – don't look or indeed smell like a car. The Winglet and i-REAL are different, smaller – but in concept, shine the same light. They can drive for relatively long periods of time without recharging. How convenient. How practical. How smart.

To make these concepts real (or, um, i-REAL), there may have to be compatible infrastructure to segregate these vehicles from legacy cars. Maybe this will work in new cities in China. Maybe it will work in the future with the changing, older demographic through much of the world. But given the combination of these shining lights of innovation to overcome battery limitations, societal limitations could be lifted. And maybe, just maybe, we can …

Get into a car and drive
To the other side.

> We've heard the electric car will enable us to shed the yoke of fossil fuels, and given use of best practices in energy generation, transmission and delivery, it will usher an era of sustainable personal transportation
>
> **Jim Misener, executive advisor, Booz Allen Hamilton, USA**

ATS signs contract for intersection safety in Alabama

READER ENQUIRY NO. 509

American Traffic Solutions (ATS) has announced that it has signed a five-year contract with the city of Selma, Alabama, to install, operate, and maintain a city-wide Intersection Safety Camera program.

Selma will join Montgomery as the only two cities in Alabama using the new technology to stem red-light running. It is hoped that these cameras will have a strong effect in reducing hazardous red-light running at the city's most dangerous intersections. ATS is working with the city to identify the best locations for the cameras. So far, studies have indicated seven to 10 locations in need of safety enhancements.

The cameras will photograph the back of vehicles entering intersections with the light showing red. The information will be reviewed first by ATS technicians, and then by a Selma Police Department officer, who will determine if a violation occurred and if a citation is to be issued. Tickets will be mailed to the vehicle's registered owner. When cameras are ready to be turned on, public announcements will be made and a 30-day warning period will be implemented to help drivers become accustomed to the change in traffic enforcement.

It is hoped that the new technology will help reduce the number of red-light runners, crashes, and injuries at dangerous intersections, and enable police officers to spend more time in the community responding to and investigating crimes. Selma police chief, William T. Riley III, says, "This is part of a larger goal of mine, which is to enhance the police presence in the community. The program should also help us improve our overall community policing, as it will free officers to pursue criminal behavior beyond traffic infractions. We can utilize technology to help make up for the shortfall of personnel. We think the new photo enforcement program will help our police department make the roads and intersections safer for our families who live and work here. Once drivers realize cameras will record them if they speed through the stop on red lights, I expect they will be more careful and improve their driving behaviors."

The Selma contract comes hot on the heels of another win for ATS in Yonkers. In October 2010, Yonkers became the fifth community in New York to operate red-light cameras.

ATS won the contract to furnish, install, operate, and maintain the city's Road Safety Camera Program.

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ISS's RTMS G4 technology to be used in Kuwait project

READER ENQUIRY NO. 510

Image Sensing Systems Inc (ISS) has announced that it will be partnering the Transmotion for Traffic and Transportation Consultancy to provide the data collection system for use on highways in Kuwait, as part of the national Traffic Data Bank project. ISS's RTMS G4 was the chosen technology for this project, after extensive evaluation and testing of several ITS technologies. The RTMS (Remote Traffic Microwave Sensor) G4 is ISS's newest radar sensor for the detection and measurement of traffic on roadways. It is a small, roadside pole-mounted radar, which operates in the microwave band.

The G4 provides per-lane presence, as well as volume, occupancy, speed, and classification information in up to 12 user-defined detection zones simultaneously. It is easy and safe to install and remove without traffic disruptions or lane closures. Output information is provided to existing controllers via contact closure and to other computing systems by serial or IP communication port or by an optional radio modem. A single RTMS can replace multiple inductive loop detectors and the attendant controller.

Transmotion for Traffic and Transportation Consultancy's manager, Khalifa B Al Fadala, says, "In previous projects, we have used RTMS and have been very satisfied with the reliable and accurate data collection. We are pleased to supply traffic data to our customers to help build a strong road infrastructure."

Contact

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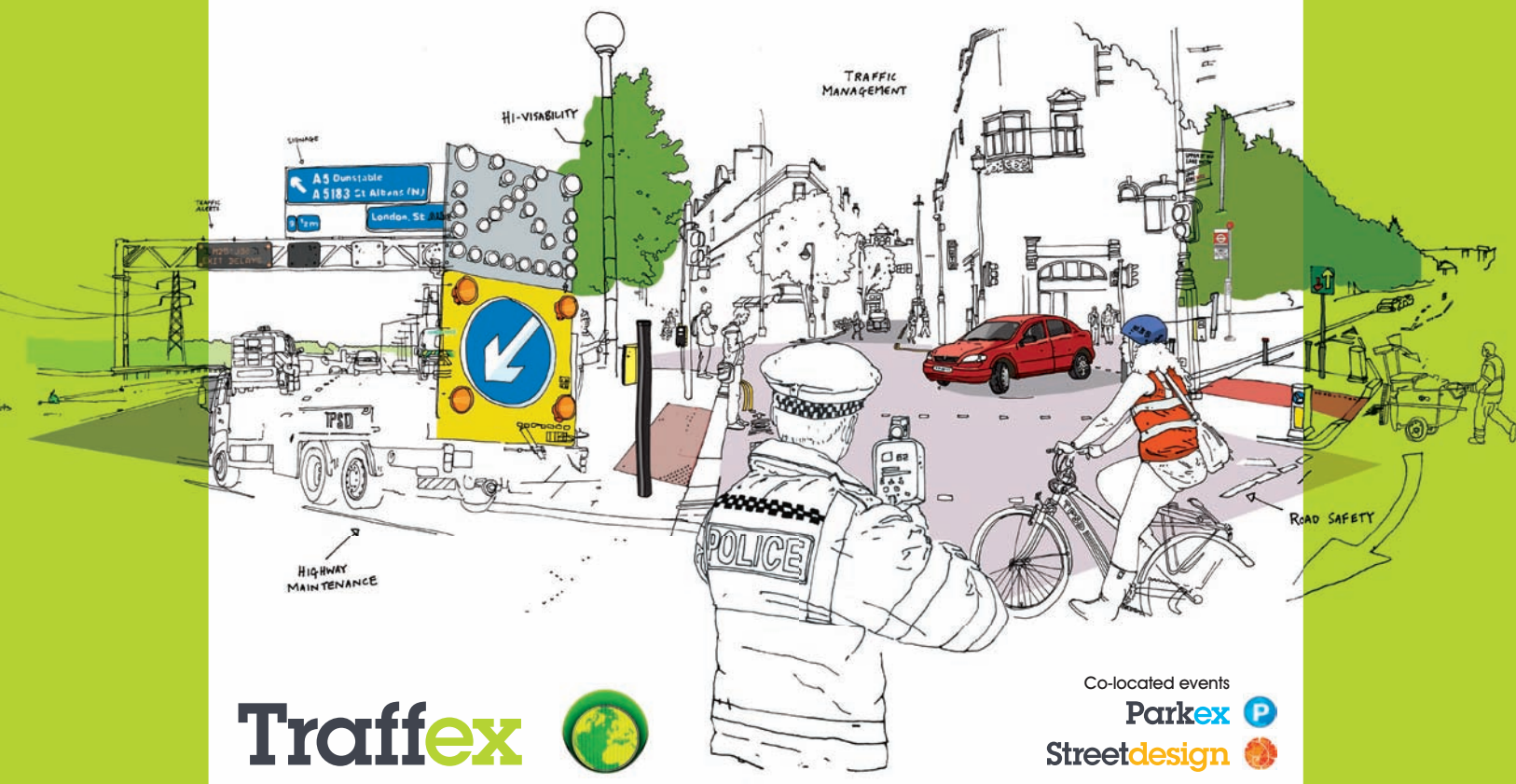

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With distrust from users and caution from operators, what can be done to fully utilize the potential of our VMS?

"The UK has already made great progress in this arena. Today, when interviewing traffic managers, VMS vendors and motorists on our side of the pond, you don't hear the anecdotes of out-of-date or wildly inaccurate messages on VMS that you did 10 years ago. It seems that in the USA, however, that the situation is not as progressive. In a litigious environment, operators are fearful of giving information such as alternate routes in case it comes back to bite them on the 'ass' in a 'Your-sign-told-me-to-drive-this-route-and-I-crashed' type of way. Yet it's a Catch-22 situation. If you want motorists to have faith in the information that's displayed, you have to be displaying good-quality, useful messages to enable them to make the right choices. The USA has access to some of the most accurate, widespread real-time traffic information technologies in the world and it should not be afraid to use them. If a traffic cop wouldn't hesitate to offer alternate route information to motorists in need of guidance, then an inanimate LED sign has no excuse. The data is there, it just needs to be displayed with more confidence."

Louise Smyth
deputy editor, Traffic Technology International, UK

"Building trust in the information being displayed is probably no different to building trust in a relationship – it comes over a period of time from personal experiences that reinforce initial impressions. This means the information always has to be timely and accurate – a single error can do much to damage the trust in the driver-VMS relationship, which then takes maybe five to 10 valid messages to restore. Messages on VMS need to align with messages that may be available from RDS-TMC and radio broadcasts. For operators, being able to confidently display accurate messages really requires confidence in the VMS system such that they know the message requested is actually being displayed on the sign, and secondly, accurate information that can be verified through secondary sources so they know the correct message has been selected. This means that for VMS to be truly effective they have to be part of a wider, integrated ITS that provides them the confidence in knowing what is actually happening on the network - verified by CCTV or other forms of detection as well as links to other agencies."

Mark Bodger
systems marketing manager, Siemens UK

"In the USA there is a reluctance with VMS to give any information other than conditions on the road that you're traveling on. VMS are not currently used to provide additional information – such as alternate routes that motorists could take. There's trepidation that somehow the government might be sued if a driver took an alternate route and had an accident. I think that's unfounded, but I find most VMS are not terribly useful. They're getting far more accurate and they will tell you traffic is bad or moving well for the next 10 miles but won't tell you how the alternate routes are doing – it won't tell you 'Get off at Exit 43' and then guide you. In-vehicle devices are better at that side of things. Bland messages are being given out on most VMS. When I was NYC traffic commissioner, I didn't hesitate to redirect people if there was an accident on one route to direct them to take another, or to change the traffic signals on those arterials. The traffic managers responsible for programming VMS should not be afraid to take the same initiative."

Sam Schwartz
founder, Sam Schwartz Engineering, USA

"As far as the UK market for variable message signs is concerned, I think the introduction of the national and regional traffic control centers, such as in Birmingham, has made a big improvement on the accuracy of the information that's displayed and the relevance of it to any given traffic situation. There is now much more consistency across the entire network. I can say categorically that 10 years ago if I mentioned what business I was in, people would always tell me about a sign they'd seen that was incorrectly set. Now, that rarely happens. Away from the motorway and trunk road network, on the urban side, the introduction of UTMC principles certainly had a big effect on the accuracy of information on car park guidance signs for instance. Accurate, real-time information is now being gathered and used. Consequently, in the UK at least, motorists have a much higher level of trust in the information being displayed to the VMS. Regions such as the USA can learn from our example and my message to those responsible for operating VMS would be simply don't be afraid to get that information up there. You can trust it's accurate, so display it!"

Roger Stainforth
chairman, VMS Limited, UK

Readers are invited to answer the Burning Question for the Feb/March 2011 issue:

What advances do you predict in the road markings sector in order to enhance traffic safety?

email answers to:
l.smyth@ukipme.com

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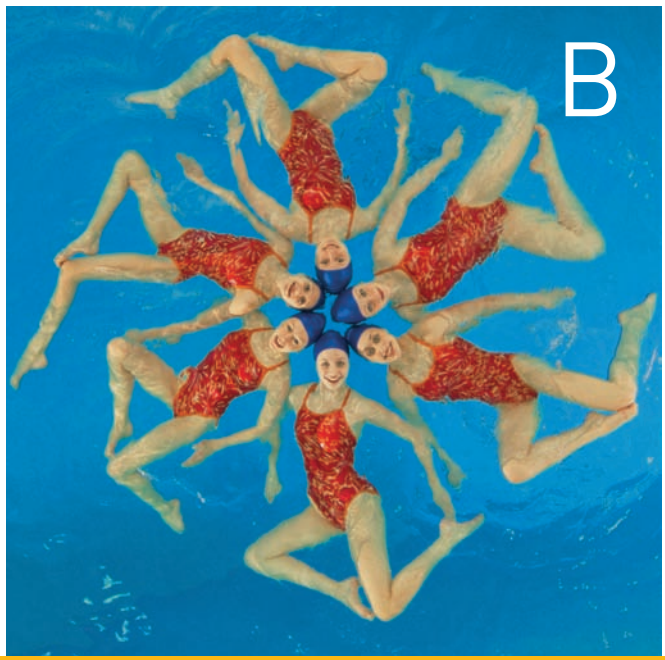

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Q: It is quite obvious where the harmony and swimmers' complete coherence are present. When it comes to more complex systems, like ITS, the real question is: how to achieve needed ultimate synchronization of all subsystems and to provide the complete solution for all your needs?

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