

THINKING CITIES

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Creating the liveable city

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6 *The smart city should not be only about the technology. The human being should be at the centre of it*



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Tomorrow today

Kevin Borras and Sylvain Haon welcome you to *Thinking Cities*

Never before have urban and regional planning authorities had so much information technology and data at their disposal. From smart payment to intelligent transportation systems; from passenger-generated trip information to Big Data, the keys to the truly Thinking City are now at the fingertips of those responsible for the design, planning and integration of our urban spaces and regions.

However, it is not only data and ICT that are unique to the 21st century and any call for a redefinition may influence how we live and work in the thinking city of the future.

We are in the middle of an evolution in urban planning and in particular transport planning. We are now planning for people. Sustainable transport planning is planning for people but it is not always obvious when and how we have done this. When it comes to transport management, we have to now think in terms of managing the movement of people and goods, not only in terms of vehicles.

This means that people should be the focus and at the centre of how we think about the city. We have come to something of a turning point enabled by ICT and data, something which today is eminently possible but was much more difficult in the past. So the Thinking City is the city centred around people and the services supporting them.

We are also at a defining time for cities as we are, for the first time for a century (if we believe the oracles), at the beginning of the introduction of a new vehicle propulsion technology with the progressive deployment of electric vehicles. These vehicles have a key role to play for the integration between sectors, in particular for integrating transport and energy in the city for greater efficiency and better control of the impact these human activities have on the environment.

ELECTRIC CHARGE

We are seeing, concurrently, a diversification of vehicles, the significant growth of the bicycle market and the explosion of the sales of electric vehicles – the Tesla Model S was the biggest-selling car in Norway in September, the first time an electric vehicle has headed the sales chart in Europe, but

even this was overtaken by another electric vehicle, the Nissan Leaf, in October. We are certainly living in changing, and charging, times.

Finally, it is about planning transport in the city and thinking laterally across all sectors to better address the health, environment, economic and financial challenges. Integrating transport is still a challenge, conversely and even more acute one with the possibilities offered by big data and ICT and the need to integrate energy and transport with electric vehicles.

It is also a necessity as it is our only way to correctly address the great challenges we are facing: environmental challenges, climate change, the financial crisis, the demographic changes, the population explosion in some parts of the world, the complete opposite in others. Integrating transport planning with other sectors is also a smart way to better integrate urban freight into the urban environment.

Thinking Cities will chart the progress, growth, and implementation of policy and infrastructure of those cities and regions. Academics, policy makers, public servants and industrial and political leaders will provide examples of the latest thinking in social policy, mobility, sustainability and energy.

Thinking Cities will be eclectic in focus, wide in appeal and both regional and global in our outlook. Our goal is to work with cities, regions and their partners from industry, research and the associations, to make sense of these changes.

Thinking Cities is about exchanging ideas to give a sense of reality to the concept of the Smart City, not just the sustainable city of tomorrow, but the sustainable city of today.

In 1910 only 10% of the earth's population lived in cities. By 2010 that figure had soared to 53% and it's estimated that by 2050 more than 75% of the world's citizens will be city-dwellers



Kevin Borras, Editor-in-Chief, *Thinking Cities*



Sylvain Haon, Secretary General, Polis

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THINKING
Highways

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The *Thinking Cities* infographic uses fascinating statistics to explain how to bring the life-saving concept of Vision Zero to life. Literally



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**Shaping
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Are tomorrow's cities ready for the evolution of existing movements? At this year's Shaping Transportation conference transport policy thinkers, shapers and decision makers will meet in Berlin to discuss how to design new concepts for current modes to achieve more integration. The challenge is to meet the increase of logistics needs and the use of alternative transport modes.

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- ▶ OECD
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www.vitronic.com
sales@vitronic.com

www.vitronic.com



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Editor-in-Chief

Kevin Borras (kevin@h3bm.com) +44 (0) 20 3463 9482

Secretary General, Polis

Sylvain Haon (shaon@polisnetwork.eu) +32 (0) 2 500 56 70

Art Editor

Barbara Stanley (barbara@h3bm.com)

Editorial Team

Kevin Borras, Sylvain Haon, Dagmar Röller

Contributors to this issue

Stephan Allgöwer, Tom Antonissen, Eberhard Buhl, Colum Crawford, Per Elvingson, Ayelet Gal Tzur, Ben Godfrey, Andy Graham, Susan Grant-Müller, Bern Grush, Brendan Halleman, Sylvain Haon, Richard Harris, Toshiya Hayata, Martina Hertel, Suzanne Hoadley, Neil Hoese, Will Judge, Bart Kamp, Gabe Klein, Sonja Koesling, Simone Köhler, Denis Naberezhnykh, Kevin Pallett, Stéphane Péan, Harold Perik, Margaret Pettit, Dagmar Röller, Richard Shennan, Phil Silver, Tommaso Simeoni, Jack Singh, Andrea Sorri, Daniela Stoycheva, Jilmar Tatto, Jörg Thiemann-Linden, Reha Tözün, Ivo Verhoef, David Vitezy, Alan Williams

Commercial Director

Duncan Ingram (duncan@h3bm.com) +44 (0) 1258 268561

Head of Broadcast Services/Presenter, Thinking Aloud in the City

Paul Hutton (paul@h3bm.com) +44 (0) 20 3463 9480

Subscriptions, Circulation & Accounts

Kerry Hill (kerry@h3bm.com) +44 (0) 20 3463 9486

Group Publishing Director

Kevin Borras

Group CEO

Luis Hill (luis@h3bm.com) +44 (0) 20 3463 9485

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H3B Media Group Headquarters

15 Onslow Gardens, Wallington, SM6 9QL, UK

Tel +44 (0) 20 3463 9480

Fax +44 (0) 20 8647 8725

email info@h3bm.com

www.thinkingcities.com

Join the Thinking Highways and Thinking Cities LinkedIn groups at linkedin.com and follow us on Twitter at thinkinghighways

Polis - European Cities and Regions networking for innovative transport solutions

rue du Trône 98, B-1050 Brussels, Belgium

Tel +32 (0) 2 500 56 70

Fax +32 (0) 2 500 56 80

email polis@polisnetwork.eu

www.polisnetwork.eu

Follow Polis on Twitter: http://twitter.com/Polisnetwork

H3B Media North America

1960 Gallows Road, Suite 220,

Vienna, Virginia 22182-3827-99 USA

Tel +1-703-893-0744

email lee@h3bm.com

H3B Media Latin America

Rua Princesa Isabel, 94, conj 112,

Brooklin, São Paulo - CEP 04601-000, Brazil

Tel +55 11 5095 0096

email sebas@h3bm.com

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Cityview

Senior transport officials from three forward-thinking cities discuss their plans for the future and how they are addressing the issues that matter most to their citizens – mobility and information, plus a fascinating look at the role of account-based payment systems and at the organogram of a city

- o **Chicago, USA** – Gabe Klein, a one-man revolution
- o **São Paulo, Brazil** – Jilmar Tatto, a man on a mission
- o **Budapest, Hungary** – David Vitezy, creating a smart city
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“I often talk about how our authority is the department of transportation and public space – it feels like what we are trying to do is balance the needs of all the different users of the public space” See page 12

ROAD ACCIDENT STATISTICS 2012



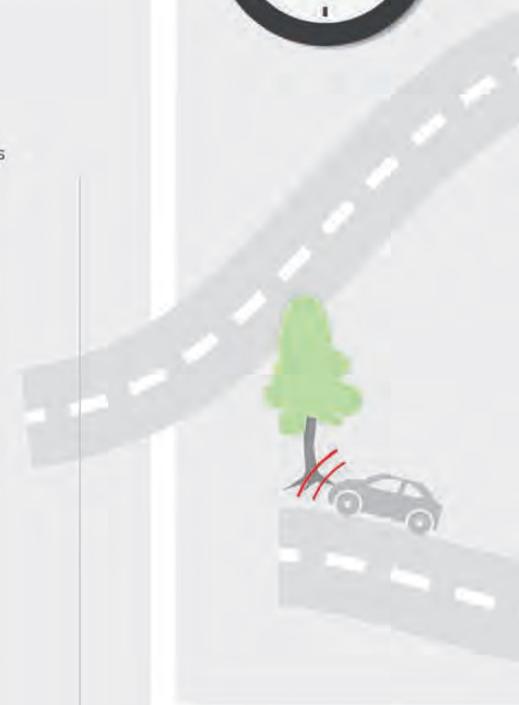
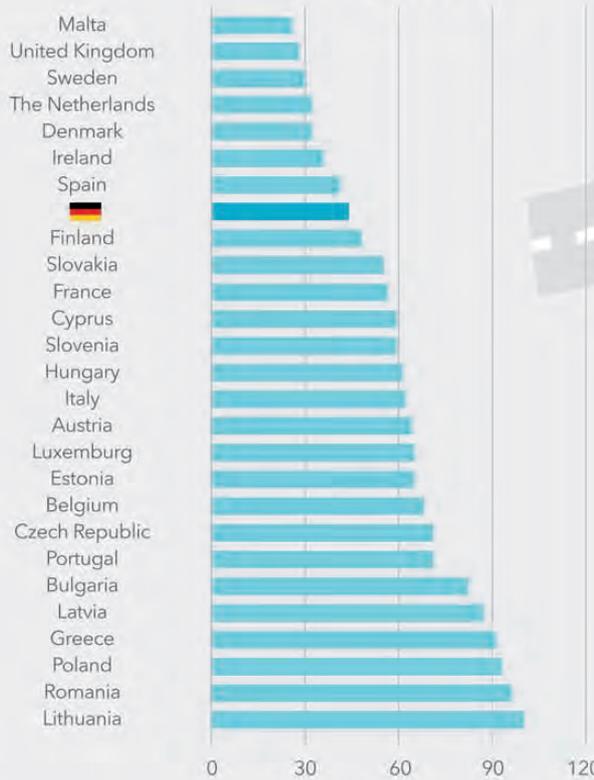
Last year, **27,800** people were killed on Europe's roads, which was a decline of 8% on 2011.



Reduced number of road fatalities compared to 2011 in %



Road fatalities per 1 million inhabitants



THE MOST COMMON CAUSES

 15,8 %

 14,8%

 14 %

Objectives:

The EU aims to cut road deaths **in half** by 2020 and to move close to **zero** fatalities by 2050.

Source: CARE (EU road accident database). Status: June 2013

ROAD ACCIDENTS ON GERMAN ROADS 2012

- every 13 seconds, one road crash is reported to the police
- every 82 seconds, one road user is injured on a public road
- every 13 minutes, one alcohol-related car crash is reported to the police
- every 2 hours, one person dies in a car crash
- every 7 hours, one person dies due to speeding
- every 13 hours, one person dies due to a collision with a tree
- every 15 hours, one motorcyclist dies in a road crash

2.4 million recorded accidents,
3,600 road deaths.
>50% of all road traffic deaths occur on roads in rural areas (state roads)

every 17 hours, one pedestrian dies in a road crash

1 in 4 victims died due to collisions with trees.

Nearly 40% of these victims lost their lives in crashes on curves.



Source: All data and information are based on the report on „Unfallentwicklung auf deutschen Straßen 2012“ (accident trends on German roads 2012). Supporting material for the Federal Statistical Office’s press conference on 10 July 2013 in Berlin. The texts and data PTV Group presents here are based on the above sources.

OF ROAD ACCIDENTS

improper turning, moving backwards, entering traffic

right of way, priority ignored

non-adapted speed

ACTIONS & THEIR IMPACT SINCE THE 1960S



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MISSION ACCOMPLISHED

Before stepping down from his position as Transportation Commissioner, Gabe Klein transformed the City of Chicago into a “customer-focused agency that is a national leader in technology, multi-modal innovation and sustainable design that consistently makes a positive impact on the quality of life” of its 2.6m residents. He tells **Kevin Borrás** how he did it

So, what do we know? An entrepreneurial businessman, well-known for his involvement in some truly innovative transportation-related start-ups, is helicoptered in from his position as director of Washington, DC’s department of transportation with the simple remit of transforming CDOT (Chicago Department of Transportation) and then two-and-a-half years and a whole raft of inspirational projects later he’s gone, off to start his own technology company. If life really is all about what you leave behind, then 42-year old Gabe Klein has built up a hugely impressive legacy. Before leaving office, then-Commissioner Klein spoke to *Thinking Cities* about just what makes a city smart, the innovative schemes he has overseen and how some of the city’s roads are able to digest pollution.

What, I wondered, was his definition of “smart” when it’s applied to a city? Is it the infrastructure? The intrinsic culture? Its citizens? Does it come down to budget? According to Klein it is, to a certain extent, based on perception.

“Do young entrepreneurs consider Chicago to be smart? Do businesses looking at relocating to Chicago consider it to be a smart city? What about the people that live here? Do they think they are living in a smart city?” he asks, partially rhetorically. “In some ways the sign of a smart city is one that flows well and works properly based on technology that’s running in the background. Is your traffic signal system optimised? Is your digital signage reliable and clearly understood? Are their easy applications to use to figure out which mode of transportation you need to take into the office today? Does the freight flow smoothly through the city?”

From Chicago’s standpoint it’s always a work in progress. “We are always trying to progress and we are always trying to learn from other cities and even catch other cities. And we are also trying to lead which is a great place to be. In some areas we are a very smart city but in others we have a lot of growing to do.”

It wasn’t as if Klein started with a blank sheet of paper in early 2011 when Chicago Mayor Rahim Emmanuel drafted him in from the capital city.

“We are lucky that we have a really robust transit system in place,” he said before rattling off an impressive list. “We have the CTA (Chicago Transit Authority) rail system, the L which is the elevated system, the subway, the CTA bus system, the Metra Commuter Rail system which is the second or third busiest in the country, we have a regional commuter bus system called PACE and we also have Union Station that has an Amtrak service plus we have a quarter of the country’s freight running through Chicago so as you can imagine there’s a lot of technology that makes all those systems work. There’s consumer-facing technology, such as digital displays in the bus shelters and rail stations and we also have very complicated systems operated by the six class 1 railroads and their trucking partners to make sure we are cutting down on congestion and excess traffic.”

In these tough economic times people don’t want to see what they perceive as “their” hard-earned money spent on projects that aren’t deemed to be entirely necessary. When it comes to transportation, people want to get to where they are going quickly, safely and as cheaply as possible, so how did Klein,

Gabe Klein is widely credited with transforming the city of Chicago’s transportation skyline in his 2 and a half years as Commissioner



Do young entrepreneurs consider Chicago to be smart? Do businesses looking at relocating to Chicago consider it to be a smart city? What about the people that live here? Do they think they are living in a smart city?



with all his business acumen, go about convincing the Chicagoans that the money he was spending on smart transportation was a good investment and was ultimately for their benefit? There are always people who will want portions of that budget spent on something “more worthy” than mere transportation but still complain when their bus is regularly cancelled.

“There’s a number of things that we do. One is we try to take a balanced approach. When we advanced the infrastructure for cyclists and we put sensors in the streets, we also put sensors in the streets for cars at the same time. This way we are improving the traffic flow for everyone at once as we are giving cyclists their own protected bike lanes.”

If Chicago is anything like London, *Thinking Cities*’ home town, then that balance Klein talks about, is a remarkably delicate one.

“Absolutely. I often talk about how our authority is the department of transportation and public space – it feels like what we are trying to do is balance the needs of all the different users of the public space. The technology is so important because you only have so much space but when you layer on the technology it’s almost like a fibre optic network – when you layer on the technology you can multiplex that fibre and add a lot more bandwidth,” he enthuses, clearly relishing his subject.

“It’s the same sort of thing with our streets and sidewalks – when we use technology for our signals and pedestrian crossings and so on it makes the

right of way much more efficient. If it means moving people out of single-occupant vehicles and onto buses or bikes or getting them to walk or synchronising the signals so the single occupancy vehicles that do need to be on the road flow better, that’s really where the high return on investment is. When we talk to the public we have to talk about it in simple terms. We have to explain how we are helping everybody, how we are doing it at a low cost-high return ratio.”

Informing the flamboyant Klein’s unstintingly assured rhetoric is the mind of a businessman with a management operations and marketing background, he is not an engineer or an economist, something rather unique in a Transportation Commissioner. His private sector upbringing has meant that he has been able to bring something of value to the government and in turn has learned a lot about how governments work. In his 20s he ran several Bikes USA stores before moving into consulting and latterly onto ZipCar where he helped to grow that business over a four-year period. He then co-founded his own electric food vending delivery and service company, On The Fly, before being drafted by the Mayor of Washington to run their transportation department. Chicago’s Mayor Emmanuel hired him in 2011 to execute his far-reaching and markedly ambitious transportation transition plan. Klein believes his business experience has helped him transfer his success to the governmental side of the table.



Klein’s forward-thinking and far-reaching plans “catapulted Chicago to the front of the nation as a leader in promoting biking, walking and public transit”

When we set off on a big program there's a whole sales proposition that goes on with the public and you have to make sure your data is on-point so you know it is going to be successful

It hasn't all been roses though as the implementation of a city-wide network of traffic cameras was just one of a number of innovations that angered the National Motorists Association. But as Chicago blogger John Greenfield put it in his chi.streetsblog.org post on 5 November, "I'd like to think he'd view getting panned by the motorists association as the highest praise for his years of work promoting Chicago streets that serve all road users, not just drivers."

"We made a permanent directional change in Chicago in terms of how people view transportation and what's important," Klein explained in a recent interview with the *Chicago Sun-Times*.

"With Mayor Emmanuel's vision and my ability to get things done, we've accomplished an amazing amount – six-to-eight years worth of work in just over two." Klein is returning to Washington DC to launch a business that promotes "transportation technology."

Ron Burke, executive director of the Active Transportation Alliance, said that Chicago was "stuck in a 1990s mentality and had not caught up with where transportation innovation had gone" before Klein took over the leadership of CDOT, a move which had seen the city "catapulted to the front" of the nation as a leader in promoting biking, walking and public transit."

THE HARD SELL

It's inarguable that cities need to become smarter, more efficient, sustainable and liveable. How is Chicago addressing these needs? Rather typically, Klein met this challenge head on with the help of one of the world's most innovative pollution-busting products.

"There are a number of things we can do. We have to pilot new activities. When we set off on a big program there's a whole sales proposition that goes on with the public and you have to make sure your data is on-point so you know it is going to be successful. We pilot things on a very small scale, we collect data about what's working and what's not working,

tweak it then put together our plan to launch it on a larger scale and then sell it to the public."

Quite often I have regretted asking an interviewee to give me an example of what they are talking about but on this occasion, it proved to be a rather significant question.

"Well, we have a street that we have named the Most Sustainable Street in America and it's in the mainly industrial neighbourhood of Pilsen. It's a neighbourhood that's going through a real shift. On one side it's industrial but on the other side it's becoming more mixed use. One side you have railroad tracks adjacent the streets, the other side it's already changed and there's shopping. We took the opportunity here to use every single type of sustainable technology that we could find, ranging from photocatalytic cement which eats smog to dual solar-wind powered sidewalk lights. We tested about 20 different technologies and for two years before and two years afterwards we are monitoring the changes."

Yes, Klein really did say that the streets of Pilsen, Illinois are paved with cement that has a digestive system.

"This is one of those pilots that takes a lot of effort but we are already seeing such a great payoff. This project, part of our overall Streetscape scheme, cost 21 per cent less to implement than the others because of the sustainable technologies we used. We are documenting whether the cement is eating the smog as it is supposed to, that the water features are working, the bioswills are performing. We are only a year or so into it but we are already seeing what's working and we are baking all those aspects into our other projects. It's an important strategy for us. Small scale, learn, large scale, but do it quickly. We have a motto here: "Make as many mistakes as you can in as little time as possible and try not to repeat them." People are terrified of getting things wrong. In relationships, in business, and especially in government. People are generally risk-averse and this creates an environment where if you can't make a mistake, you also can't excel." 

CONNECTING WITH THE PEOPLE

Two and a half years is a long time in politics, especially for a CDOT commissioner, and one of the most notable changes implemented under Klein's stewardship has been in how the city connects with and to its citizens. Connectivity with the citizens, connectivity for the citizens. Power, quite literally, to the people.

"We now have NextBus and NextRail smartphone apps which you can get from the Apple Store and from the CTA website and we also have something called Chicago Traffic Tracker. This not only tracks arterial speeds and congestion in real time using the buses' GPS, it can now also predict what the traffic is going to look like three or four hours ahead based on historical data. We built that ourselves here at CDOT and we have a direct fiber link to the CTA so we get the bus data in real time."

So the people of Chicago get what they want, when they want and on what they want. A city asking its inhabitants to comment on its transportation plans isn't anything new but it looks like Chicago is going out of its way to give the people that call it home the transportation network, and crucially the modal options, they deserve. I mention something about my home town installing a tram system in 2000 after a long consultation period which included local residents.

"Well, trams are pretty expensive! But we are building the first of two bus rapid transit lines and are currently in the study phase for a second one and we are designing a BRT network. Clearly a system like this is heavily reliant on technology to make them work. It's new infrastructure so it looks and feels like rail but has the benefit of traffic signal prioritisation. We are using off-bus fare collection, making use of the apps, to make the bus as fast as possible. Also we are just launching a new smart-card system, similar to London's Oystercard, with Cubic. It's called Ventra and it's actually the first of its kind in the country in that it will have two purses so you will be able to use it as a Visa card anywhere and also pay your fares.

None of these projects are cheap and no city has a bottomless pit of money to dip into when they want to build a shiny new transportation system. One only has to look at Detroit as an example. The pit has a bottom alright, and there's barely any loose change left, let alone hundreds of millions of dollars.

Says Klein: "We spent a fair amount of money this year as we are also building a new virtual traffic management center, designed by Delcan, for the city. We also have a lot of signal interconnect



projects going on and we are launching one of the biggest bikeshare systems in the US with over 300 stations. I like to think of that as a scheme where old technology, the bicycle, is merging with new technology such as solar power, GIS, GPS, and advanced payment systems. We have to think sustainably – not just in terms of emissions but financially. We have a sustainability plan for the city and we also have one within our agency and it calls for a very specific greenhouse gas emissions reduction as well as energy reductions for vehicles, buildings, internal goals for agencies and larger macro goals as well. There's a lot going on," he concludes in his sole nod towards understatement.

"And I didn't mention smart agriculture. That's the jurisdiction of another part of the city but we have aquaponic farms springing up that have a symbiosis between fish farming and vegetable farming. Fish waste is used to fertilise the vegetables and vice versa, which is really interesting."

Really interesting. If there's a more appropriate, though underplayed, phrase to sum up Gabe Klein's tenure as the City of Chicago's Transportation Commissioner, I would like to hear it. Whoever steps in to Klein's shoes is going to have a whole lot of thinking to do... 🤔

Mayor Rahm Emanuel and Commissioner Klein discussing the newly released 'Streets for Cycling 2020 Plan'

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Jilmar Tatto,
São Paulo's
municipal
secretary for
transport says
public transport
is his city's
priority

“We want to democratise public space...”

Jilmar Tatto, Municipal Secretary for Transport of São Paulo, Brazil, talks to **Daniela Stoycheva** for *Thinking Cities* about his and his city’s needs to make the best possible use of the available space

Polis recently met with Jilmar Tatto, the Municipal Secretary for Transport of the city of São Paulo, Brazil, to learn more about current trends and future ambitions for the transport in the city. In this interview for *Thinking Cities* he shares the transport problems that the city is facing, the solutions they are working on and his vision for a ‘smart city’. A licensed federal member of the Parliament, currently exercising the function of Municipal Secretary for Transport of the city of São Paulo, Mr Tatto also presides over two transport companies – CET (Traffic Engineering Company) and SPTrans, responsible for public transport in São Paulo.

How would you describe transport in São Paulo? What are the main challenges and trends currently?

São Paulo is a city of 11m inhabitants. This scale causes significant transport problems. The economic development of Brazil led to an increase in its GDP, which brought along prioritisation of individual transport. In addition, the automotive industry was promoted as it plays a strong role in the country’s economic growth. The traffic in the city is oriented from the peripheries to the city centre where the economic activities take place. All these factors added together lead to huge congestion every single day. Therefore, the newly elected mayor, Fernando

Haddad, is rethinking the whole transport system in São Paulo and developing new strategic planning methods. The new way forward suggests making public transport a priority, investing more in buses and bus rapid transit (BRT), searching for new areas of development to avoid everything being concentrated in the centre, and building new real estate close to public transport infrastructure.

As Municipal Secretary for Transport what are your priorities?

Public transport is our priority. This is the only way out of the problem. This is also what the people expect and generally they support us in that. We are doing a venturesome programme investing heavily in dedicated bus lanes. We have now 370km of dedicated bus lanes on the right-hand side and will build an additional 50km by the end of 2013 – more than it was expected to have by the end of the year. To get an idea about that dimension, until the end of last year São Paulo had only 120km dedicated bus lanes. In addition, new corridors are being built on the left-hand side (BRTs). We will invest in 150km of BRT up until 2016.

The speed limit for cars was reduced to 50km/h in order to on the one hand put pressure on the car-users and stimulate them to leave their car, and on the other to allow cyclists to share the streets with the cars. Also we are currently working on an

Public transport is our priority. This is the only way out of the problem. This is also what the people expect and generally they support us in that

integrated centre for mobility to control the traffic, public transport, freight, etc and have that connected with the police, emergency services and so on. For that we want to use open platforms for the integration of different services and are looking into the UTMC system from the UK and the European project POSSE. We are currently making a revolution that is not often seen in the big cities of Brazil and this process is not easy as we are encountering many conflicts – with the drivers, with the shop-owners who want to have their cars parked in front of their shops, etc. Therefore, it is not easy as the whole mentality and culture of the population needs to be changed. Also, as I said, the car manufacturing industry is important in Brazil, so it is not easy to go against it.

So an expanded BRT and bus network is your strategy for a functional public transport system in São Paulo?

Not only that. We are convinced that public transport has to be done on rails. The bus is not for mass transport. São Paulo does not have adequate mass transport. We have only 134km of tram lines and 78km of metro lines, whereas we need at least

500km. The system in the city is overloaded, we have 15,000 operating buses doing 4500km per day.

What does a 'smart city' mean for you? Is a 'smart city' only about technology or also about policy objectives?

A 'smart city' is for me a city that allows people to move freely and where they are informed about all possible mobility choices – a city where people are certain about reaching their destination. A smart city is, in my opinion, a city with good infrastructure where everyone is able to move – good sidewalks for all groups of people, children, the elderly and adults, cycle lanes for cyclists and traffic calming measures to guarantee their safety.

It is a city where the public space is for everyone, shared in a democratic way. This is not what happens today as the car has precedence over public transport and the pedestrian. Moreover, a smart city is a city where the public authority can centrally monitor the movement of vehicles, people and freight through a centre using technological tools in such a way as to achieve a harmony between them. That is why a smart city needs to invest heavily in technology in order to allow the public authority to take adequate decisions. And for that we also need to search for experiences and information in different places, as Polis are doing, and apply them in the best possible way. But the smart city should not be only about technology. The human being should be at the centre of it. People's wishes about what they want to do in their city should come first. Technology and the integration of different technologies should be used to keep people informed, to benefit the people and improve their quality of life, not only for monitoring.

Is there any place for alternatives to motorized transport in São Paulo?

A big challenge for São Paulo is to first guarantee public transport for everyone. Obviously, this is not enough. Investments are also necessary to improve

Tatto is investing in a network of dedicated cycle lanes





sidewalks, to increase the number of dedicated bicycle lanes. And this is exactly what we are trying to do – create a totally new concept about the city: not to give priority to road works, but to the creation of bus lanes, not to give priority to the car, but to the bicycle. We want to ‘democratise’ public space as public space in São Paulo is not democratic. We need to win it back to have it for everyone and this conquest is difficult as it requires a change: a change in culture, strong action from the people and one day a change in mentality.

In planning your activities are you getting inspiration from other cities around the world? What are the topics on which you would be most interested to exchange information?

We have direct contacts with different places. This year I was, for instance, in London and Glasgow. We have also spoken to the mayor of Bogota, Colombia, who has implemented a BRT system. We have contacts with various authorities and experts around the world. Now we are discussing communication

São Paulo is a sprawling metropolis of 11m inhabitants

A ‘smart city’ is for me a city that allows people to move freely and where they are informed about all possible mobility choices

The smart city should not be only about technology. The human being should be at the centre of it

between the different elements in transport in São Paulo, which will be made easier by means of open specifications. Thus, we are not locked-in to one product or one company. In that respect we are looking at what is happening in the USA and now also at UTMC from the UK. A common language will make the equipment cheaper. As I mentioned before, public transport is our main priority now. That is why when looking for good practices we are predominantly interested in mass transport. Europe has good quality to offer there. But we do not exclude other good ideas that have given good results either, such as calming traffic, or other pieces of information that may solve a specific problem of mobility.

São Paulo is hosting some FIFA World Cup games next year and some Olympic events in 2016 so you will be expecting thousands of people travelling to the same place at the same time. Are these major sports events a challenge or a chance for the city's transport system?

Both! São Paulo is prepared for these events and we have the adequate infrastructure. Obviously, the World Cup is something extraordinary, especially in that Brazil adores football. The opening ceremony of the World Cup will take place in São Paulo, so we are preparing ourselves. The Federal Government, the State and the Municipal Government are all involved in a strategy for the World Cup.

We, from the transport side, also have a mobility plan for the tourists that will be coming. It takes into account technology for access, control, etc. to assist mobility especially on the day of the opening ceremony. We have also announced the day of the opening as a bank holiday that will greatly alleviate any mobility issues. The mobility plan includes moving between the game venues, as well as between those places and where the training camps of the teams will be, and of course between those places and where the main tourist points will be. The organisation is well underway and we are convinced that this



will be a big event and the city will correspond to the challenges appropriately. Our main concern is actually that the Brazilian team wins the World Cup and makes a great show. But in terms of security, mobility and information to the tourists, we are well prepared and we believe that the FIFA World Cup will leave a good legacy for São Paulo in terms of both investment and organisation. 🌐

15,000 buses are in daily operation in São Paulo

FYI

Daniela Stoycheva is project manager at Polis
dstoycheva@polisnetwork.eu

jilmartatto.com.br

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New urban transportation system



Sustainability through exchange

Tamás Mátrai spoke to **David Vitezy**, CEO of Budapest's transport authority BKK, about consequences of the global financial crisis, the smart city and what Budapest has learned from London, Milan and Paris

What are the main transport challenges and trends in Budapest today?

Thanks to the constant effort to make public transport more attractive, following the worldwide financial crisis in 2008, personal motorized traffic is decreasing. People are searching for more sustainable mobility modes such as public transport and other non-motorized transport. The number of cyclists has continuously increased in the last 10 years.

The main vision of Budapest is to become a more liveable city – transport must give support to reach this goal by completing missing elements of the existing networks, removing system bottlenecks, providing reliable and competitive public transport services with modernized fleet, real-time passenger information, reallocating public space to serve the changing needs, especially in the city centre.

As CEO of BKK, what are your priorities?

BKK has a dual responsibility: we must operate our existing transport networks at higher standards and, secondly, deliver efficient development projects to improve our services. The main priorities are to improve rail-bound public transport services (e.g. refurbishment of tram lines), complete the missing links in our PT system and renew the deteriorated rolling stock (e.g. new bus management model, tram and trolley bus procurement).

FACTBOX

Budapest

BKK (Budapesti Közlekedési Központ): Budapest's integrated transport authority. Established in late 2010, it oversees public transport, cycling, road infrastructure management, city parking, taxi services and the management of transport-related EU projects under one umbrella.

Hungary's capital: it has a dense transport network that serves nearly **2million** inhabitants in the metropolitan area:

4500 km of roads are crowded in peak hours, **3322 km** of public transport network delivers **1.4billion** trips per year, **three** metro lines, **260** bus lines and **30** tram lines operate over **2200** public transport vehicles every day.



BKK is always open to learn from other cities experiences, and tries to consider the best practices around Europe



David Vitezy, CEO of Budapest's transport authority, BKK



Budapest's main vision is to become a more livable city

And what do the people of Budapest expect?

The people of Budapest and its agglomeration expect an accessible, fast, reliable and convenient transport system – BKK, as the transport authority of Budapest, must provide a sustainable mobility mix to serve this need, with increased share of sustainable mobility modes such as public transport, walking and cycling that give a real alternative to personal motorized transport. Our services in the city must be well-connected to other mobility services in the region, as the boundaries of the functional city are no longer the same as the institutional boundaries – we are open for regional partnership and co-operation.

Are citizens responsive to sustainable urban transport policies?

Yes, people generally understand and act towards sustainable urban mobility, which can be seen by the increase in PT ridership. Before the worldwide financial crisis in 2008, Budapest followed the general way of motorization, families bought their second and third cars, the national highway network has been extended, shopping malls that can only be reached by car have been built all around the M0 ring road, which also has been completed around the city. After the crisis, people are tending to be more careful with their financial decisions that also have an effect on their daily mobility.

On the other hand, with the help and powerful campaigns of NGO's and civil movements such as Critical Mass, young people found a new tool of their personal freedom and mobility: the bicycle. These two trends gives us, the integrated transport management body, a unique chance to make steps forward to better services that can receive the expected

The public bike-sharing scheme, MOL Bubi, will be launched this spring. István Tarlós, Mayor of Budapest and Zsolt Hernádi, CEO of MOL



public response. To give an example: Budapest will launch its public bike scheme “MOL-bubi” in spring 2014 expecting more and more people using their own bicycles as well the ones in the system.

How do you conciliate the expectations for better cycling, walking and public transport, and the hope to have more fluid car traffic?

Finding the right balance between public and personal transport services, also creating the optimal share of public space for mobility and other urban activities has never been easy. BKK as an integrated transport authority has clear responsibilities, stronger control over service providers and operators within a public service obligation contractual framework that can lead to success.

Car traffic, in general, was the answer to all mobility challenges in the 1970s and that has led to a car-focused infrastructure and mobility habits up to now. We must change that by engaging more and more people to use more sustainable modes – that needs actions towards a less car-focused infrastructure and better public transport services.

Budapest citizens will remember the 150 new buses, which started to operate recently and they will recognize the effort for real-time information provision as well. Several measures were introduced in favour of cyclists and pedestrians and the replacement of the paper-based ticketing system is also on its way. These developments are all part of our legacy.

Car-free day in Budapest



The main vision of Budapest is to become a more liveable city – transport must give support to reach this goal by completing missing elements of the existing networks

What role should transport technology play in enabling Budapest to become a smart city?

Our recent developments regarding active travel demand management, real-time information provision, restricted traffic zones and the MOL-bubi public bike scheme can all help Budapest to achieve its goal of becoming a more liveable city. Technology changes quickly, but we try to introduce the most innovative solutions for our networks (such as contactless bank cards for our new e-ticketing system), trying to skip the internal steps that proved to be outdated.

The recently introduced AVL system is helping Budapest to become “smarter” by reducing response time for incidents and providing higher levels of public transport services. We are also experiencing an increase in the public usage of smart phones and tablets and therefore we are opening for that way as well, developing mobile applications for the provision of real-time information. BKK is involved as a partner in four European research and development projects to keep up with current trends of innovation and to learn about best practices and adoptable know-how.

What does a ‘smart city’ mean for you?

To me a “smart city” means a complex urban environment, where all different stakeholders act together in co-operation towards creating a more liveable city, using the available new technologies effectively. Although the “smart city” concept does not only apply for transportation, we can speak about it in the mobility context that also covers a lot of different measures: a “smart city” should not only invest in better infrastructure, it needs to manage all available resources in an intelligent way, in order to achieve sustainable economic development and daily operation. A “smart city” should be efficient and needs to focus on innovation as well.

In planning your activities are you getting inspiration from other cities?

As with many other developed cities in Europe, Budapest is involved in several exchange activities

with the help of international networks such as Polis. The concept of BKK itself has been inspired by Transport for London. During the preparation works of a possible congestion charging scheme for Budapest, we incorporated several ideas from experiences of Milan. The concept of our public bike scheme MOL-bubi was heavily influenced by other existing systems such as the ones in Paris and London. BKK is always open to learn from other cities experiences, and tries to consider the best practices around Europe. ICT and open data are two fields that interest us but also intermodal interchanges or Sustainable Urban Mobility Plans are topics for which we have already started the knowledge exchange and we are keen to continue work this way. 

Budapest is investing in allowing its inhabitants to find the right balance between personal and public transport



FYI

Tamás Mátrai is project manager at BKK

tamas.matrai@bkk.hu

www.bkk.hu

Accounting for progress

Larry Yermack looks at the key factors that are shaping urban transportation systems in 'smart cities'. He explains why account-based payment systems are essential, and how, over two decades ago, the EZ-Pass electronic tolling system pointed the way to the future

This expansion is coming at a time when significant infrastructure upgrades are difficult if not impossible to implement, both logistically and financially

For the first time in the history of mankind, the majority of the world's population no longer resides in rural enclaves, but lives in cities. The World Health Organization (WHO) figures show that in 1990 less than 40% of the world's population lived in cities. In 2010 that had grown to 50% and predictions show that it will be around 60% by 2030 and 70% by 2050.

Fuelled in the developed world by two key demographics – 'baby boomers' and 'Millennials' – urban populations are growing by some 60 million people a year. To get these urbanites around their cities a proliferation of new paid-for transportation services have developed.

Yet all this expansion is coming at a time when significant infrastructure upgrades – in new roads, tunnels, bridges, overground and underground train lines – are difficult if not impossible to implement, both logistically and financially.

Fortunately, technology is riding to the rescue, bringing the promise (already a reality in some cases) of 'smart' cities. In this scenario, populations move around on integrated multi-modal transport networks managed by Intelligent Transportation Systems (ITS). At Cubic Transportation Systems, our take on this is 'NextCity', a comprehensive fully integrated, whole-of-transport journey and payments management system.

Built around an account-based fare transaction processing system that takes data from all the city's transport modes, NextCity captures integrated real-time data, both public and private. In doing so, it enables operators, regulators and planners to understand how a city's population is moving, and why they choose different modes at different times. This holistic view enables transportation operators to predict and manage demand across the entire network, using real-time travel information and dynamic pricing to influence passenger behaviour.



Larry Yermack suggests that the key to sustainability is the linking of information systems to payment systems

HOLY TRINITY

Three technology innovations over the last decade make integrated transportation systems possible. First, the advent of robust, reliable wireless networks enables the aggregation of data from all the different devices that control access to each transportation mode. This can be at a parking lot, subway station, tolling plaza, or bike share location.

Second, the rapid penetration of smartphones – estimated to be in use by 70% of the world's population by 2015 – is transforming ticketing in particular and travel in general. Not only can travellers use their smartphone to buy tickets, the two-way communication enables operators to provide individual passengers with tailored, timely, accurate information in real-time, based on what the provider knows about them. It can inform them of service delays or alterations, suggest alternative routes, or advise them on how to save money.

The third innovation is the development of 'device agnostic, back-office-centric' financial processing systems. So long as the transaction data from the access device is in a format the back-office can



understand, the system doesn't care whether it's 'talking' to a device at a subway, a tolling station or a parking lot.

NextCity is Cubic's concept, and other suppliers will have their own ideas of what a smart city's transportation system looks like. I believe, however, that any solution must have four key characteristics, the 'Four Is': they must be Individualized, Interoperable, Informative, and Integrated. While the eyes of the urban transportation industry are firmly focused on the future, looking backwards also provides real value.

E-ZPass, conceived of in 1991, brought together seven major toll authorities through a single electronic toll tag that worked across all seven agencies' facilities. Over two decades on, E-ZPass is not only still the largest toll collection system in the world, but also has a strong claim to be the world's largest ITS. Why this is so will become clear as we look more closely at the Four Is, as will the extent to which E-ZPass itself pointed towards the future

of mass transportation in two particular aspects – account-based customer relations and multi-agency interoperability.

INDIVIDUALIZED TO EACH CUSTOMER

Before EZ-Pass, toll patrons were anonymous. They just threw coins into a basket or gave cash to a toll collector. EZ-Pass changed that by introducing account-based payments. When you created an EZ-Pass account and linked it with a payment source and a tag, you were no longer anonymous; you were a 'customer'.

Starting with EZ-Pass, there has been a steady evolution in ticketing media from the 'data-poor' anonymity of cash, tokens and paper tickets to today's 'data-rich' media – first to smartcards like London's Oyster, and now to contactless debit and credit cards and smartphones. With each advance, transport providers have been able to capture more data and create a direct, individualized connection between themselves and their customers. It started

London's Oyster scheme is just one of a number of high-profile migrations to data-rich smartcards



Public officials only had the bully pulpit as a way to encourage and change transportation usage but now the direct and personal communication possible with users of all transport modes means the message is very different

with tolls, but now it's happening with transit, parking and bike- and car-share services.

This benefits travellers, who get improved visibility of their payments, refunds, and so on. It also provides new revenue opportunities for transport agencies, with personalized communications from targeted marketing and improved customer services.

INTEROPERABILITY

In 1991 when I was CFO of Triborough Bridge and Tunnel Authority, the largest US toll authority, I discovered that several engineers were testing what was then called AVI, or Automatic Vehicle Identification technology. They were testing to ensure that the tags we eventually bought would not interfere with the other tags from nearby agencies. I asked them whether it wouldn't be a better idea if, rather than non-interference, our goal was cooperation? What about one tag in the car that all agencies would use?

That led not only to the birth of E-ZPass; the interoperability between operators also paved the way for the first payment system across different systems. Now you could pay for bridge and road tolls in New York as well as toll roads in New Jersey. Eventually the system spread to about a dozen states up and down the East Coast of the US.

Today, multi-agency interoperability offers exciting opportunities for both tolling and transit operators. As the transportation industry moves to account-based systems, the arguments for integrating accounts for different agencies and service providers across regions are compelling. Linking multiple providers can improve the customer experience because all partners, large or small, can use the same customer relationship management tools.

A high level of security and auditing integrity built into the back office system reduces financial risks, maintaining separate general ledgers and revenue apportionment rules for each party. Transaction-processing costs are minimized due to greater

aggregated volumes. Intermodal loyalty is also encouraged; for example, a toll customer receives a discount for using a transit park-and-ride system to complete their journey.

INFORMATIVE SYSTEMS

From the earliest days of ITS in the United States we dreamed of a multi-modal traveller information system that would provide pre-trip and en-route information to travellers on all modes. It would allow them to make real-time decisions to optimize their trip. The problem with the dream was that it depended on the Tooth Fairy – there was no viable revenue model for the systems and we simply depended on the largesse of the federal government.

Today, of course, that model is dead in the US, thanks to political gridlock in Washington DC. The strident opposition in some quarters to any form of infrastructure funding, whether or not it is good for the country, has killed any such plans dead. Without a reliable revenue stream, funding for information systems will be elusive. The only model that has worked is 'eyeballs', or rather 'ears' – the advertising model based on some minimal revenue per thousand patrons. However, for this model to produce significant revenue the customer base needs to be better understood and the ads more personalised. This is what Google is able to do and what some location-based services are attempting to do, but it's simply not enough to support a robust information stream.

If, however, a transportation information system is associated with the transportation payment system then we might have something sustainable. After all, it is in the best interests of the operators of paid transportation services to keep their customers informed. If we have multiple operators in the same system then there is even more motivation to support a robust traveller information system as well as a source of information on the state of the system



INTEGRATED TRANSPORTATION SOLUTIONS

The system that we are describing clearly has benefits to the individual user and can save money for the operator, but it actually has an even more powerful benefit in that it is a traffic demand management tool par excellence.

Until today, public officials only had the bully pulpit as a way to encourage and change transportation usage. When a major thoroughfare closed the local mayor would go on TV to tell people not to drive that route. Now the direct and personal communication possible with users of all transport modes means the message is very different.

How about this scenario of a tough morning on a particular highway? The integrated system can send an individualised message to highway users letting them know where the nearest park-and-ride lot is, when the next train leaves, and if it knows you like a certain cappuccino-cum-latte concoction to get you going in the morning, throw in a coffee coupon for the ride. When you arrive, extra taxis are waiting to take you to your final destination, having alerted the local cabbies to the additional passenger load.

All this, and more, is possible with account-based systems, driven by a single back office financial system processing the transactions from a wide range of transport modes operated by multiple agencies. A system like Cubic's NextAccount makes it possible to treat each event in a journey – buying a train

ticket, or paying a toll – individually. Once you can do this you can look at the journey completely differently. In effect, you can price the complete journey on whether the combination of events it consists of was the best choice for the traveller, or for the authority, and price it accordingly.

This mix-and-match capability is enormously powerful, because it allows operators to tailor travel propositions to individual travellers along the lines of: “The way you chose to travel today was the best possible choice for the transportation network as a whole, so you will pay less than someone who made a less efficient choice.”

If you're able to do this, then those challenges I outlined at the beginning – expanding urban populations putting pressure on finite infrastructure and limited budgets – look infinitely more manageable. And our debt to EZ-Pass looks great indeed. ☺

“The way you chose to travel today was the best possible choice for the transportation network as a whole, so you will pay less than someone who made a less efficient choice”

FYI

Larry Yermack is strategic advisor with Cubic Transportation Systems and founder of Wendover Consult

larry.yermack@cubic.com

www.cts.cubic.com

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The organogram



of a city



Is information management the key to more efficient cities, ask **Richard Shennan and Colum Crawford**

The conversation about making cities more efficient is often centred on the design, construction and operation of physical infrastructure and services. It is essential to get this right, particularly for cities where there is a significant element of new expansion.

However the key to realising the potential benefits in social, environmental and economic terms is the performance of the infrastructure and services as an integrated system and the behaviour of the people that interact with it. Information management is central to this.

DATA, DATA, DATA

The management and maintenance of city assets is all too often a headache for those charged with keeping our cities going. However asset information modelling and management has emerged as a potential agent to help put right much of what is currently wrong with cities around the world. The potential benefits to individual asset owners in delivering better performance, while reducing cost and carbon, have been widely discussed. Yet owners are only in the early stages of understanding what this means. The rapid development of technologies provides the opportunity, but focusing on modelling technology alone will not deliver the results that are so urgently needed.

At a city level, the key elements are:

- long-term vision.
- integration of information across systems and sectors.
- understanding the way in which people access and respond to information (both at professional and citizen levels).
- sharing knowledge across boundaries.

As a vision for future cities, one can imagine city-wide information models, based on the principles of a common data environment and open data transfer

between different technologies. These are the same principles that have been identified by the UK Government's Building Information Modelling (BIM) task group, which has made such a big impact over the last few years. This supplements earlier work by the Department for Transport on Urban Traffic Management and Control over a decade ago. Now is the time to start taking this forward with a strategic plan that can transcend the political cycle. The large amount of data across all sectors that would need to be organised is daunting, but technologies to host data are developing faster than ever. A single version of the truth is likely to end up with less total data than the distributed, duplicated or out-of-date data alternative. With a strategy for data management in place, well organised information generated by new or upgraded infrastructure projects and services across cities could feed in like pieces of a jigsaw, building up the city information map.

An example of organised data generation, as part of urban infrastructure works, is the generic three stage process Mott MacDonald has followed putting an asset model together.

- 1 As with any complex project in an existing city, step one is to gather information about existing assets. This is often inconsistent, out of date or incomplete.
- 2 All gathered information is then inserted into a model. Where provenance or accuracy is uncertain the features are tagged and conventional discovery takes place as works get under way.
- 3 As the works progress, the models are then updated to reflect what is actually there. When combined with the integrated models of the new works this leads to a reliable legacy model of everything.

Imagine if this is fitted into a space in a city information map framework and that all other new or upgraded infrastructure works are required to produce the same standard of information in an agreed format. Pieces would start to join up over the years, with dramatic consequences for efficiency of operation, maintenance and disruption to city life.

SYSTEMS INTEGRATION

Integration across systems can bring another level of benefits in the planning, execution and through-life performance of city assets. Just has been seen in the world of buildings, where collaboration has been identified as a key requirement by three generations of major UK industry reviews dating back over 20 years. The ability to access and make



decisions based on reliable common data across all aspects of city planning is an objective that is now coming within our grasp. Imagine a model that would enable optimisation of planning and development decisions. This could be for new cities and neighbourhoods or major upgrades and be taken on the basis of weighted assessment across systems ranging from energy, water and transportation, to environment, health and education. Many of these are intrinsically inter-related, with opportunities for synergy at almost every interface.

An example of a common data environment at a wide scale is the application of GIS at Mott MacDonald. Organised data with map interface can be used to deliver economic, social and environmental benefits. For example in the West Midlands:

- The transport model built for the Birmingham Box Managed Motorway scheme accumulated and generated data that has lots of other potential uses.
- The PRISM transport model built for the West Midlands integrates data from a wide range of local, national and derived sources.
- Local data, such as planning statistics, public and private transport surveys are collated through partnership with local stakeholders and the Highways Agency.
- In-depth market research is used to reflect the behaviours of the local population, supported by innovative data sources such as environmental and social factors.

The transport model built for Birmingham Box Managed Motorway scheme utilised a common information model to integrate data from a range of local and national sources including; public and private transport surveys and market research which provided a view of population behaviour to the scheme

- National datasets, such as the national PLANET rail and National Trip End Model, contain a vast amount of local and regional transport network data such as road characteristics, signal plans and public transport services.

If integrated, these data sets could offer significant long-term value for other regional projects.

Building on this, both the Apollo system in the UK and FieldBook in the USA bring together data that is used for multiple purposes, ranging from land ownership to utility usage patterns. Through simple apps this information is available to everyone – when and where they need it. By adding a layer of analytics, multiple options can be assessed across different classes of infrastructure to get much closer to optimised outcomes.

INSTIGATING BEHAVIOURAL CHANGE

The act of organising data will not in itself deliver all of the necessary changes – it is the behaviour of people that will make the biggest difference. People respond and react to information and use it to carry out their tasks in a more efficient way, but only if it is presented to them in a way that is simple, focused on their needs and reliable. If any of these criteria fail to be met, the investment required to build and maintain a city information model will not pay its full dividend. There are two primary categories of people who are empowered to make future cities more efficient:

- The population at large in the choices they make and actions they take.
- The technical community responsible for the design, construction, operation and maintenance of the city environment and infrastructure.

The way in which a city's inhabitants behave is central to sustainability. A common aspiration can be established by leadership at local and political level, but information is then required to enable people to make informed choices in support of their overall wishes. Too much information in terms of either volume or technical content will have a negative

effect, so a strategy for city information models must include a clear set of potential data extractions that will meet this requirement. As with all other aspects of the information model, a means of getting data to the point of need is essential.

This is a challenge that Mott MacDonald is helping the London Legacy Development Corporation (LLDC) to address for the first new residential development on the Queen Elizabeth Olympic Park, the site of London 2012. The LLDC are committed to presenting the community with information about energy and water use in a way that encourages responsible, sustainable behaviour. An approach providing residents with comparative assessments, simple financial calculators and possible targeted tips is being considered. It is anticipated that this will maximise behaviour change. However the required investment and delivery mechanism does not fit easily within an isolated project. A city scale approach would make this achievable. Two-way communication between devices and systems within buildings and external utility networks begin to open up the possibility of smart utilities, but the 'Internet of Things' still requires a suitable Wi-Fi connection in every place and a strategy for data exchange and interoperability. Exclusion of the households without Wi-Fi would undermine the cohesion. However a comprehensive and inclusive approach could bring even more benefits, such as providing real-time transport information to individuals, enabling a two-way interaction on public transport services for both providers and users. This would create genuine opportunities for optimisation of resources and services.

At a more practical level, the technical information required to create and operate a city infrastructure is also key. The technology is not the barrier here. The advancement of common information modelling environments, cloud, mobile data, smart devices and augmented reality already offer huge potential. The problems are in the attention to detail required to establish a reliable and ultimately credible data set, the financial structures that do not properly take account of future costs and the uncertainties

Information is required to enable people to make informed choices in support of their overall wishes

ABOUT MOTT MACDONALD

Mott MacDonald is a uniquely diverse £1 billion global management, engineering and development consultancy. It delivers leading edge solutions for public and private sector clients across 12 core business areas – transport, power, buildings, water, environment, health, education, industry and communications, international development, urban development and oil and gas – each of which contribute to Mott MacDonald's smart cities capability and offering.

that surround institutional change at all organisational levels. This is where new city neighbourhoods and developing countries perhaps have an advantage. With less legacy systems, a young population ready to adopt new ways of working and the opportunity to require information generated around the creation of new assets to be organised in a way that meets the overall city objectives, these cities can more readily demonstrate global leadership.

BREAKING BARRIERS DOWN

The final component required to realise the potential for future cities is knowledge sharing. While data can be generated and managed, the creation of useful information from this data and the transfer of knowledge between parties requires willing participants with shared ambitions. Cities need to network in new ways, based on common criteria such as climatic zones, demographics, economics, natural resources and wide area infrastructure. Assessment methods for infrastructure also need to be adapted to local conditions. Even within the small scale of the UK it doesn't make sense to apply the same assessment criteria to the importance of capturing and storing rainwater in Manchester as in Norwich. Global networks of cities with similar issues would be of great value.

As well as the need to openly share ideas and experiences, there is an information management aspect to knowledge sharing. Many urban initiatives are implemented without robust plans for the collection and interpretation of data gathered about actual asset performance and social and economic outcomes. Well-organised data from asset creation combined with ways of easily collecting relevant through-life data can increase the speed at which lessons are learned. Feedback based on



Urban traffic management and control (UTMC) systems can contribute to the creation of smarter cities by providing a common approach to data management and integration, enabling control room operators to be provided with information from a disparate set of sensors from multiple vendors into a single coherent picture, which then allows appropriate information dissemination to the public resulting in improved network operations and informed travellers

good information can lead to greater confidence in adjusting course towards what works best in a cycle of continuous improvement.

New city neighbourhoods and developing countries have an advantage. They can require modelling to be carried out as part and parcel of the creation of new assets. The challenge for existing cities with well-established and complex infrastructure systems is to retrofit data on them into new models over time. This is an exercise that will require a long-term approach and model owners to plan for the handing on of data to successors.

The need for improvement is clear. Terminology may vary between smart, sustainable, future, living or eco, but the reality is that every city, developed or developing, should be driving in the same direction if the global challenge is to be met. Information management and the associated collaborative working across boundaries are things that can be moved forward with immediate effect. ☺

FYI

Richard Shennan is Group BIM Champion/ Divisional Director within Mott MacDonald's Buildings division
richard.shennan@mottmac.com

Colum Crawford is a Senior ITS Engineer within the Transport Technology Services sub-division of Mott MacDonald
colum.crawford@mottmac.com
www.mottmac.com

Environment and Health in Transport

This section looks at the impact that urban and regional mobility has on the environment and on health, and how the adverse impact can be reduced

- Örebro, Sweden – cycling city
- Ghent, Belgium – living streets are the future
- Berlin, Germany – the rise of pedal power
- Milton Keynes, UK – electric bus integration
- Rotterdam, The Netherlands – electromobility
- Emilia-Romagna, Italy – moving, electrically
- Riyadh, Saudi Arabia – lessons learned
- Networked Mobility – what is it and how does it work?



It has been proven, by the World Health Organisation among others, that policies promoting cycling, such as in Örebro, Sweden, yields fantastic health benefits that have a positive influence on the quality of life of the citizens, as well as on their life expectancy.

These individual benefits turn into tangible collective gains, for instance in savings in health spending. The design of the city, the way we live and interact in our neighbourhood, also play a role in how we move and consequently preserve our health. It is not by chance that the Belgian city of Ghent is building an example of a Living City, it is also an example of a city which has successfully supported active modes of transport, such as walking and cycling.

Thinking Cities are Liveable Cities.

Thinking Cities are Healthy Cities.

How to make a good cycling city even better



When a group of international experts reviewed Örebro, Sweden, as a cycling city earlier this year their conclusion was: “There are no reasons not to cycle in Örebro”. But even a good cycling city can become better – **Per Elvingson** takes a closer look at recent developments and upcoming projects



All photos: City of Örebro

We want to build an attractive city accessible for everyone, also for those who cannot afford a car

The citizens of Örebro city centre use their bikes for every third trip. This means that the people living here cycle as much as those in Copenhagen, one of the cycling capitals in the world. A good reason for using the bike in Örebro, a city of just over 100,000 inhabitants 200km west of Stockholm, is that the city is flat and rather compact, which make cycling both fast and convenient. Nearly all citizens have access to a bike.

CYCLING STRATEGY

But it was not until October this year that Örebro got its first comprehensive cycling strategy. It was developed as a part of the EU-funded project CHAMP, which brings together European champion cities in the field of cycling.

“Thanks to the model developed in the CHAMP project the strategy is built on a solid ground. It started with a self assessment, followed by a peer review with experts from participating cities and consultancies. Thereafter we had internal workshops and consultations with both NGOs and regional bodies. Finally we got a decision in the City Executive Committee a few weeks ago,” so says Anna Åhlgren, project manager at the City Administrative Office.

ACCESSIBILITY FOR CAR

Most of the shortcomings identified in the self-assessment and peer review process have been addressed in the new strategy. But it is also true that the strategy in itself will not be sufficient to get a big increase in cycling – it is also important to change the accessibility for cars.

Changes in the infrastructure are however on their way and the political signal is clear: The cars drivers will have to adapt to new conditions in the future. Central streets with many cars today will look different in the future and more space will be given to cyclists.

“Bikes are very space-efficient,” comments Lennart Bondeson, vice-Mayor responsible for sustainability issues.

“Giving more priority to cyclists is a way to maintain high level of accessibility in a growing city. But equally important are the social aspects. We want to build an attractive city accessible for everyone, also for those who cannot afford a car.”

NEW CYCLING NETWORK PLAN

In a new cycling network plan the city focuses on four different layers to optimize the network and to meet the needs of different target groups.

- Main high quality cycling corridors

FACTBOX

Örebro – key figures

Location: 200 km from Stockholm in Sweden

Inhabitants: 140,000

Km roads & streets: 419 km

Km bicycle roads & lanes: 216 km

All trips modal share cycling: 25%
(women 27%, men 23%)

Work trips modal share cycling: 30%

Inner city modal share cycling: 33%

Car ownership: 430 cars per 1,000 inhabitants

Access to a bicycle: 92%

Seriously injured cyclists per year: 6 people (2012)

Bicycle parking in the city centre: 5,800

Other: A university with around 14 000 students



In Örebro cycle paths are given priority over roads

– mainly for commuters travelling at high speed.

- City network and regional routes – high availability and secure travelling between different parts of the city. The regional routes are planned in cooperation with the Swedish Transport Administration and the Regional Development Council.
- Local network – designed for safe transfer to local destinations. Children and elderly are important groups.
- Recreational routes – leisure cycling for the citizens and visitors.

HIGH QUALITY CYCLING CORRIDORS

Örebro is the first city in Sweden to invest in this type of high-quality cycling corridors (i.e. cycle lanes). An extensive and innovative GIS-analysis is the basis for the network plan. The analysis consists of travel surveys and statistics presenting the location of residents and workplaces. Taken together, the 15 corridors will

connect the most important locations and provide fast and comfortable cycling, especially for commuters.

These cycling corridors are distinguished by orange lines separating pedestrians and cyclists, and they also have signs in the same colour. The cycle paths run continuously along the cycling corridors, meaning that cars cross the cycle paths instead of the other way round.

In addition to the continuous cycle paths, the positioning of bicycle detectors, signal poles and push buttons has been reviewed at signal-controlled road junctions.

Cycle route guidance and lighting have also been improved along the cycling corridors.

Five of the main cycling corridors have already been completed and more cycling corridors are in the pipeline this year.

“An evaluation shows that cyclists are on the whole satisfied with the cycling corridors. The continuous cycle lanes reduce the speed of motorists, thus reducing the risk of

accident and injury to cyclists,” says Anna Kero, head of infrastructure at the City Planning Department.

WINTER CYCLISTS

But even more important for the city’s cyclists than an expanded cycling network is perhaps better maintenance of the existing infrastructure, not least during winter months.

Anna Åhlgren maintains that Örebro has a relatively high percentage of people who continue to cycle even during the winter. “When compared to a number of cities in Sweden and Finland, Örebro had the highest proportion of winter cyclists. More than half of the cyclists continue to cycle in Örebro despite it being winter and cold.”

Cycle paths are already given priority over roads, but the strategy also point to the need to raise ambitions regarding snow clearance and grit removal and to have a written maintenance plan for the bicycle network, and inspect the network regularly by bike.



Örebro has developed a cycling account that presents the result of the cycling measures completed during the previous year

BIKE PARKING

Bike parking is another area in the strategy, where an important aim is to provide more safe and secure possibilities. An inquiry is running for the moment to find out what kind of bike racks is favoured among local cyclists and next spring a new storage facility will be inaugurated at the central station. It will be fully automated with an electronic access system and will include recharging possibilities for electric bikes. Commuters are the main target group.

CYCLING ACCOUNT

Also the dialogue with the citizens needs to be improved. As a first step Örebro has developed a cycling account. It presents the result of the cycling measures completed during the previous year and includes several indicators, for example regarding bicycle traffic, infrastructure, maintenance, traffic safety, media and communication, citizens' satisfaction and bicycle theft. "We will do more marketing activities to certain

target groups, but we also want a better dialogue with the cyclists. An advisory committee has recently been started, both to get input of fresh ideas from the users and to increase the understanding of what is possible to reach with limited resources," Åhlgren adds.

Finally a few words about comparing the share of cyclist between cities. At the beginning of this article it is stated that the share of cyclists in the central part of Örebro is at the same level as in Copenhagen. In Copenhagen the proportion of cyclists on trips starting and ending

in the city is 33 per cent but you can count this in many different ways.

Most important is perhaps to develop methods where you can follow the trend in your own city, and also routines to make it possible to compare the result of different measures, projects and investments. This is one of Örebro's pilot projects within the CHAMP project.

The final word goes to Anna Åhlgren: "If we can show results of our efforts it will inspire our own organisation to work even better, and also justify and encourage more investments in cycling." 🚲

FYI

Per Elvingson is climate strategist for the City of Örebro

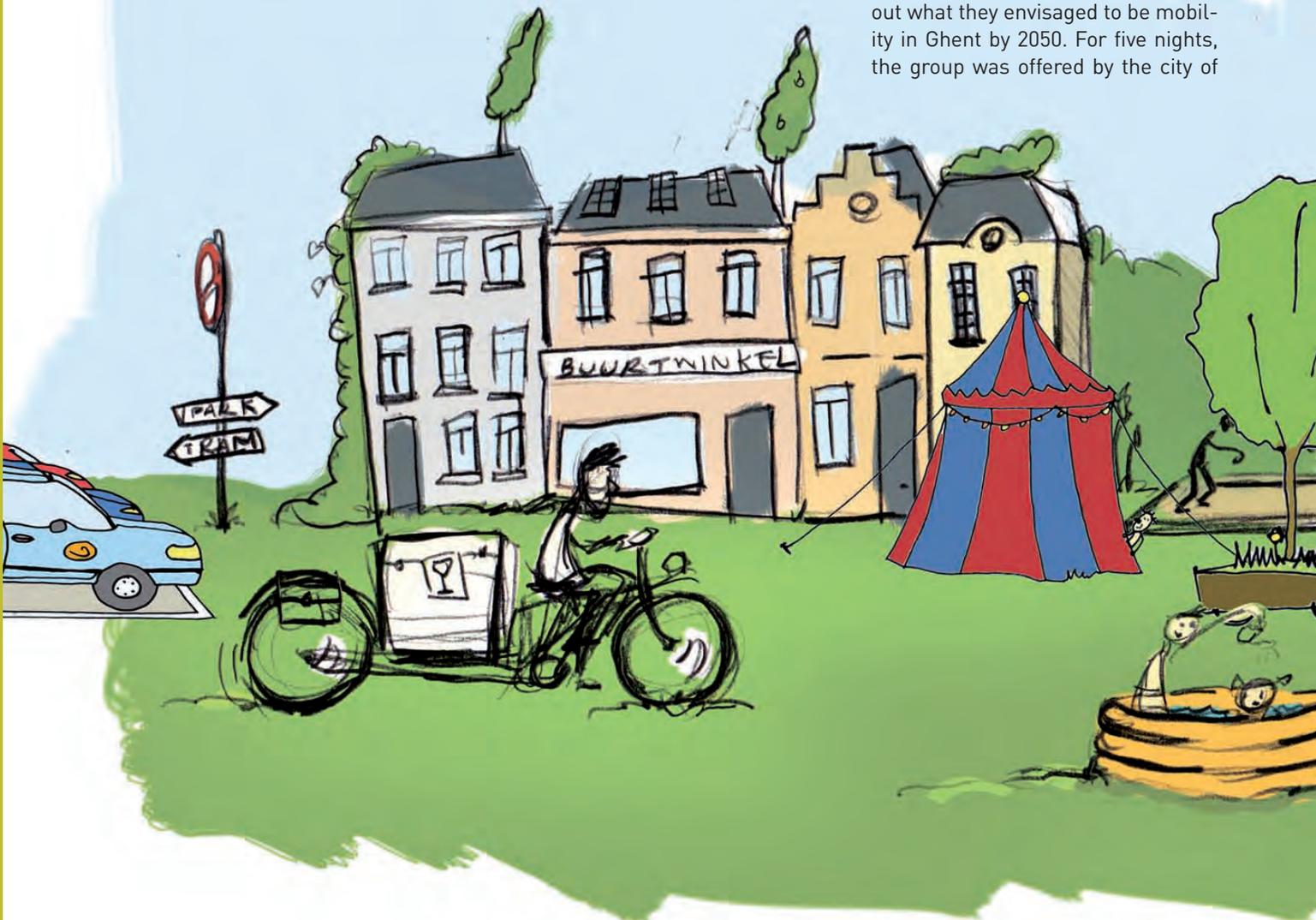
For more information, contact: **Anna Åhlgren**, the City of Örebro, the Unit for Sustainable Development, Box 300 00, SE-701 35 Örebro, Sweden. Telephone: +46 (0)19-21 10 00. Email: hallbarutveckling@orebro.se

Learn more about CHAMP at www.champ-cycling.eu. Here you can find a toolkit for making cycling strategies and examples from the participating cities, including Örebro. Örebro's cycling account can be found here as well.

The living street

What if today you could see what your street will look like in 2050? **Daniela Stoycheva** takes a peek into the future

In 2012, a group of 25 volunteer 'front runners' from the Ghent Climate Alliance (Gents Klimaatverbond), all with divergent backgrounds, came together into a so-called 'transition arena'. Thanks to the INTERREG IVB NWE project Music (Mitigation in Urban Areas-Solutions for Innovative Cities) they were given the assignment to sketch out what they envisaged to be mobility in Ghent by 2050. For five nights, the group was offered by the city of



The vision for 2050 was of liveable streets constituting a network of car-free zones concentrated around central squares

Ghent the necessary time and room to analyse the current mobility system, find out its possible flaws and work out a joint sustainable future scenario consisting of iconic projects. The proposed solutions were put together in "The Bike of Troy".

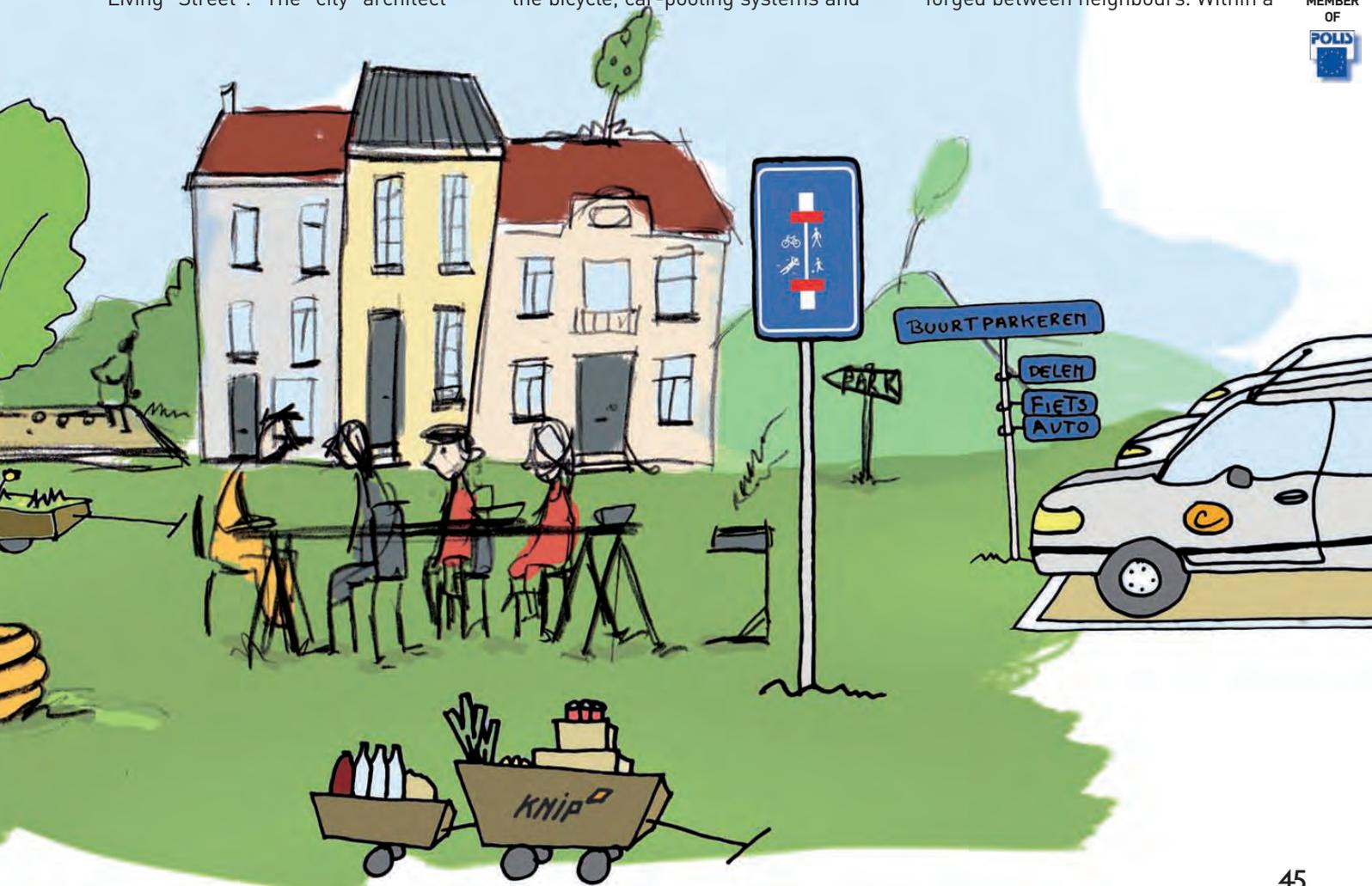
In the beginning of November 2012 these 25 members of the transition arena presented their projects in front of 100 other citizens.

One of these projects was the "Living Street". The city architect

Koen Stuyven challenged current perceptions and realities suggesting leaving cars out of the mindset, trying to make people think out of the box. What if in 2050 there are no cars around and city architects look back to 2012 and laugh at our plans for cars?

The vision for 2050 was of liveable streets constituting a network of car-free zones concentrated around central squares. Strong public transport, the bicycle, car-pooling systems and

alternative transport have sharply reduced the number of cars on the roads. Streets not leading anywhere for through traffic are now "pedestrian only". Parking a car in front of your door is only needed in case there is something to load or unload. Children can come out safely on the street and more meeting space leads to new interaction at street level. Street life becomes more intense and a more cohesive bond is forged between neighbours. Within a



walking distance there is access to a rapid transit bicycle network, a centrally located public transit stop, or one of the many 'short-cuts' that will quickly take you to your destination even on foot.

However, those present at the meeting decided that they did not want to wait until 2050 to see this street becoming a reality. Around 20 citizens from five different streets

started thinking about how they could accomplish this in Ghent now.

MAKING THE 'LIVING STREET' ALIVE

Two roads in Ghent showed readiness to be the test streets of the initiative for the month of June 2013 – Pussemierstraat and Karel Antheunisstraat. The project was presented to all citizens on the streets

by the volunteers. Neighbours would gather in a living room and make the whole street enthusiastic about the idea. Three goals were set for the project:

- experiment with sustainable mobility
- create another approach to public space
- create social interaction between the inhabitants

The idea was to organise something very local, neighbourhood-based, on a small scale, and not big crowds in the centre. The activities were not organised in advance, they would just happen spontaneously. An article in a national newspaper about the project made the idea popular among sponsors who themselves started contacting the volunteers. A large network of sponsors who participated with cash donations was

Pussemierstraat and Karel Antheunisstraat before the transformation (below and left)

Activities were often not planned in advanced but decided upon on the spur of the moment



Ghent's Living Street is owned by the citizens – it's not a project of the city administration

created, with the money used to buy a green carpet, barbecue, benches, etc., with sponsor materials, such as electric and cargo bikes, with checks for the public transport and taxis to use these means of transport instead of the private car and create sustainable mobility. People started experimenting and trying out new things on their living street. Coming back home, they would gather on the street, have a chat and relax, play music, read books, the children would play games, and ultimately create a social space instead of locking themselves inside their homes.

THE ROLE OF THE CITY OF GHENT

The 'Living Street' is a bottom-up initiative by the volunteers from "The Bike of Troy" network together with the inhabitants of the streets. It is an ownership of the citizens, not a project of the city administration. The city of Ghent wanted to create with the 'Living Street' a product people would identify with. The most important role of the city was to create this experimental space and let it happen. Ghent city administration wanted to start this as a temporary approach,

which step-by-step would motivate behaviour change and transform into something permanent. Imposing a permanent vision on the citizens from the outset would be difficult to accept and would not lead to the same enthusiasm.

Two departments from the city administration were involved in the project – the department of environment and the mobility department. The partnership with the city helped the volunteers to organise meetings with the police, garbage collection companies, etc. and obtain permits for closing the streets. The city's role was restricted to only creating the framework for the realization of the idea.

THE LEGACY OF THE EXPERIMENT

Pussemiersstraat has become significantly greener. Neighbours on the street changed the façade of their houses by submitting a common application to the city administration for funding for planting plants in front of their houses. The political consent of the city councillor for mobility was gained to make Pussemierstraat a permanent living street. More than any tangible legacy, the mindset of the people changed proving that a change in mobility behaviour is possible already today. Citizens lived through the process, taking part in every step of it and had thus time to take account of it.

Evaluation of this first edition was made by the volunteers of the Troyan Bike-network together with the city administration and VITO (Flemish institution of Technologic Research).

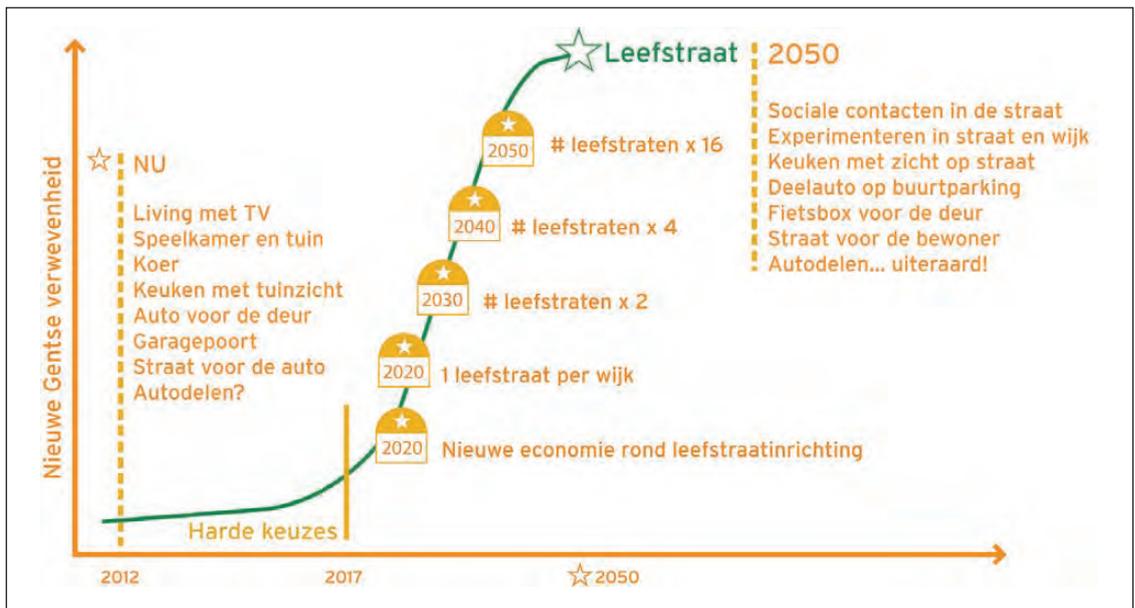


Residents have created a common social space for use by all ages engaged in a variety of activities





Plans for Pussemierstraat (above) and a project progression graph plotting the course of the Living Street (Leefstraat) up to 2050



It will be distributed to all partners involved in the project. A second edition of the "Living Street" is planned in spring 2014. The intention for this new edition is to upscale the concept so that more streets participate. A new, economy-related approach will be tested in 2014. The idea behind it is to create proximity of the food to the people living on the street and try a different kind of shopping than the type we are used to. Instead of making many individual trips to the shop, citizens will make only few big trips that would deliver the food to a close-by depot. This would be a common

depot somewhere close to the street where companies would store food and people would go and collect it by bike or on foot.

An overall objective of the project is to create a network of 'living streets' connected together in the transition arena. The ultimate goal of the project is to see how the city reacts to it, how people more widely react to it, how one can organize it and hopefully when seeing that, the government will absorb these ideas into their policies.

So does your city want to follow in the footsteps of Ghent?

FYI

Daniela Stoycheva is project manager at Polis dstoycheva@polisnetwork.eu

Special thanks to Mr Dries Gysels from the Department of Environment, city of Ghent, Mr Tim Scheirs from the Mobility Department, city of Ghent, and Karel Vancoppenolle, volunteer who started the 'Living Street' experiment for providing valuable information for this article.



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Saddle up

Martina Hertel and **Jörg Thiemann-Linden** encourage Berlin commuters to do the modal shift

The electric bicycle pedelec (Pedal Electric Cycle) belongs to the group of light electric vehicles (LEVs) and is still legally a bicycle, not a motor vehicle according to EC Directive 2002/24/E and in Germany according to section 1, paragraph 3 of the Road Traffic Act (Straßenverkehrsgesetzes (StVG). Driver licence, insurance identification and helmet are not mandatory. Characteristics are the engine support when pedaling alone – up to 25km/h limit support – and an engine power up to 250W.

“E-Bikes” are mostly understood as faster, electric-powered vehicles, where the control of the engine works via the handlebar grip. The terminology is sometimes ambiguous and often the statistical boundaries are indistinct or even doubtful.

Largely because of the aforementioned pedal assistance up to 25km/h, pedelecs are becoming increasingly popular. Pedelecs ease cycling and increase cyclists’ range and spatial coverage. Over the last few years pedelecs have lost their image of a means of transport for the elderly and they are now seen rather more as an expression of individual lifestyle and are possibly on the way to becoming something of a status symbol.

In 2013 over 1 million pedelecs were in stock in Germany but various studies show that the current use of pedelecs predominantly occurs in



It is hoped that the pedelec corridor will encourage Berlin commuters to leave their cars at home

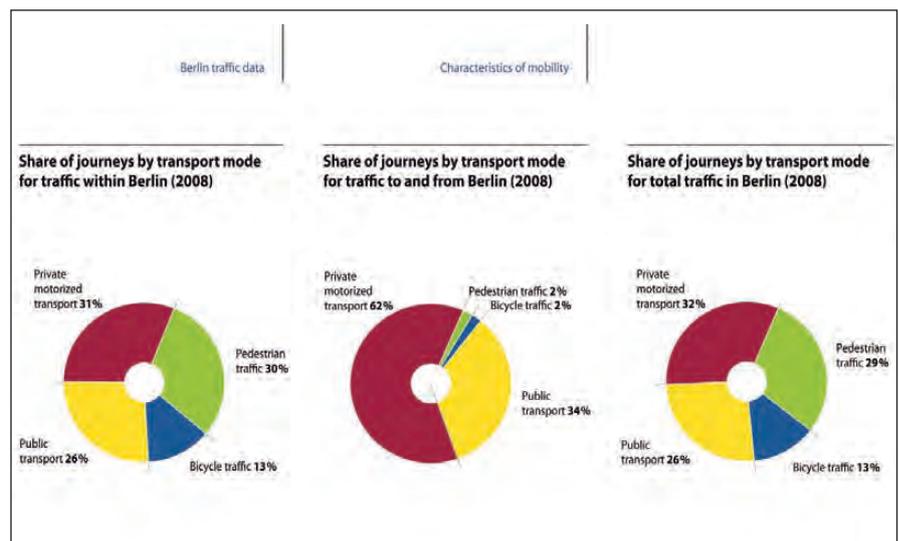


Figure 1: modal split of Berlin (2008).

Source: *Mobility in the City – Berlin Traffic in Figures* (edition 2010)

*Over the last few years
pedelecs have lost their
image of a means of
transport for the elderly*



Most pedelec use is associated with leisure and holiday journeys and takes place in more touristic areas

the tourism sector (leisure and holiday trips) and lies mostly in suburban and rural, often touristic areas. The use of pedelecs in everyday traffic has – although the pedelec is known as an individual, eco-friendly, space-saving, health-promoting and innovative means of transport – not yet established itself as a substitute for cars. The impediments are presumably the relatively high cost of a new machine, the high risk of theft and lack of safe parking options have emerged, in particular, in built urban environment.

THE GERMAN ELECTROMOBILITY SHOWCASE INITIATIVE, A NATIONWIDE PROGRAMME

The German Federal Government wants Germany to become the lead market for electric mobility and in 2011 it launched an Electromobility Showcase initiative, a nationwide program highlighting Germany's electric mobility expertise. On the basis of a resolution adopted by the German Bundestag, the Federal Government was given the task of supporting and promoting research and development into alternative drive systems. As a result, they made available a total of €180 million in funding for the Showcase programme. The objective of these large-scale regional demonstrations and pilot projects is to test and promote electric mobility at the interface of energy systems, vehicles and traffic systems.

The aim of the showcase projects for electric mobility is the vivid illustration of how electric vehicles can penetrate everyday life. Since April 2012 Berlin-Brandenburg has been one of four regions chosen to take part in the Electromobility Showcase initiative. The showcase combines Berlin City as an internationally oriented city and Brandenburg as a rural region but important for Berlin's energy supply. The "pedelec corridor project", which is described below in more detail, is linking both

The willingness to move towards a multi-modal future is growing

Berlin and Brandenburg. In Stuttgart (Baden-Württemberg) the Transport Association is setting up more than 10 "e-bike stations" with charging options. In the Lower Saxony (Region Hanover) showcase in the city of Göttingen, Germany's the first "electrified cycle highway" ("e-Radschnellweg") is already under construction.

PEDELEC PROJECT IN BERLIN/ BRANDENBURG

Initiated by the Senate Department for Urban Development and Environment of Berlin, the Land Berlin (16 Länder make up Germany's partly sovereign constituent states) finances the pedelec project and has already achieved a reduction in car

commuters. The conditions for such a project are excellent in Berlin: the car is gradually losing its symbolic value for the younger generation and is increasingly considered, from a purely practical point of view, as one of several means of transport. The tendency and the willingness to move towards a multi-modal future is growing and moreover the change to multimodal transport with electric vehicles serves the aims of the Berlin urban development to implement a new city-friendly mobility culture. In this context pedelecs are particularly relevant for longer commuting distances but so far pedelec use in metropolitan Berlin is still very poor, arguably due to the lack of theft-proof storage space.

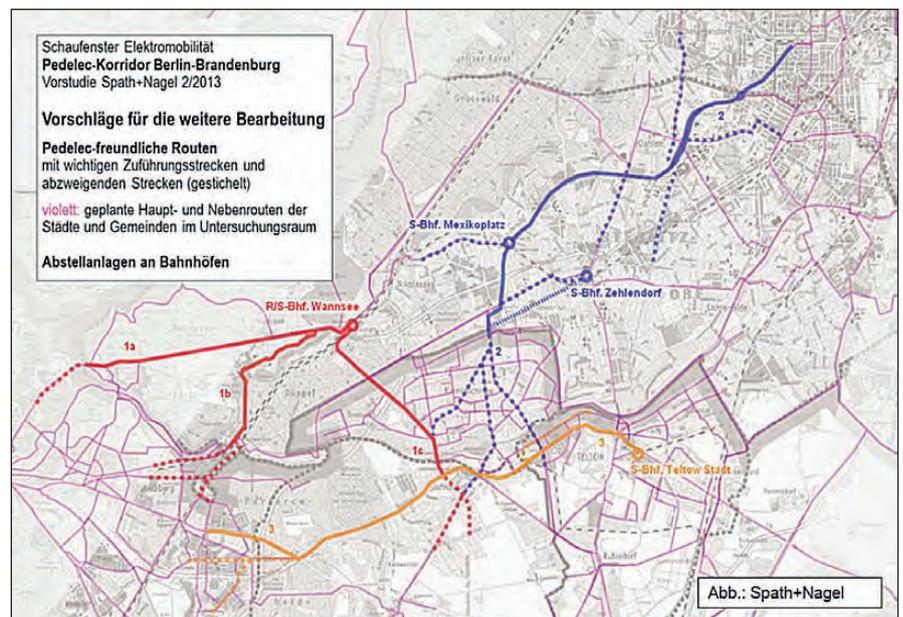


Figure 2: Corridor as an experimental area with pedelec-enabled cycling connections and stations

Source: Preliminary core project A6 – pedelec corridor "500 electric bicycles for Berlin-Brandenburg" (unpublished)

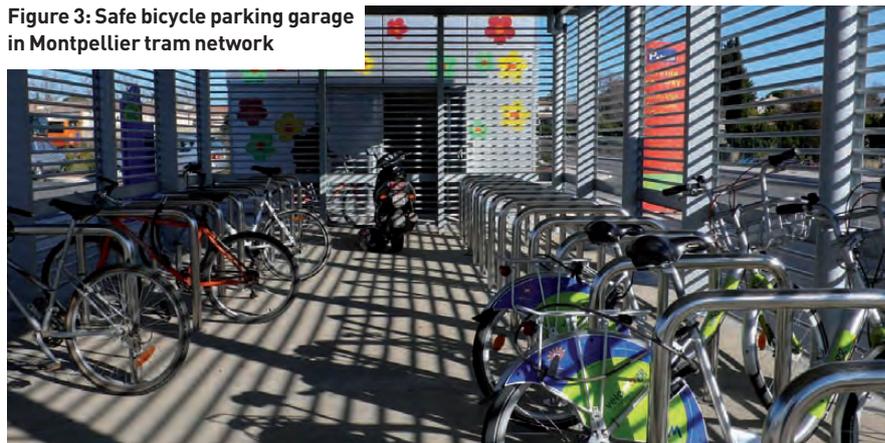
Promoting the take-up of pedelecs in Berlin is part of the new cycling strategy of Berlin¹ as the increase of cycling improves the quality of life in the long term. However, action is required to address the numbers of commuters from Brandenburg that travel by car (Figure 1) – the pedelec can make a significant contribution towards addressing this problem. A corridor as an experimental area between the large urban districts Friedenau and Steglitz in Berlin up to the suburban municipalities Stahnsdorf/Kleinmachnow/Teltow in Brandenburg was selected (Figure 2). This corridor locates relatively high-income households that often possess a secure garage to store the pedelec and are also able to connect the battery to the power supply.

PEDELEC-CAPABLE CYCLE SCHEME AND SECURE PARKING

More bicycle/pedelec usage will contribute to better accessibility to the shopping locations both in Berlin and the Brandenburg municipalities which will consequently ease the car parking demand there. Bicycle retailers will get a stimulus for more engagement on their specific skills necessary in the pedelec market.

Compared to other bicycles, pedelecs can travel at much greater speeds, one advantage of which is less door-to-door travel time. Pedeling support is limited up to 25km/h but not the acceleration while starting the ride. This means it becomes a more attractive travel mode and a larger modal share of cycling is expected accordingly. But what does this mean for a suitable cycling network in future? In the project's corridor area some example street shapes will be implemented, mainly new cycle lanes on wide carriageways. This should not stress the limited budget too much but will

Figure 3: Safe bicycle parking garage in Montpellier tram network



need political courage to rearrange the road's cross-section.

As part of the project companies in the area will be required to provide battery charging and secure parking on their premises. The staff will have pedelecs available on a temporary basis for 2 to 3 months at a time for their own testing. It is hoped that the employees who sign up to the project will quickly realize the benefits of engaging in a healthy physical activity, and it will also do wonders for for the company's limited spaces and its public image.

The pedelec acceptance and usage within this mobility management initiative is to be monitored by accompanying research. The main focus is on the social groups with good or poor response to the pedelec usage. The main question is on the conditions to be provided by a "pedelec system" for modal shift from driving to cycling.

Train stations as pedelec destinations are also the subject of some focus of the project. As a condition of the project secure and attractive storage space for the expensive pedelecs must be provided for "bike & ride" schemes (Figure 3). Research in that field has only just commenced, but there is a great need for action to meet the pedelec's

everyday mobility needs. Important questions concerning the structural design of the pedelec parking spaces at railway stations and possible operating models of community garages have begun to be asked. This topic of discussion is still developing recently and promises significant innovations during the project period. Therefore, a study of expected electro-technical innovations will be carried out before any investment will take place.

Other aspects will be considered as well: On one hand, pedelecs will shift new users to public transport as due to public transport deficits in the surrounding suburban area, pedelecs offer an interesting option to complement public transport. On the other hand, especially the S-trains in the corridor area suffer congestion in the morning peak hours and pedelecs can help to significantly ease the situation. 🔄

FYI

Martina Hertel and **Jörg Thiemann-Linden** work for the German Institute of Urban Affairs in Berlin

hertel@difu.de

thiemann-linden@difu.de

www.difu.de

www.nationaler-radverkehrsplan.de/pedelec/

NOTE

1 NEW CYCLING STRATEGY FOR BERLIN 2013 <http://edoc.difu.de/edoc.php?id=D128IT4B>

Electric avenue

Denis Naberezhnykh and Ben Godfrey
discuss the integration of electric buses with
the electricity distribution network



Installed IPT charger in Wolverton,
Milton Keynes, UK

The Milton Keynes demonstrator project will be installing two inductive chargers at either end of the number 7 bus route

A Thinking City can mean different things to different people. A Thinking City could be described as a city where the use of limited resources and infrastructure is optimised in order to respond to demand in real time, while trying to minimise adverse effects on the provision of other services and use of other infrastructure. By doing so, it is possible to improve the efficiency and effectiveness of existing infrastructure, leading to a more sustainable society that is able to cope with the growing demands placed on our energy and transport infrastructure in cities.

In order to achieve this long-term vision of a Thinking City, the integration or, at the very least, communication between the different elements of city infrastructure is now required.

Imagine a city where all public road transport is electric and is not restricted by battery range as it charges wirelessly directly from the road as it continues its daily operations, producing no local air pollution and drastically reducing national CO₂ emissions. In order to make sure that the local electricity distribution network is able to cope with the additional demand on the network, the buses continuously report their progress along the route along with their battery state of charge (SoC). The distribution network is then able to combine this information together with real time data on the quality of the network and prioritises charging of each bus accordingly. At the same time, other buses with excess battery



Number 7 bus route in Milton Keynes with three charger locations

capacity are able to feed power back into the grid in order to provide additional reinforcement if required. This vision of a Thinking City may not be as far from reality as it may first appear.

Demonstration of the possible impacts and opportunities of integrating elements of the transport system with the electricity distribution network is the aim of the Electric Boulevards project, a joint Western Power Distribution (WPD) – TRL, Low Carbon Network Fund (LCNF) project taking place in Milton Keynes, UK, a city some 100km north of London.

ELECTRIC BOULEVARDS

An entire bus route going all the way across Milton Keynes between Wolverton and Bletchley is being electrified as part of a demonstration programme. All eight buses on the route will be replaced with electric buses and to ensure that they are able to complete the demanding daily

duty cycle without needing to stop for recharging or running out of battery charge, the buses are being equipped with inductive power transfer (IPT) chargers that enable the buses to opportunistically charge during end of route stops through the day.

In order for this concept to be feasible and not to disrupt existing timetables, charging of the buses must happen over a very short period of time during scheduled end of route stops. This requires a very high level of power transfer of 120kW between the grid and the bus. For comparison, a typical electric car public charging post delivers between 3 and 7kW of power. Use of such high power transfer rates can place a substantial demand on the electricity distribution network and potentially introduce disturbances into it. WPD are investigating the impacts that the use of such buses and chargers can have on their distribution network and together with TRL, are investigating the feasibility of intelligently managing this impact, as well as identifying opportunities for improving the quality of the distribution network through the use of intelligent charging and vehicle to grid (V2G) applications.

INDUCTION COURSE

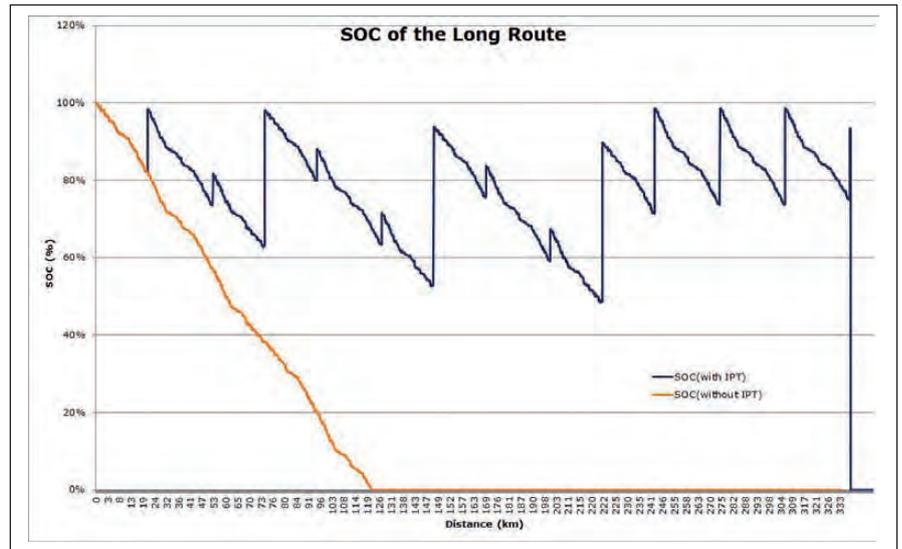
The Milton Keynes demonstrator project will be installing two inductive chargers at either end of the number 7 bus route, at Wolverton and Bletchley. In order to fully investigate both the impact of the inductive charging equipment on the

distribution network and potential for intelligent management of the chargers based on the condition of the distribution network, (without jeopardising the operation of the demonstrator), the project will install an additional, third charger at another location where the buses stop during the day – Central Milton Keynes (CMK) bus station.

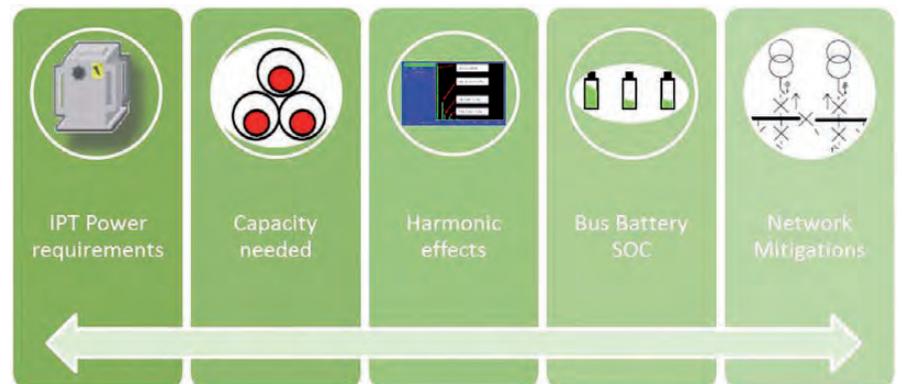
This set up, and in particular the use of the third charger, allows the project to examine the impacts on the distribution network at different times of the day and at different locations. More crucially, it allows varying when and how much power is delivered to the bus from the third charger based on the condition of the network at the time.

Of course, a Thinking City doesn't have to stop at optimisation of charging of electric vehicles in order to manage the load on the distribution network. Spare capacity of the on-board batteries in the buses could be utilised to feed power back into the network when existing loads become too high, or the power electronics in the charging equipment can be used to provide additional filtering on the network.

The Electric Boulevards project is also investigating the feasibility of such V2G applications. However, during the demonstrator it would be undesirable to discharge the vehicle battery directly and risk insufficient remaining capacity to complete the remainder of the daily duty cycle until a feasibility assessment has been carried out. Therefore, a stationary battery bank is being installed near the CMK charger in order to simulate the on-board battery of the bus by replicating the available capacity and SoC, and providing battery to grid (B2G) capability when necessary. In an actual implementation in a Thinking City, this B2G capability could be provided by the batteries on board the bus as a V2G application, at whichever location it happens to be



Example of bus battery SoC change through the day with and without the IPT charger



Issues to be considered in integration of electric bus IPT charging with the electricity distribution network

charging at the time. The additional benefit of having a battery bank near the charger is that the battery can be used to provide the energy and power required to the chargers, instead of placing the entire load directly on the distribution network at peak time. The batteries can then be recharged off peak.

PROGRESS TO DATE

The Electric Boulevards project is an example of how two separate systems, the public transport system represented by the electric buses and the energy system, represented by the distribution network, can be

combined to achieve better performance as a joint system than they would do independently. The use of electric buses reduces national CO₂ emissions and improves local air quality while the use of high powered IPT chargers makes it possible to use electric buses on a demanding route without running out of charge. At the same time, understanding IPT charger demand and bus batteries' SoC throughout the day helps to mitigate any negative impact on the electricity distribution network, while using V2G could improve the quality of the network. All elements of this system are working in harmony

THE ROAD AHEAD

The reality of Thinking Cities may not be as far away as some may think. The Electric Boulevards project is already investigating many of the elements necessary for the smart integration of transport, energy and communication systems to enable improvements in the sustainability of the transport and energy networks without the need for extensive reinforcement of the existing distribution network infrastructure.

Electric buses are due to commence their service as part of the demonstrator in Milton Keynes at the end of November. The resulting demand, load and disturbances on the network will be analysed by WPD and TRL and intelligent management of one of the chargers will be trialled. If anticipated benefits of the integrated approach materialise, then this concept could be rolled out in other cities, gradually increasing the amount of real time control over the charger power output and availability.

carried out preliminary modelling in the project.

It was largely found that under optimal operating conditions, two chargers should provide sufficient opportunistic charging throughout the day to ensure all buses are able to complete the route with contingency battery capacity remaining of at least 35% by the end of the day.

However, with two chargers, only limited opportunity exists to reduce charging power during times of high demand or to cope with reduced charging efficiencies. The quoted efficiency for perfect alignment of primary (road coils) with secondary (vehicle coils) is 90%. Two charger arrangement could allow tolerance of reduced power transfer efficiencies of up to 70%, equivalent to 84kW, assuming all other parameters remain under optimal operating conditions throughout the day.

The addition of a third charger could allow the buses to function with much smaller batteries or to significantly reduce charger power at times of high load on the distribution network, down to 56kW. Alternatively, utilisation of chargers can be changed to minimise charger use during peak network load. ☺

to achieve optimum efficiency and effectiveness while improving the overall sustainability of both systems.

To a large extent this concept has been made possible through the use of high powered IPT charging, which allows opportunistic, wireless and automatic charging of electric buses with high power and minimum driver intervention. Because the chargers can be seamlessly integrated into the road surface, they help to reduce unnecessary street clutter; are not reliant on drivers remembering to plug them in; are not subject to vandalism or accidental vehicle damage and, are capable of transferring high power without increasing the risk of electrocution.

A real time communication and control link between all of the different components of the system was not set up in the project because the risk of disruption to the bus service through real time control would be too great before the concept is proven. Therefore, the project is analysing recorded data from the electric buses used in the demonstrator; all three chargers; the battery bank and from the distribution network equipment. From this it will be possible to implement changes in how the third charger is used based on patterns identified in the analysed data.

POWER STRUGGLE

In a Thinking City set up, all of the systems would be communicating in real time and allowing real-time control of the subsystems to actively respond to demand from the vehicle batteries and load on the distribution network. This highlights the importance of the communication network in enabling the integration of the energy and transport networks. TRL's preliminary analysis shows that in order to capture and analyse sufficient data to assess and manage peak power demand and harmonic disturbances on the network, up to 63MB of data per 24 hours will need to be captured and communicated from each substation. Furthermore, up to 3.6MB of data from each stationary battery bank and up to 217MB of data from each IPT charger and each bus will be required to be captured and communicated to the back office every 24 hours. Most of this would be required to be communicated wirelessly in real time and, if large numbers of buses and chargers are in use, then high-speed wireless communication through 4G or WiMAX becomes preferential.

In order to gain an understanding of possible charger utilisation; energy demand from the network and to perform a sensitivity analysis of the anticipated demand, TRL has

FYI

Denis Naberezhnykh is Head of Low Carbon Vehicle and ITS technology at TRL.
dnaberezhnykh@trl.co.uk

Ben Godfrey is Innovation and Low Carbon Networks Engineer at WPD.
ben.godfrey@westernpower.co.uk

Western Power Distribution is the distribution network operator for the Midlands, South West England and South Wales, and is responsible for delivering electricity to approximately 7.7m customers in the UK.

The future is electric



ROTTERDAM.CLIMATE.INITIATIVE

Rotterdam has embarked on a new phase of electromobility as **Lutske Lindeman** and **Arjan Orange**, two of the project's main protagonists, explain to **Ivo Verhoef**



Municipality of Rotterdam/Herman van Gestel

By the end of 2014 we want the city to have an infrastructure in place of 1000 charging points, and 25% of the municipal fleet should consist of electric vehicles

The tipping point will not be achieved until electric vehicles can be sold at a competitive price compared with regular petrol and diesel models

Electric transport plays a prominent role in Rotterdam's sustainability and climate ambitions. In this respect, the city maintains a clear vision on the mutual roles of the government, market parties and citizens.

"Electric transport is important for the city for several reasons, but particularly when it comes to our ambitions with respect to the reduction of CO₂ emissions and air quality improvement," according to Lutske Lindeman, programme manager of Rotterdam Elektrisch (Rotterdam Electric). "For instance, we aim to achieve a 50% reduction of CO₂ emissions by 2020 as compared with the levels of 1990. In addition, we have defined a number of policy objectives in the Rotterdam Programme on Sustainability and Climate Change (Programma Duurzaam), the Rotterdam municipal executive work programme that started in 2010 and will run until 2014."

A number of these objectives are related to electric transport. "By the end of 2014, for example, we want the city to have an infrastructure in place of 1000 charging points, and 25% of the municipal fleet should consist of electric vehicles. By 2020, we aim to have 20,000 electric cars in the city," she says.

ROLE OF THE MARKET

At this point, the main obstacle is the price of electric cars, according to Lindeman.

"They are still too expensive for many people, but this may change

quickly. Today, almost all of the major car manufacturers offer electric vehicles in their model ranges and a large number of new models are expected to be launched next year. Prices are expected to decrease as volumes increase."

Nevertheless, the market for electric vehicles is still far from mature, as Oranje states. "We have looked into the best way to contribute to this process from a government point of view." He feels that the development of new products and technologies is a role that market parties should take up.

So what is the view of the City of Rotterdam on their role in this process?

"We focus on three specific key areas that offer the best opportunities to facilitate the market," Lindeman declares. "These key areas are the development of a charging infrastructure, communication and public information on electric transport and building up a reservoir of knowledge and experience through pilot projects in conjunction with market parties and other organizations."

INFRASTRUCTURE

"The infrastructure of charging points is a prerequisite to persuade consumers to buy electric cars. Therefore, it is our job as a city to ensure that the infrastructure is in place," insists Oranje. In this process, the city acknowledges that the technology for charging systems may be subject to change in the future. "However, we have decided to develop a working

infrastructure at this point, using technology that has proven itself in practice," he says. The city is right on schedule with the installation of charging points and by the end of 2013 we will have 500 charging points in place.

"If we proceed at the same speed, I am confident that we will achieve the goal of 1000 charging points by the end of 2014."

COMMUNICATION

Raising awareness and creating support is yet another important task for the municipality when it comes to promoting electric vehicle use. Oranje says: "Our approach is tailored to the specific target groups. Apart from websites and flyers containing general information, we have set up a special information centre in the city to provide citizens and businesses with targeted advice. Furthermore, we have appointed a so-called 'EV-Makelaar'

E-networking

Rotterdam actively participates in initiatives including the following national and European networks and projects:

- Formule E-Team
- Hybrid User Forum
- Clean Fleets project
- TIDE project
- FREVUE project
- Polis
- Eurocities
- HyER
- Life+

A HANDS-ON APPROACH TO INNOVATION

Rotterdam considers innovation a key factor in realizing its electromobility ambitions. In this process, the city relies primarily on the innovative forces of local private citizens and businesses.

“Instead of simply handing out subsidies, we listen to private citizens and companies who propose initiatives, and find ways, as a municipality, to help them. We do this by leveraging our communication channels and our knowledge network, and by removing barriers in policy and regulations,” says Lode Messemaker, coordinator of Innovation Projects and Vehicle Fleets of the City of Rotterdam. To illustrate his point, he provides two practical examples.

ELECTRIC URBAN DISTRIBUTION BY HEINEKEN

Early in October of 2013, Heineken beer brewery deployed the largest fully electric commercial vehicle in Europe. Heineken developed this truck in collaboration with Hytruck, G. van der Heijden Distributie B.V. and the City of Rotterdam. Heineken uses this commercial vehicle in a pilot set-up for urban distribution. “We offered Heineken facilities including a communication platform during the important Ecomobiel trade show that took place in Rotterdam in October. In addition, we conduct studies in conjunction with market parties such as Heineken into adaptation of the so-called allowed delivery times for electric freight traffic into and out of the city centre.”



Flashart, Daniëlle van Leeuwen

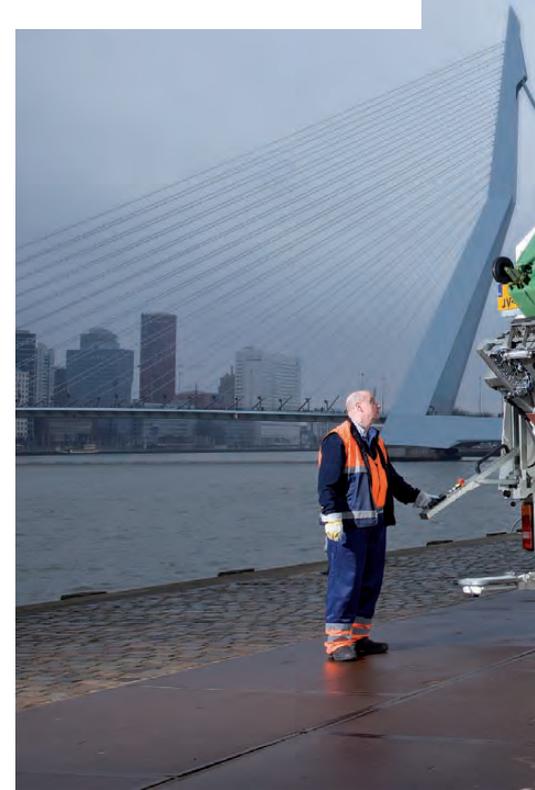
ELECTRIC SCOOTER FACTORY (ESFA)



A Dutch manufacturer of electric scooters approached the City of Rotterdam, stating that, primarily for environmental reasons, he wanted to relocate his manufacturing operations to the Netherlands. “In order to find a location, we introduced him to the Port of Rotterdam Authority, who run the RDM Campus in the port area, a business location that was specifically set up to accommodate

startups and innovative companies. This is where the Electric Scooter Factory Rotterdam is currently located and where the company has a partnership with DAAD, an organization that helps long-term unemployed persons reintegrate into the labour market. Furthermore, we purchased ten electric scooters, and subsequently brought the initiative to the attention of our partners. Within fourteen days, he had signed one hundred orders.”

Among Rotterdam’s fleet of electric service vehicles is a Hybrid Volvo refuse collection truck



(electric transport broker) to visit companies to discuss and enumerate the options and opportunities of electric vehicles.”

In fact, the charging points themselves prove to be particularly effective means of communication.

“I have personally experienced that people came up to me while I was charging my car and enquired about it. People are triggered once they see how it works in practice,” recounts Lindeman. “Whenever people apply for a charging point, we therefore invariably write a letter to their neighbours to inform them and call their attention to electric transport.”

PILOT PROJECTS AND ALLIANCES

To promote the further rise of electric cars, Lindeman firmly believes that the city needs to expand its knowledge and experience.

“This is why the city participates in

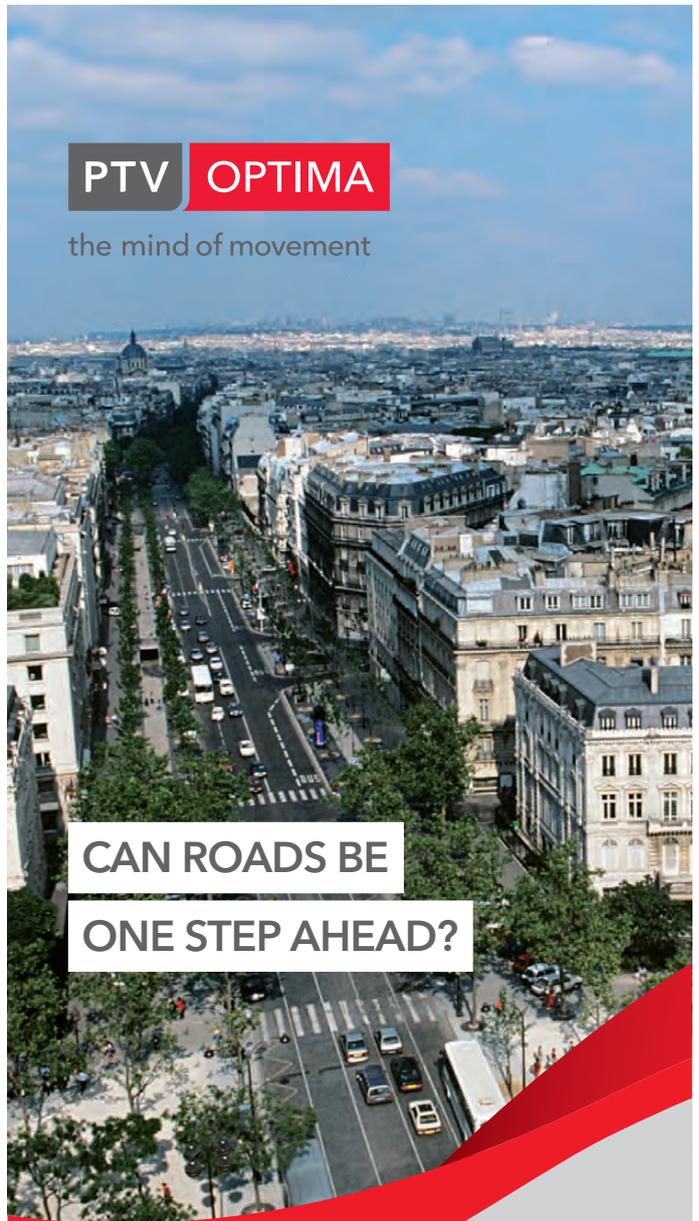


a large number of research projects and networks. To name one example, together with power company Eneco and network operator Stedin, we monitored the use of our three vehicle fleets. The results showed that

**Mrs Alexandra van Huffelen,
Alderman for Sustainability,
the City Centre and Public
Spaces and Vice Mayor of
the City of Rotterdam**



'As a world port city, Rotterdam accepts its responsibility for a sustainable future. The municipality is doing this by promoting electric transport among other things. Electric vehicles are clean, quiet and efficient. Rotterdam wishes to accelerate the introduction of this form of transport and sets particular effort to achieve the maximum results possible.'



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The infrastructure of charging points is a prerequisite to persuade consumers to buy electric cars. Therefore, it is our job as a city to ensure that the infrastructure is in place

even today, it is possible to replace 60% of our smaller vans by fully electric equivalents. These study results can also be used to convince businesses and other parties.”

The city collaborates with various tiers of government and market parties at a regional, national and international level.

“This includes conducting meetings with car manufacturers in order to scope out new technologies they are working on. One of our contacts at Renault recently told us that their head office in Paris regards the Netherlands as a front runner when it comes to electric transport,” says Lindeman. “I must say I was rather proud to hear that.”

THE FUTURE

Lindeman continues by announcing that Rotterdam has now reached a level where it is meaningful to evaluate the concrete effects of the increased numbers of electric vehicles in the city.

“However, it is still too early to discern a material impact on CO₂ emissions and air quality,” she adds. “This will have to wait until thousands of electric vehicles cruise the city streets on a daily basis. And the tipping point will not be achieved until electric vehicles can be sold at a competitive price compared with regular petrol and diesel models. In addition, the development of a mature used vehicle market is important, as is a nation-wide approach in creating a charging infrastructure network that covers the entire country, not just the large cities.”

TIME FOR THE NEXT PHASE

“In the past few years, we, as a city, have contributed to the promotion of electromobility. Now, the time has come to embark on the next phase, in which we will pursue more benefits of scale, create pressure to preserve tax incentives, and strive to develop a

nation-wide charging infrastructure network,” Lindeman and Oranje conclude. “The practical details will have to be fleshed out as we go along, in collaboration with the other parties involved. In any event, it is clear that we cannot afford to lose the current momentum.”



Municipality of Rotterdam/Herman van Gestel

The city is right on schedule with the installation of charging points

FYI

Lutske Lindeman is programme manager of Rotterdam Elektrisch (Rotterdam Electric)

Arjan Oranje is project manager of Oplaainfrastructuur Rotterdam (Charging Infrastructure Rotterdam)

<http://www.rotterdam.nl/elektrischrijden>

<http://www.rotterdam.nl/Stadsontwikkeling/Document/Rotterdamelektrisch/120529%20vastgesteld%20Kader%20Oplaainfrastructuur%20auto.pdf>

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Innovation for better mobility





A moving story

Mi Nuovo Elettrico (I Am e-Moving) is Emilia-Romagna's innovative strategy for electromobility.

Tommaso Simeoni discovers that it's more than just a case of adding charging points

Mi Nuovo Elettrico is an electromobility programme launched by Italy's Emilia Romagna Region in 2010 to develop the infrastructural network. The goal was very ambitious: to develop a plan with charging points for electric vehicles all around the region of 4.5m inhabitants and not only in an urban context.

The idea is based on two principles:

- the interoperability on a regional scale
- the integration of all available mobility services.

The final goal of the programme was to promote and disseminate the principles and benefits of e-mobility at the regional level. The Emilia-Romagna Regional Government signed agreements with the three electricity providers operating in the

region - ENEL, HERA and IREN - and also with the main municipal administrations. According to these agreements an innovative charging points network, included in the "Mi Nuovo" integrated ticketing chip card, was set up and e-providers were bound to realize the infrastructure (Mi Nuovo Elettrico is therefore a free programme for the public authorities) and to cooperate with each other to ensure the interoperability of the network. Now users can recharge electric vehicles regardless of the energy provider.

With the "green corridor" mainly located on the south east-north west historical Via Emilia axis, it is today possible to use the electric vehicles in the entire territory.

Besides the public and private partnership agreements, the Emilia-Romagna Region fosters electric

WHY SHOULD ELECTRIC VEHICLES BE DEVELOPED?

Strong reasons to promote electric mobility with electric vehicles are:

DIRECT BENEFITS	No noise pollution
	No air pollution and zero greenhouse gas emissions, when electricity is generated from renewable sources (as it is the case in Emilia -Romagna)
	Possibility of being integrated in smart grids
	Economic benefits (for owners)
INDIRECT BENEFITS	Mobility cost reduction thanks to more energy efficient electric engines
	Decrease of the dependence from fossil fuels and indirect support for renewable sources development (if it is required that energy come from renewable sources)



mobility also through:

- incentives for the procurement of low impact buses (electric, trolleys, hybrids, natural gas and LPG powered). Trolleys circulate today in Parma, Modena, Bologna and Rimini for a total amount of a 120-vehicle fleet;
- incentives for the purchase of e-vehicles (included scooters and e-bikes);
- communication and information campaigns to raise awareness;
- the promotion of the use of eco-compatible vehicles.

RESTRICTED ZONES ACCESS

In line with the regional policies to reduce congestion, pollution and CO₂ emissions, moreover the Region promotes e-mobility through the harmonization of the rules for access and parking inside the limited access areas, achieved in October 2012 though an agreement with the main cities. Electric cars have free access and can park for free within the restricted zone access h24 on blue stripes in all the Region.

THE E-VEHICLE CHARGING INFRASTRUCTURE

The charging points are the key elements of the project and they need to:

- have interoperable standards;

- be placed in a good location, near to LPT services or point of interest (cinemas, shopping centres, etc);
- display high level of technology, in order to guarantee the access to the smart grid.

Interoperability is the key-issue in the “Mi Nuovo Elettrico” plan. It is now possible to charge electric vehicles all across the region regardless of the electricity provider, and to use the regional mobility chip card “Mi Nuovo” held by Public Transport users, and bike sharing and car sharing subscribers.

In order to ensure an adequate coverage of the infrastructure, the location and the number of charging points have been defined in cooperation with the municipalities.

In order to facilitate the access to already circulating vehicles fleets, the charging points use two different plug typologies, SCAME and MENNEKES. The innovative technologies adopted allow the flexible energy flows management at the various grid knots. In this framework, it will be possible for every smart access to the network, such as, for instance, the charging points for e-cars, to communicate with the entire grid and to adapt the performance according to the system needs. In the future, an electric car connected to a charging point will be able on the one hand to recharge the battery and, potentially, also to upload electricity to the grid.

CERTIFICATED ELECTRICITY GENERATED FROM RENEWABLE SOURCES

Aiming at reinforcing the commitment for environmental sustainability, all the above mentioned agreements signed by the Emilia-Romagna Region with private and institutional partners, foresee that the charging electricity must be generated from renewable sources, so that e-mobility can be completely zero-emission.



TOWARDS ELECTROMOBILITY IN 2020

It is not so easy to provide a forecast in this complex economic period, but we believe that the market share of electric vehicles (including hybrid plug-in) will reach 5-10% of new registrations in urban area by 2020. For this reason is very important to create the right conditions for the development of electromobility.

An international standardization of the electric plug and the type of recharging system is very much needed. In most recent years, the users are more likely to use a fast charge system, because the main manufacturers give the possibility to rent the battery. More fast charge systems are needed, and these stations have to foresee payment system for occasional users that do not require specific subscription, as it is the case today.

Interoperability also must be guaranteed, starting at the national level, and in case of different operators



ABOVE and RIGHT: Electric cars have free access and can park for free within the restricted zone access h24 on blue stripes in all the Region



there should be the possibility to recharge a vehicles, without a specific subscription.

The cooperation between privates and public authorities reduces the risk of an over installation of charging points and thus preserves the territory. Most of the users charge the cars at home, and during the nighttime, and charging points are used only in case of need during long



distance trips, or for intensive use of electric vehicles.

Connecting electromobility with green energy makes e-mobility completely zero-emission. Specific indications and incentives on this direction may be given from the European Commission.

New standardised services may be developed in order to make it possible to book the charging point, and to inform the user when the charge is finished. ☺

FYI

Tommaso Simeoni is Technical Manager from Regione Emilia-Romagna, Italy
tsimeoni@regione.emilia-romagna.it
<http://mobilita.regione.emilia-romagna.it/mobilita-elettrica>

<http://mobilita.regione.emilia-romagna.it/mi-muovo-1>

The smarter the investment...

Smart Cities Invest in Mobility.
A simple statement but also
the title of a fascinating session
at the IRF World Meeting, as
Brendan Halleman and **Tom
Antonissen** report



Riyadh's traffic centre has the type of setup needed to create the shift towards guiding people's decisions rather than just informing them

Ultimately the goal would be to reach “predictive information” which could guide people’s decisions instead of simply informing them

The International Road Federation (IRF) convened the 17th IRF World Meeting & Exhibition, a global summit for road and transportation stakeholders, from 10 to 14 November in Riyadh, Saudi Arabia. At the invitation of H.E. Abdullah A. Al-Mogbel, Mayor of Riyadh and IRF Chairman, over 2,000 industry professionals from the private sector, academia and government, including an unprecedented 15 Ministers of Transport, took part in discussions spanning the sector’s strategic challenges.

Highlighted global issues included road traffic injuries, responsible for 1.3m deaths a year, the highway infrastructure funding gap, estimated at nearly US\$16 trillion in between now and 2030, the growth of urban areas across emerging economies, climate vulnerabilities in the existing road network, as well as the connections between road networks and socio-economic development.

The IRF World Meeting was held against a backdrop of unprecedented investments in transport infrastructure investments in the Gulf region, and singularly in Saudi Arabia where government authorities have engaged a multi-billion dollar investment programme in support of urban growth and inter-urban connections. “With unprecedented investments

across all modes of transport, the IRF World Meeting could not have come at a better time for the global community of transport professionals,” according to the IRF President and CEO Patrick Sankey. “In response, we managed to put together the most comprehensive World Meeting yet”.

With over 100 plenary, executive, technical and scientific sessions covering every aspect of surface transportation, delegates were able to interface with thought leaders, practitioners and academic specialists from every region of the world. In support of the UN Decade of Action for Road Safety 2011–2020, one of the Executive Sessions organised tackled the topic “Smart Cities: Mobility, Efficiency, Safety and Sustainability”.

FREEDOM FOR THE PEOPLE

While the 20th century saw an unprecedented migration from rural areas to cities, the first decades of the 21st century will be marked by how the public and private sector came together in tackling the intertwined challenges regarding environmental sustainability and safety. Such co-operation, according to experts from renowned companies like Iteris, IBM, Siemens, SWARCO and 3M, will be the only way to truly harness the potential of technology in reconciling the tensions between

a continuing population growth and citizens’ justified mobility demand.

As Iteris’ President and CEO Abbas Mohaddes said, within the past 5 years the amount of data produced has grown by a factor of 9 to nearly 2 zettabytes, and it will continue to grow exponentially in the near future. According to Mohaddes: “Big Data is characterized by the 3 Vs: Volume (of data), Velocity (of data provisioning and processing) and Variety (both of data types and data sources).”

IBM’s Global Leader for Smarter Transportation Eric-Mark Huitema added his 3 As: “Awareness (the need to leverage real-time visibility across city data sources), Anticipate (to proactively identify problems in order to mitigate their impact) and Act (to coordinate cross-agency operations so as to drive better business outcomes).”

Ultimately the goal would be to reach “predictive information” which could guide people’s decisions instead of simply informing them, so traffic information would change from being mostly reactive to becoming proactive as such data should be turned into useful information that travellers can actively use. The traffic centre in Riyadh was quoted as resembling the centres of excellence that would need to be created to deal with such a shift.

Siemens' Klaus Theml agreed that, as mobility of people and goods is one of the toughest challenge cities face today, recent studies have shown this is the "number one priority on mayor's political agenda". As Dubai is now benefiting from investments made in public transport and route guidance, Riyadh is in the process of awarding new mobility projects which will benefit the capital and its population of close to 7m.

Other examples mentioned of cities which had already implemented existing technologies were IBM's Mobility Service Platforms set up in London, Stockholm, New York and Chicago; Siemens' Integrated Mobility Platforms in Hamburg and Lisbon; SWARCO's Supervisor Systems in Bucharest and Florence; and 3M's Smart Transport Solutions deployed across US cities and worldwide. Such integrated platforms enable cross-provider integration of mobility services such as intermodal mobility, parking management, law enforcement, fleet management, tolling systems, adaptive traffic control, active traffic information, car sharing, individual trip planning and booking, and eTicketing.

SMART TECHNOLOGY USED SMARTLY

Appreciating such industry expertise, the European Commission (EC)'s Pawel Stelmazczyk reiterated that almost three quarters of Europeans now live in cities, consuming 70% of the EU's energy. Looking at the effect on mobility, congestion currently costs Europe about 1% of its GDP every year meaning around €130 billion is yearly lost in traffic jams, most of them located in urban areas (which, coincidentally, create some 80% of the EU's GDP). Against this background, it is commonly agreed that smart technologies can make a major contribution to tackling many urban challenges – and therefore "smart" cities are encouraged by



the EU to first and foremost invest in unhampered mobility as the backbone of sustainable economic and population growth.

However, as the status of ITS deployment across the EU is "not that great" – due to a lack of interoperability, standards, cooperation across borders, data protection, and liability issues – the EC published an ITS Action Plan and Directive in 2008 in order to provide the necessary legal framework, which now includes Urban ITS Guidelines developed in consultation with a high-level platform of industry experts. This has been further complemented by the Smart Cities and Communities Partnership, which has seen its funding increased from €81m in 2012 to €365m in 2013.

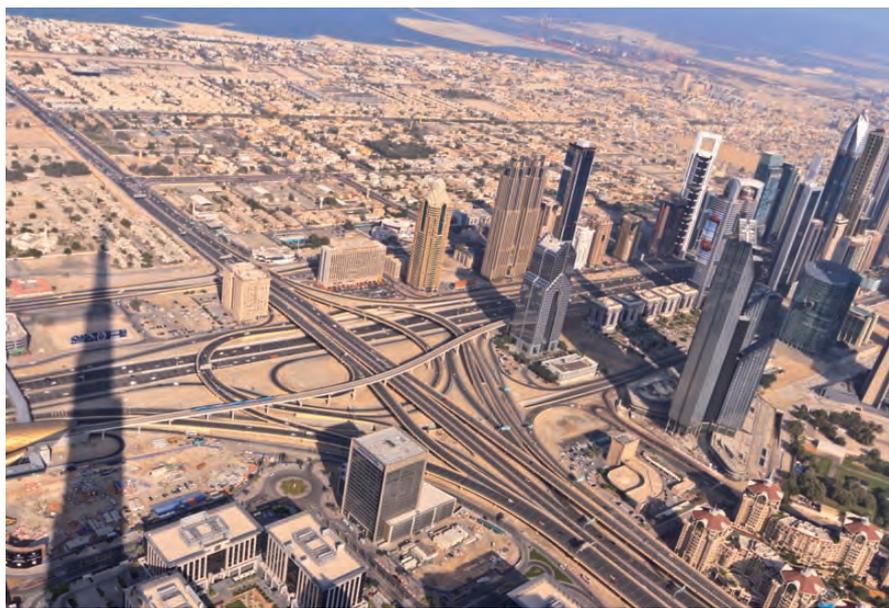
CONNECTING EUROPE

Looking ahead to the budgetary period of 2014-2020, the Trans-European Transport Network is set to benefit from the revised TEN-T Guidelines which come with a funding instrument under the name of the Connecting Europe Facility, earmarking €26.2 billion for nine so-called corridors identified to create a "core network" within the EU.



Furthermore, the future €70 billion R&D programme Horizon 2020 will foresee around €7 billion for transport projects as well – including for smart cities.

In addition, Civitas – an acronym for 'cities, vitality, sustainability' – is funded by the EU's current research framework programme FP7 to support cities in their efforts to innovate for more sustainable urban mobility.



The IRF World Meeting was held against a backdrop of unprecedented investments in transport infrastructure investments in the Gulf region, and singularly in Saudi Arabia and Dubai

that is capable of integrating existing systems from different suppliers in order to create a “system of systems” and do away with the current “silos” (the company is currently in the process of installing a system in Riyadh to increase its traffic safety and road network efficiency).

As existing traffic infrastructure will not be replaced overnight, both public and private actors should agree on how to drive forward improvements in smart architectures and transport planning, the uptake of new Information and Communication Technologies, the deployment of intelligent transport and energy systems, and new ways of integrating all these areas within a network of linked-up and “interoperable” cities. Such a paradigm shift should include a presumption that those cities’ data be “open” – whether related to standards, interfaces, source software or mindsets – so that public data can be re-used by private service providers to create additional benefits for citizens, businesses and governments.

Based on a true partnership approach, time and effort will be necessary to educate users and decision-makers on the benefits ITS can bring to the economic vitality and overall efficiency of a city. As spoken by 3M’s Global Director Dan McGurran: “Sustainability is a mindset, not a destination. Citizens must see and appreciate the benefits – it is our responsibility to develop valuable applications” 

FYI

Brendan Halleman is Head of Communications & Media Relations at the International Road Federation in Washington, DC
bhalleman@irfnews.org

Tom Antonissen is an independent European Affairs Adviser based in Brussels
ttom.antonissen@EURESupport.eu

Since its start in 2002, Civitas has supported more than 700 demonstration activities in around 60 cities within a total network of 200 cities that learn from those demonstration activities. With a total investment of more than €200m from the EU, this leveraged an additional investment of close to €1 billion from local and regional authorities, as well as from private partners.

Such funding initiatives were welcomed by SWARCO’s Chief Technology Officer John Chipperfield, who exemplified emerging technologies as witnessing data collection and traveller information moving from the roadside to mobile devices, leading to the advent of cooperative systems, smart sensors, the “Internet of Things” and other axioms such as being “always connected”.

He saw computing technology furthermore evolving with the arrival of cloud computing (with a next generation already being dubbed “fog computing”), Software as a Service, social media as emergency warning systems, and multipurpose back-offices. Therefore EU funding for such innovation within cities should be welcomed, as the “legacy systems” in place are not fitted to deal with urban mobility challenges such as congestion and pollution – though it sometimes feels like cities’ budgets remain as static as these systems. To get things moving, SWARCO developed its OMNIA open platform

Tomorrow today

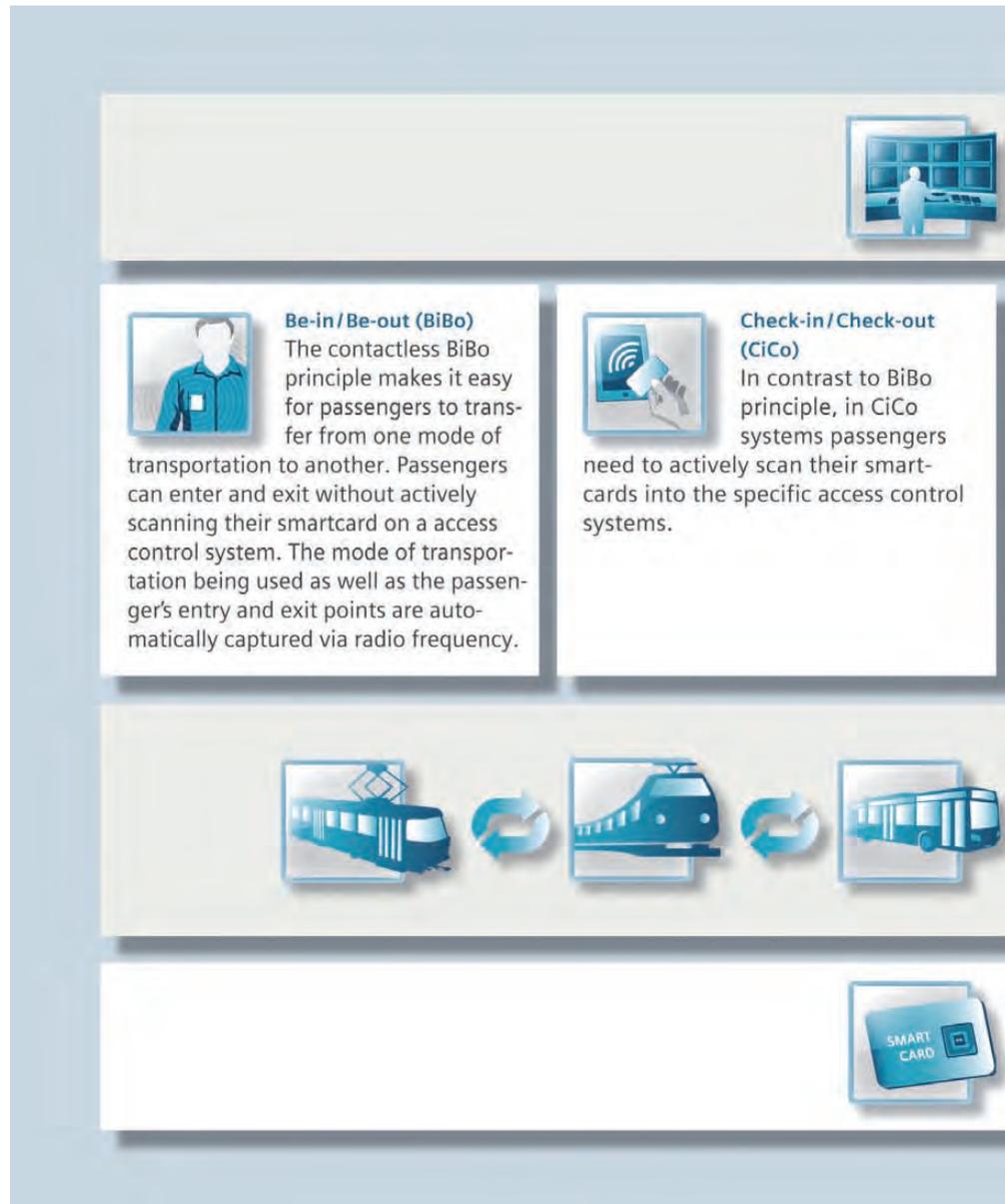
Networked mobility offers benefits for travelers, mobility providers and cities, as **Simone Köhler** explains

Demographic change, urbanization and climate change will in future characterize our society, confronting us with global challenges. In relation to the topic of mobility in cities, this means that by 2050 the annual distance traveled per person in cities will have trebled. In order to cater for growing traffic volumes, new and attractive transportation concepts are called for, which will shift the modal split in favor of environmentally friendly mass transit and at the same time combine intelligently with individual transport. The need is for solutions that are convenient and make it simple to reach any given destination in major cities.

Efficient and economical mobility solutions are thus the key area for action for cities and communities around the world. Because they represent a key to overcoming traffic gridlock, air pollution and the shortage of parking spaces, and safeguard the attractiveness and competitiveness of cities worldwide. It is essential that we work towards the intelligent networking of transportation resources, facilitating the realization of universal mobility chains and smooth traffic flows within urban areas.

TWO CHIPS

One response to the challenges facing passenger transport today is eTicketing. Electronic tickets are not just a replacement of paper tickets. They offer a range of additional functions and, what is more, can be used across all modes of transport.



Passengers can change flexibly between different modes of transport without losing time in purchasing individual tickets and selecting the

correct fare. Siemens therefore pools different modules of eTicketing solutions and areas of expertise to provide intelligent, electronic ticketing

It is essential that we work towards the intelligent networking of transportation resources, facilitating the realization of universal mobility chains and smooth traffic flows within urban areas

Backoffice system

PT®nova is a central backoffice sales system that brings together all the data of the upstream sales components and enables a coordinated exchange of data from the smartcard to the card reader to accounting. The system handles customer and contract management as well as chip card and device management.



Ticket inspection

Each eTicket contains a trip authorization that is stored along with all relevant ticket information on the smartcard.

When the ticket is checked, the eTicket is read using mobile readers or stationary control terminals. This process verifies the validity of the ticket and checks whether it has been blocked by the backoffice system.



Payment methods

Payment by credit balance, direct debit, or credit card: During registration, passengers can choose between postpaid and prepaid payment options,

which also allows them to travel anonymously and without specifying personal data.



Access via cell phones

Thanks to the Mobile Ticketing app for cell phones and smartphones, in addition to purchasing location and time-dependent tickets, passengers can also access additional information services such as fare and schedule information as well as up-to-date announcements.



Smartcard

The smartcard is the key component for registering trips on different modes of transportation as well as for the intermodal use of additional mobility and leisure activities. Thanks to its dual functionality, the Siemens smartcard can be used in both BiBo and CiCo systems.

systems, which will in future allow an individual journey to be conducted and billed on a multi-modal basis. The key component in the networking

of the different means of transportation is the eTicketing access media such as smartphones or smartcards. The Siemens-developed smartcard,

designed in credit-card format features one active and one passive RFID chip, and serves to register the individual journeys, whether by subway,

intercity train, tram or bus. In future it will basically be possible to use one card on an intermodal basis for different means of transport, with interoperability between different transit companies and tariff consortiums, as well as connected service providers. It will, for example, be possible to use it to pay for chargeable parking spaces or to hire cars.

Thanks to its dual functionality, the Siemens smartcard not only supports common “Check-in/Check-out” (CiCo) access control systems, for which the card must be actively read in, but is also designed to put the enhanced “Be-in/Be-out” (BiBo) approach with their high levels of passenger convenience into practice. The contactless BiBo principle eliminates the need for any action on the part of the passenger. The card does not even have to be visible, so it can be carried in a pocket, wallet or jacket. The system automatically registers the routes traveled as well as any breaks in the journey and transfers between service classes, and charges the passenger accordingly.

NETWORKING THE TRAVEL CHAIN

eTicketing with a smartcard or cell-phone is thus an important component in the move towards multimodal networking of the traffic and transportation offerings, which also takes account of individual travel by integrating parking or incorporating car-sharing. To leverage these developments, Siemens is currently working on an integrated Mobility Platform, that enriches ticketing with additional functionalities for information, route planning, reservation and navigation. The integrated Mobility Platform is designed to achieve the most comprehensive possible networking of transportation users, mobility providers and urban traffic management centers. The B2B platform makes it easier for



operators to integrate complementary mobility services into their own portfolio. A taxi company could, for example, bundle its mobility services with those of a rail operator via the IT platform. In the same way, the operator of a parking lot would be able to offer its services in conjunction with a car-sharing provider.

From this will emerge bundled mobility offerings which simplify the planning, booking and billing of multimodal travel from door-to-door. By means of apps, road-users, for instance, will receive precise information about traffic situations and recommended routes, as well as help in selecting the best means of transportation. Thanks to the “networked mobility” concept it is possible not only to plan an individual journey, but also to perform bookings and reservations taking in a number of different providers. For clearing of all mobility services used the B2B platform supports central billing processes between all mobility providers and users. The various transport services and traveled routes could be registered via mobile or card-based ticketing solutions. In that way billing can also be based on the most favourable tariff.

THE OPTIMIZED TRAVELLER

For transportation users, networked mobility enables convenient, multimodal travel, transparent, real-time travel information and, thanks to the cooperation of multiple providers, a wider and simple-to-use mobility offering, as well as attractive price models. Transportation providers can design their offering to be more demand-oriented, enhance the service for existing customers, dismantle obstacles to access and boost passenger numbers. In addition extra revenue can be generated via the complementary offering of mobility services augmenting those described.

In future it will also be possible to optimize travel according to ecological and economic aspects, benefiting quality of life and the environment, and ultimately also bringing improved positioning within the urban competitive scenario. 🔄

FYI

Simone Köhler, Siemens Mobility and Logistics Division, Road and City Mobility IT
simone.koehler@siemens.com
www.siemens.com

Siemens is a strategic partner of the Thinking Cities multimedia project

Mobility, Multimodality and Traffic Efficiency

The section on Mobility, Multimodality and Traffic Efficiency addresses issues related to network management, network efficiency and innovative services, with a particular focus on Intelligent Transport Systems

- o London, UK – back office systems
- o Flanders, Belgium – green and smart mobility
- o Turin, Italy – dynamic traffic prediction
- o Turku, Finland – urban growth and mobility
- o POSSE – open specifications and standards
- o Stuttgart, Germany – sustainable, regional mobility
- o Social media
- o The Thinking Cities Business Case



“Since its launch Oyster has expanded to embrace almost every conceivable mode of public transport in London” See page 76

Playing from the back

Why the back office route to the smart city is best,
by **Phil Silver**

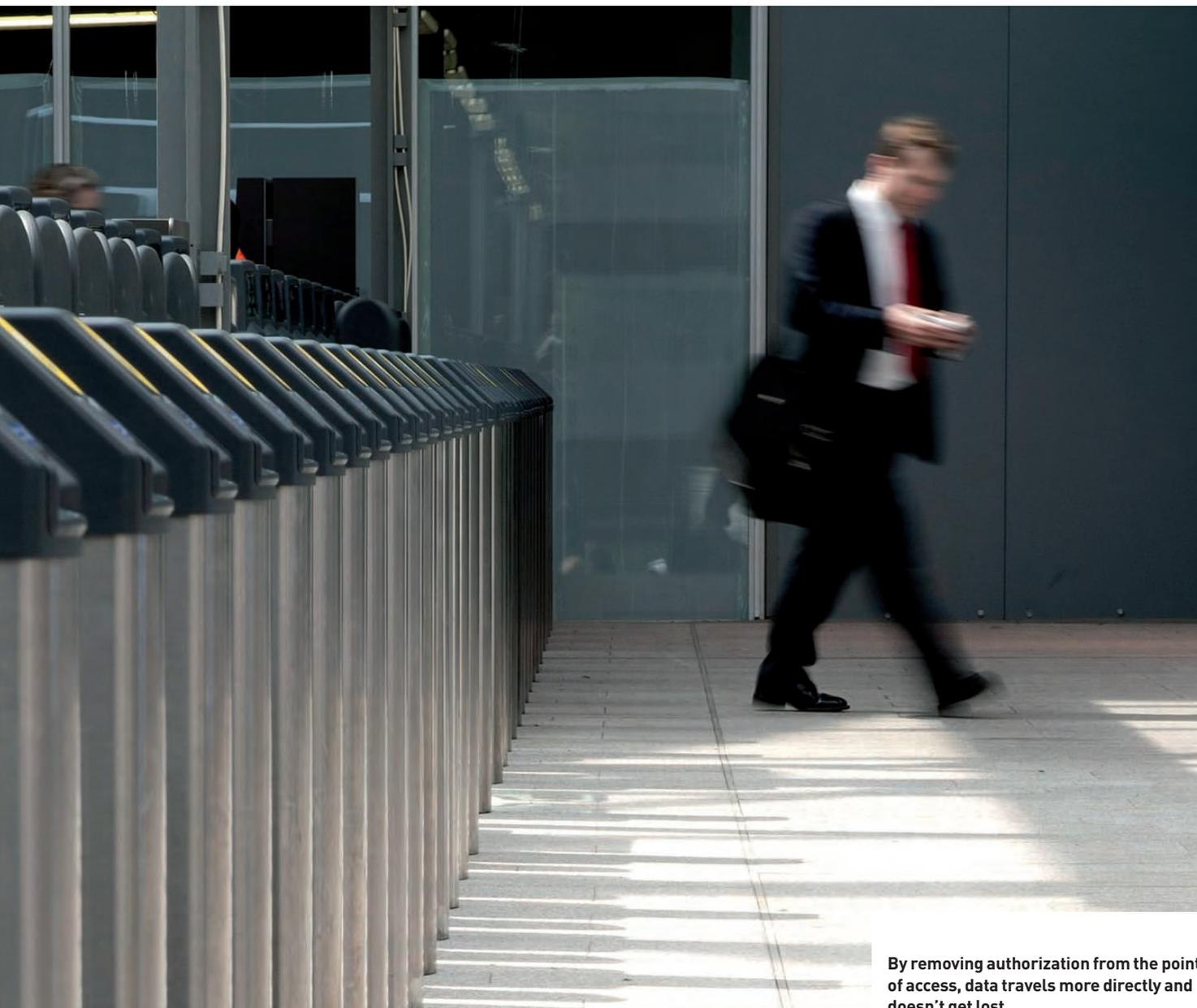
As the “smart city” concept gains currency, there is an increasing realization that a vital component will be equally “smart” urban transit networks to move people around them. In such networks real-time data from multiple transport modes (tolling stations, car parks, buses, trains and even bike-share schemes), operated by multiple agencies, are aggregated in a central IT environment and used for the benefit of all transit stakeholders. Passengers plan and buy travel easily and conveniently, from operators who know the modes and routes they usually take and can tailor travel products accordingly. Meanwhile,

operators, authorities and agencies understand who is using the network, how and when, can “talk” to them via their always-on mobile devices, and can make informed decisions about current and future transport provision. It’s a vision of intelligent transport and mobility that appeals to everyone.

The international gold standard for this concept is London’s Oyster scheme. Since its launch in 2003, Oyster has expanded to embrace almost every conceivable mode of public transport in and around London, paid for by both agency-provided and open-payment media, and is now poised to embrace the



Whether via the transponder at the toll plaza or the ticket or smartcard at the ticket barrier, the main concern was proving users were authorised



By removing authorization from the point of access, data travels more directly and doesn't get lost



Since its launch in 2003, Oyster has expanded to embrace almost every conceivable mode of public transport in and around London

city's car- and cycle-share schemes. Inspired by London's example, other cities are at various points along the road to multi-modal, multi-agency integrated transport networks.

As the systems integrator for Oyster, Cubic is engaged with a number of the operators and agencies involved in these projects.

As schemes evolve, many realise that integration is hindered by what can be described as a POS-heavy, device-centric architecture. To understand why, we need to go back a few years, to a period before integrated transport was considered feasible, when each stage of a journey — parking, tolling, ticketing, and so on — was a distinct process with its own approach to transaction

management. Integration with other modes was not a priority for the designers of each system, who instead naturally focused on controlling and facilitating access to the system. Whether via the transponder at the toll plaza or the ticket or smartcard at the ticket barrier, their concern was proving users were authorised.

Technology-wise, therefore, the focus was on communication between the media presented — token, cash, magnetic-stripe ticket, smart card, transponder — and the access-control device. In these systems all the logic resides at the access point — at the point of sale (POS), not in the back office. The problem with this architecture is it doesn't easily accommodate

the ranks of multiple devices arrayed at toll plazas or subway stations. Install these and you have to add controllers to aggregate the data from each device and pass it up the chain to a host system, and further up the chain there has to be a financial processing system to record and audit transactions, produce reports for management, and so on.

Because these functions are essentially afterthoughts bolted to the original POS-focused design rather than an organic feature of the architecture, such systems are characterised by unacceptably high levels of lost transactions, which causes auditing difficulties and generally poor reporting. Furthermore, each modal system is a silo, built

Systems can be configured to cover entire regions, taking the benefits way beyond the city boundaries, serving multiple agencies across widely distributed towns and cities

for a specific function and unable to communicate with other systems. The underlying technology in a subway fare gate system means it can't "talk" to a tolling system or a parking system, and vice versa.

Agencies pursuing integrated multi-modal transit systems are now realizing the implications of this approach, and are living with financial back office systems that are not fit-for-purpose because of the data loss between the POS device and the general ledger that goes with depending on POS collection of data. The result for some agencies has been an inability to account for transactions, and the associated problems this creates for the public authorities who are supposed to administer and control these funds.

WORK OUT FROM THE BACK

The alternative approach, developed by Cubic for London, Chicago, Vancouver and Sydney, is to rotate the architecture 180 degrees, instead locating the access-control and transaction management intelligence in a dedicated back office specifically designed to handle multiple modes and multiple operators. By removing authorization from the point of access, data travels more directly and doesn't get 'lost', so transactions are processed accurately, are auditable, and reporting is not only robust but also flexible enough to satisfy stakeholders' different requirements. Systems can be configured to cover entire regions, taking the benefits way beyond the city boundaries, serving multiple

agencies across widely distributed towns and cities.

Three factors make this approach possible. The first is the relatively recent development of reliable high-speed wireless networks to connect all the data capture and processing devices an intelligent transit system needs. The second is the ubiquity of "always on" mobile devices — particularly smartphones and tablet PCs — that enable two-way communication between the network operators and their customers.

These two factors are there for other transit system integrators to leverage. The third, I believe, is unique to Cubic: our experience in those cities I have cited has given us an in-depth understanding of the issues that determine the success of an integrated travel system. In turn — alone among integrators — we have applied this understanding to design and build a completely new platform, NextCity, that features a single scalable financial back office system specifically designed for multi-modal operation. This approach contrasts starkly with competitors whose offerings are built on integrating multiple back office systems, one for each mode; instead a single system interfaces with POS devices controlling access.

OPEN TO THE NEXT

Fundamental to the NextCity back office concept is the fact that cities do not have to replace all their legacy systems to take advantage of it; the back office is designed to interface with existing systems in order

to aggregate the data they generate. Not only does this reduce costs, aggregation means the businesses providing the transactions — the pay-by-phone parking company, for example — may benefit from economies of scale by paying lower transaction processing charges than those available from their current provider.

Costs are further minimized by building the financial and reporting systems on commercially available business intelligence, reporting and general ledger products that use open standards and thus can easily be interfaced with multiple IT systems. A welcome consequence of this non-proprietary approach has been to bring all-in-one integrated transport within the reach of smaller regions and communities that face the same transit challenges as larger conurbations, but on a lesser scale that has previously made them difficult to tackle commercially. That is now changing.

Looking to the future, demands on the back office are only going to grow as the components of the urban transport environment become increasingly integrated and increasingly higher priced. The era of POS-centric architecture has passed and future solutions will be uniformly driven from the back office. ☺

FYI

Phil Silver is director, strategic initiatives at Cubic Transportation Systems
Phil.silver@cubic.com
www.cts.cubic.com

Contact high

Through innovation, Belgian research centre Flanders' DRIVE wants to play a leading role in the transformation of the vehicle industry in Flanders towards green and smart mobility. It works with companies and other research institutes at application-oriented research and develops technological solutions that contribute to a strong Flemish manufacturing industry, as **Harold Perik** explains

Flanders' DRIVE sets up research projects together with leading Flemish companies, SMEs and other research institutes, with financial support from the Flemish government. It recently presented the results of the project Inductive Charging, a feasibility study into the wireless charging of electric vehicles.

Renilde Craps, Director Flanders' DRIVE, explains: "Over the past two and a half years, we co-operated closely with nine Flemish companies and two universities, focusing on stationary and dynamic charging of buses and stationary charging of cars. Wireless charging appears perfectly feasible and can be done safely and efficiently, both stationary and while driving. All this using, among other things, expertise and technology gained and developed in Flanders, the northern part of Belgium."

In this research project, Flanders' DRIVE focused on technological aspects such as systems efficiency and the impact on both energy supply and non-technological issues such as safety and social acceptance. "We studied the applications on a traffic lane of the N769 in Lommel, which served as test track, and in the Flanders' Drive research facilities," she adds.

Renilde Craps,
Director
Flanders' DRIVE



Using, among other things, expertise and technology gained and developed in Flanders

Inductive power transfer is done using the operating principle of a transformer consisting of magnetically connected coils. When transmitting a variable current through one of the coils, called the primary

coil, this will generate tension in the secondary coil. In an inductive charging system for vehicles, these two coils are not physically connected to one another as in a conventional transformer: one is suspended





An electric bus and electric car, used in the Flanders' DRIVE project's 'Inductive Charging'

below the vehicle whereas the other is installed in the road surface. The main challenge is to control the magnetic field that is generated upon the transfer of energy in the free space in between both coils.

STATIONARY AND DYNAMIC WIRELESS CHARGING FOR ELECTRIC BUSES

Craps explains: "The basis for the system studied by us is the charging technology originally developed

by our project partner Bombardier for trams. In the autumn of 2010 we started with the integration of this system in a Van Hool bus. Parallel to this, we worked on the integration of primary coils in the road surface

of the test track. We installed connected segments in asphalt and concrete surfaces.”

Craps says that the centre studied the efficiency of the energy transfer in proportion to the speed of the bus and the lateral and vertical positioning of the secondary coil above the primary one. Here, results show a horizontal positioning tolerance of 40cm upon a vertical distance between both coils of 10cm.

“We’ve also gained knowledge about how to measure the magnetic field during the energy transfer. The first charging system prototype of 100 kW that we used in the research didn’t yet meet the ICNIRP safety standards, but Bombardier applies a system meeting these standards. We also studied which impact the characteristics of a dynamic inductive energy transfer have on the charging of batteries.”

STATIC WIRELESS CHARGING FOR ELECTRIC CARS

In the spring of 2011, Flanders’ DRIVE widened its research efforts to a car, using as a test vehicle the first Volvo C30 Electric that was available in Belgium. Craps explains that tests that were conducted with the vehicle included work with a 3.6kW static inductive charging system developed by Inverto, a company with more than 10 years of experience with inductive power transfer for industrial applications. This system charges the car, with a battery of 24kWh, in seven hours.

“Subsequently, we also studied a 22kW charger from Bombardier, which was developed using the expertise gained with the bus and which charges the battery in just one hour. As for the integration of the receiver in the car,” she continues, “we’ve chosen an add-on architecture and focused on energy management and control. To limit the size and weight of the secondary coil, we incorporated as many functions as

Static wireless charging of an electric Volvo C30



The possibility of charging electric vehicles using a simple, wireless system represents a major step towards improved social acceptance of electric vehicles

possible in the primary coil.” As for the positioning of the secondary coil in the car above the primary one in the road surface, Craps’ test results show a lateral deviation tolerance of 30cm upon a vertical distance of 10cm. The research also shows that inductive systems of 3.6 to 22 kW are possible.

These systems meet the expectations indicated by consumers and experts in a survey for charging electric cars at home. EMF tests show that the construction of the car protects passengers during the energy transfer against the electromagnetic field according to the ICNIRP standards. Also outside the vehicle, these standards are respected. The charging system is automatically activated upon disconnecting the motor. A user interface developed by Flanders’

DRIVE informs the driver on the status of the battery and the remaining time needed for charging it.

CONCLUSION

Wireless charging of electric vehicles is feasible, safe and user-friendly. Says Craps: “The study shows that wireless charging using an inductive charging system can be done almost as efficiently as charging with a cable. The average efficiency of the charging systems used in the study exceeds 90% (compared to 94% with a standard conductive charger typically used at home) for both for stationary and dynamic charging at speeds up to 70km/h.”

ON THE ROAD

It also appears that the integration of charging technology in asphalt and

concrete is equivalent as to quality but that prefabricated modules can offer a higher uniformity and that their implementation can be done more efficiently. At present, the test track is again open for normal traffic and the effects on the road surface are still being monitored.

The possibility of charging electric vehicles using a simple, wireless system represents a major step towards improved social acceptance of electric vehicles.

The achievements of Flanders' DRIVE and its Flemish partners will doubtless generate lots of possibilities. They represent a solid basis for further applications. For instance, in early 2014 in the Flemish Living Lab for Electric Vehicles, wireless charging of electric buses will be tested in real everyday conditions.

The project results also provide the Flemish project partners with interesting perspectives on how to reap the rewards of their technological expertise on an international level. Bombardier, for instance, has been able to successfully apply wireless charging technology developed in this project on cars and buses and is now ready for commercial exploitation. The other partners also

Partners on the Inductive Charging project

Bombardier, Energy ICT, Infrac, Inverto, Catholic University Leuven, Mobistar, NXP, OCW, Van Hool, Volvo Cars Company and Free University Brussels, with the support of the city of Lommel and the Roads and Traffic Agency of the province of Limburg and financial support of the Flemish Government, through IWT.

extended their expertise in view of further commercial developments in electric driving. For Flanders' DRIVE, the project is part of a wider programme aimed at evolving towards autonomous vehicles.

FIRST COMMERCIAL APPLICATIONS FOR ELECTRIC CARS AND PUBLIC TRANSPORT BUSES

"The first commercial applications for cars can be expected as from 2015, possibly as optional feature, with home and work as main charging stations," says Renilde Craps. "Many drivers of plug-in hybrid cars

appear to plug in their car only rarely or not at all. Here as well, wireless charging may offer a solution.

"For public transport buses, we consider static charging at one or more stops on their route as a first step. This may be combined with short inductive strips on steep inclines, with the absorbed energy being immediately deployed for driving the vehicle. From an economic point of view, it would obviously be interesting to install charging points at stops where several bus lines come together."

BROAD RANGE OF LOCAL AND INTERNATIONAL ACTIVITIES

Flanders' DRIVE also supports individual companies in their innovations. For instance, in the innovation project "E-Truck", supported financially by the Flemish government through IWT, E-trucks Europe developed a modular electric powertrain for trucks up to 22 tons with Flanders' DRIVE and Triphase. The electric powertrain can be integrated in both existing as well as new trucks from different brands. This kind of electric truck can produce a significant contribution to the evolution towards green transport of goods in city centres.

Flanders' DRIVE encourages and assists both Flemish major players and SMEs to innovate, in order to support them to become or to remain global players in their domain. On an international level, Flanders' DRIVE collaborates among others with the research centres of car manufacturers and participates in European research projects. 

FYI

Renilde Craps is Director of Flanders' DRIVE based in Lommel, Belgium
info@flandersdrive.be
www.flandersdrive.be



Dynamic wireless charging of the bus on a test track in Lommel

Fixing issues in real-time



Copyright: iStockphoto/Dario Egidi

Sonja Koesling reports from Northern Italy where a dynamic traffic prediction tool is making the region's traffic flow impressively smoothly

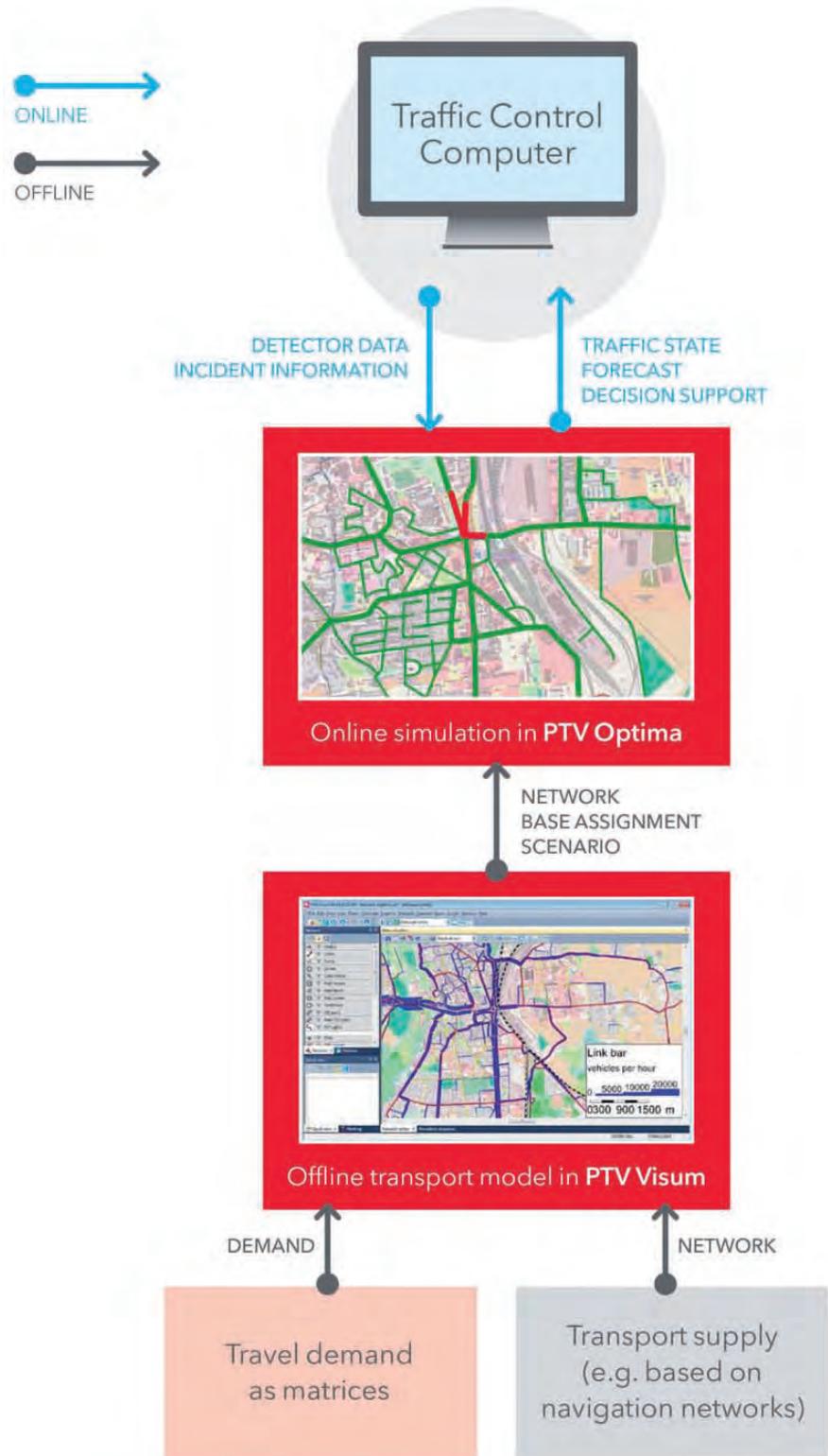
Covering an area of 25,000 square kilometres, Piedmont is, after Sicily, Italy's second largest region: its provinces are intersected by more than 34,000 kilometres of main road. In order to create a sustainable and accessible mobility system on a regional level, the regional government of Piedmont decided to invest in Intelligent Transport Systems (ITS). The company responsible for managing traffic and

providing mobility information in this region is 5T, a public company owned by the Piedmont Region, the City and the Province of Turin. Since autumn 2013 the company's traffic managers have been using PTV Optima to assist them in this task: a tool that enables dynamic traffic prediction.

"5T was awarded the contract to develop a regional traffic operations centre which is based on a regional traffic control system," says Rosella



Panero, Managing Director at 5T and President of TTS Italia, the National Association for Transport and Safety Telematics. The aim was to provide real-time traffic monitoring including traffic data acquisition, processing and aggregation. Another goal was to deliver real-time data completion in order to estimate traffic states that also take areas without traffic sensor infrastructure and measurements into account. The



PTV Visum processes travel demand data offline and provides PTV Optima with a basic simulation of the network. PTV Optima then uses real-time data from the traffic management system and provides up-to-date traffic information and traffic forecasts. Moreover, it assists traffic managers in evaluating their strategy

project also focussed on alarms to be triggered in the event of anomalous traffic situations such as traffic congestion or accidents including traffic control systems informing travellers via suitable services.

“Actually, the challenge of this project is to provide a reliable centralized traffic information and management system that also covers areas outside the city boundaries,” explains Panero. “This result is achieved by merging fixed traffic sensor data with ‘virtual sensor’ data coming from different data providers and fleet managers with a monitored area which is eight times enlarged at minimal infrastructure update and maintenance costs.” Consequently, congestion on the major roads, particularly in and around urban areas, is reduced by several per cent, thus improving air quality. At the same time road safety is increased. PTV Optima is the solution that helps 5T to achieve its ambitious goals.

FROM OFFLINE TO ONLINE

PTV Optima combines the tried-and-tested offline transport modelling method with real-time data and algorithms. This process is based on a transport model created in PTV Visum that shows each “typical day” (eg, working days or weekends) for the selected transport area. It models transport services and travel demand using demand matrices. Dynamic traffic assignment is used to calculate the time-related traffic volume and turning movements in networks based on travel demand.

This is where online data comes into play. In PTV Optima, the data is used in real time in order to adjust capacity, speed and volume from PTV Visum’s base model to the current local flow and road conditions. The simulation of PTV Optima includes the network structure, traffic flow dynamics and the route choice behaviour of road users, covers the traffic situation for routes without

detectors and predicts the impacts also of unforeseen incidents. “PTV Optima is the solution which best meets our requirements”, says Dr Fabrizio Arneodo, ITS Design & Development Manager at 5T.

DYNAMIC NOT STATIC

Alongside Floating Car Data (FCD), approximately 1,400 induction loop stations as well as 200 stationary sensors, such as infrared and radar, are currently implemented in Piedmont, delivering new measurement data relating to real-time traffic patterns at 5-minute intervals. “This allows us to observe roughly one half of 76,000 arcs of our Transportation

Graph. The other, much larger section of our routes is covered by PTV Optima”, explains Arneodo, adding that this is a solid base for traffic management.

Being able to predict traffic behaviour is key to ensuring the traffic management team can dynamically control traffic. PTV Optima can give an up to 60-minute forecast on the development of traffic. “Here we have opted to use a rolling approach”, says Arneodo. “That means that we simulate a 60 minute time frame which is then automatically recalculated every five minutes.” This allows 5T to see what effect the volume of traffic, speed and disruptions have on the

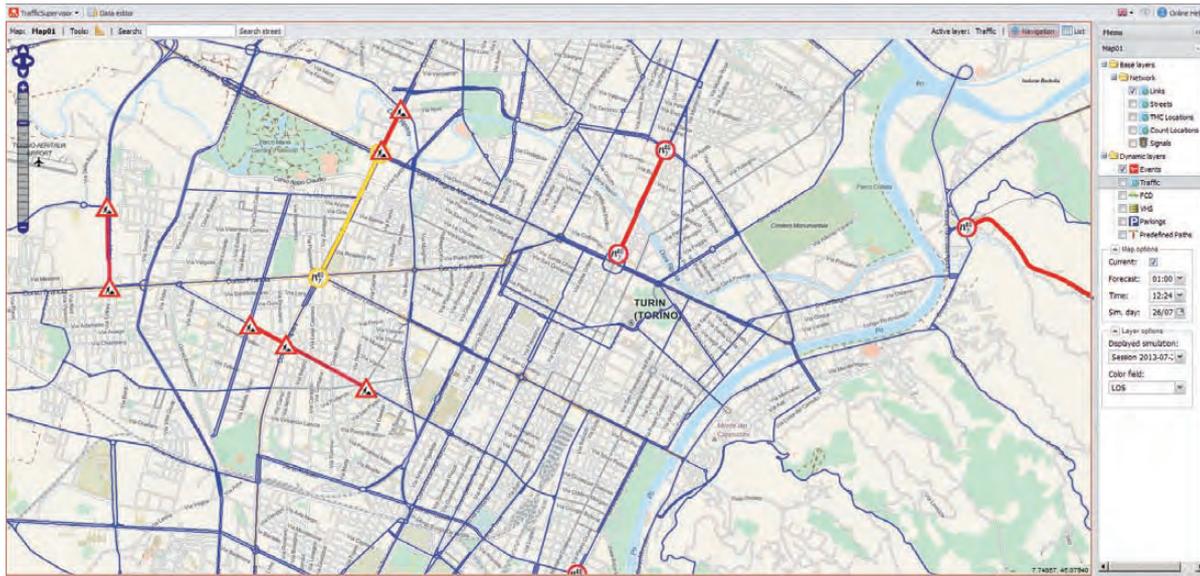
Statistical vs. simulation modelling approach

There are two general approaches to address network and traffic forecasting: a statistical approach and a simulation modelling approach.

	Observed data	Statistical approach	Model based approach
Traffic estimation – ‘What is going on?’	Maybe, with extensive measures	Yes	Yes
Traffic forecast – ‘What is going to happen?’	No	Only ‘usual’ conditions	Yes
Scenario evaluation & decision support – ‘What would happen if?’ ‘What should we do?’	No	No	Yes

A direct comparison of a statistical and model-based approach

The statistical modelling approach uses interpolation, interference, data mining, “artificial intelligence” and mathematical models to match the observed timeseries with historical patterns. Flow and speed variables are analysed and forecasted without trying to explain and reproduce the underlying phenomena, namely vehicular interaction and driver behaviour. Statistical modelling techniques can be used for predicting traffic measures in low volatility or homogeneous traffic patterns with random variable discovery methods. However, this technique fails, if there is not enough historical data, which is often the case in unusual situations, eg accidents or road works. As a result, the statistical modelling approach is not appropriate for those traffic conditions. The operators will then need more support! Conversely, the simulation modelling approach is based on an explicit and physical interpretation of the network and traffic conditions and this is accomplished by the explicit simulation of the interaction between travel demand and road networks (supply) through assigned routes based on a previously developed equilibrium assignment model, such as the PTV Visum base model. In real-time simulation models, incoming data is used for on-line calibration of the real-time model in order to adjust the base simulation of the current day type using observed real-time data following a rolling horizon model.



PTV Optima shows current incidents and provides then a forecast for the next 30–60 minutes

The challenge of this project is to provide a reliable centralized traffic information and management system that also covers areas outside the city boundaries

various sections of road.

At 5T the system is generally put into action for two main applications. The first is when the traffic manager receives information from the relevant police authority regarding a traffic incident. An ‘incident’ could be an accident or even a group of demonstrators on the road.

“His job is to apply this information to a specific scenario and to respond with appropriate traffic measures”, explains Fabrizio Arneodo. This could involve, for example, opening extra lanes, putting changeable message signs in place or passing information on to road users via text message, the company’s website, mobile applications or the radio.

The second application makes use of an automated feature. If pre-defined thresholds are exceeded

– because actual traffic behaviour differs greatly from normal patterns – the system will send a warning to the traffic manager. This can, for example, be due to the weather.

“As we are situated next to the Alps, there are a lot of tunnels in this region which we have to close in winter during adverse weather conditions”, says Arneodo.

“Closing the tunnels leads to unusual congestion patterns in the traffic network. The system recognises this change automatically and suggests an intervention strategy to the traffic manager.”

A RELIABLE AID

At 5T intervention strategies are developed offline by traffic engineers before being applied to the PTV Optima online environment

where they are assessed, compared and weighted using real-time traffic data. The engineers then share their results with the traffic managers based at the traffic management centre. They are the ones responsible for turning scenarios developed by the team into operative measures. PTV Optima aids managers in this task by making it possible to quickly return traffic to normal levels within the road network.

“I like the robustness and efficiency PTV Optima is delivering reliable information”, exclaims Arneodo. “PTV Optima is an extremely sophisticated system, but it features a straightforward interface that has been developed and designed with the user in mind, making it simple for anyone to use.”

FYI

Sonja Koesling is Manager PR & Marketing Traffic Software PTV Group
Sonja.Koesling@ptvgroup.com
www.ptvgroup.com

PTV Group is a strategic partner of the Thinking Cities multimedia project

The Finnish article

How can urban growth be brought into sync with the increasing mobility requirements of residents and commuters? The Finnish city of Turku and Siemens Mobility Consulting have been exploring this issue and an initial study shows the positive impacts an intermodal transport concept and a new planned light rail system can have for the city, as **Eberhard Buhl** reports.

In Turku, the fifth-largest city in Finland, city planners are focusing on integrated mobility



Light rail systems can help to prevent the collapse of a city's transport system: this finding has long-since proven its validity in megacities around the world. But how do smaller cities and regions cope with their transport problems? After all, most cities worldwide are

medium-sized, with something in the region of 200,000 residents.

Turku in southwest Finland also belongs in this category. Founded in the 13th century, Turku is currently the country's fifth-largest city with just over 180,000 residents. As the center of Finland's third-largest metropolitan



Municipal transport director Sirpa Korte

Urban planning and transport planning have to support one another – that’s the crucial factor in areas of new development.”

Sirpa Korte, Transport Director, Turku

area, it plays an important role in culture and education. Several vocational institutions and three universities are based in Turku, including the Åbo Akademi, Finland’s only purely Swedish-speaking university.

Thinking in terms of sustainability has been the norm here for some time. The Turku Climate and Environment Program of 2009, for example, aims to reduce the 1990 levels of greenhouse gas emissions per capita by 30% by 2020. Like elsewhere in the world, however, growth and prosperity are giving rise to negative impacts: the city’s growing traffic volume is responsible for around a quarter of local CO₂ emissions. Noise and air pollution are constantly increasing, as are congestion and accident rates.

THE GOAL: INTEGRATED MOBILITY

The municipality wants to tackle this problem with an intermodal transport strategy. The goal: integrated mobility. The strategy, for instance, aims to increase bicycle traffic around 50% by 2030. With annual population growth of around 2%, public transport should absorb the additional transport load between the suburbs and the city center. At the same time the strategy aims to generally shorten journeys between people’s homes and places of work through urban planning measures such as densification and mixed building utilization.

All in all these are very sound measures, as the structural plan for the Turku region anticipates around 60,000 more residents and roughly 20,000 new jobs in the next two decades.

“If this population increase takes place evenly across the region, as we have seen in the past, this will pose an enormous challenge to the transport systems of the city and the surrounding area,” explains Sirpa Korte, director of the municipal transport authority. “More private cars place a great load on the road network, the air quality deteriorates and quality of life generally declines.”

The conditions for a sustainable public transport network in Turku are certainly more favorable than elsewhere. In the central areas, at least, bus services have been steadily expanded.

“Unfortunately, the capacity of the bus lines in districts like Varissuo and Runosmäki is far from sufficient,” says Korte. “And it’s difficult for us to persuade more people to take the bus when there is literally no more room for extra passengers at certain times of the day.”

THE ANSWER LIES IN RAIL

Examples in many cities worldwide show that light rail and tram systems, integrated into an overall strategy, prove to be popular measures for improving the use of urban space. In addition, an electric-powered public transport network can contribute significantly to attaining ambitious climate goals, such as those set in the Turku Climate and Environment Program.

Central Turku used to be served by an extensive tram network until the city decided to discontinue its operation in 1965. In the meantime priorities have changed: the city’s politicians are in favour of building a new light rail system and feasibility studies for two lines are already underway. As transport director

Korte explains: “Public transport has to be good enough to make people want to use it instead of their own cars. That means smooth journeys, easy access and comfortable travel. Depending on the district in question, trams or an advanced bus system form the cornerstones of an overall transport strategy.

But how can city planners ensure that their measures will actually lead to the desired results? The municipal authorities went looking for a strategic partner with the necessary expertise in this field and opted for Siemens Mobility Consulting. The team consists of Siemens tram experts and Finnish colleagues

Finding the best way

Experts from Siemens and Turku are currently working on another study as part of a three-year cooperation agreement. They are developing a concept for sustainable city districts in order to manage the expected population growth in the most environmentally friendly way possible. Consultancy experts from Siemens are also actively involved in the creation of new urban concepts in various cities around the world. A study is currently being developed for Singapore to examine the CO₂ prevention potential of technologies in the areas of transport, residential buildings, non-residential buildings and information technology. The study also includes recommendations for action.

in the region. The choice made sense, bearing in mind the Siemens Infrastructure & Cities Sector offers solutions for transport, building technologies and electric power from a single source. The city of Turku and the Siemens project team then carried out a study to ascertain how the favourable conditions in the region could be translated into a sustainable urban solution.

TRANSPORT AND REAL ESTATE

The study focused on two areas: the environmental angle was to examine the influence of the planned tram system on the development of CO₂, particulate matter and nitrogen oxide (NOx) emissions within the city limits; and the economic aspect focused primarily on the development of real estate along the planned routes.

Economic development in the direct catchment area of a rail network is consistently positive all over the world. This is demonstrated by successful projects such as the new light rail system in Houston, Texas. The Turku planners expect to see a similar economic boost along the Blue Line, due for completion by 2025, and the Red Line, expected to open in 2035. The intention was to use the results of the study as a basis for future decision-making processes. Case studies from 10 European and US cities showed that the modal split – the distribution of the transport volume among different modes – rises by up to 163% within three to 15 years of the introduction of a tram or light rail system. Even with the most conservative scenario, public transport use in Turku could increase by at least 40% – and the effect is likely to be considerably greater. The calculations suggest that the introduction of the light rail system could prevent an around 25% rise in CO₂ emissions by 2035, which equates to 130,000 tons per year as well as a 42% increase in pollution from particulate matter.



Korte is certain that trams like the Avenio will make urban regions more attractive. "What's more, we already have in place a universal ticket and information system for the region."

However, for the required 11.5 million tram journeys per year to actually be attained, municipal policy will effectively have to start promoting public transport use to the city's residents years before the system goes into operation. As a result of such an integrated solution, the switch of many car and bus users to the light rail system will reduce road traffic enough to bring about an estimated 11% cut in CO₂ and around 12% in NOx emissions. In addition, particulate emissions will fall by around 8% and – an important factor for a country with typically long winters – particulate pollution due to road gritting services and abrasion from studded tyres will decline by 7%.

ON THE RIGHT TRACK

Greater Turku, which includes the neighboring towns of Kaarina and Raisio, covers around 13.5 million sq metres, around 60% of which is within an 800 metre zone around the planned light rail lines. A comparison of experiences in other countries showed that an integrated light rail solution leads to above-average growth in real estate value within this zone, even by conservative estimates. The value of the municipal properties alone could rise by €58 million, thus contributing to the financing of the entire transport project. These calculations do not

even take into account the so-called soft Factors – the greater quality of life for the residents and the increasingly positive image of the city. Once more, cases around the world show what a boost these factors can give to the economic, environmental and social development of a region in the medium term. The conclusion of this study clearly shows that Turku is on the right track with its plans for an integrated transport solution. Transport director Sirpa Korte also feels the choice is justified.

"A light rail system is a tried-and-tested means of making public transport quicker, simpler and more attractive for the city's people. In that sense, our plan is not just a transport project, but an important step toward a more pleasant life for everyone in the city center. There's no doubt about it: the light rail system heightens the appeal of our city." 

FYI

Sirpa Korte is Turku's municipal transport director
sirpa.korte@turku.fi
<http://www.turku.fi>

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Intelligent Solutions for Traffic Surveillance



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Open season

POSSE – opening up a new ITS reality for the thinking city, by **Suzanne Hoadley**

Intelligent transport systems (ITS) are widely implemented in cities and regions to manage traffic and to influence travel behaviour through systems such as adaptive area-wide traffic control, real-time travel information, bus priority at traffic lights, smart card ticketing and car park management and guidance, among others. ITS have largely been implemented in an uncoordinated and incremental way, due in part to the

multitude of organisations involved, the absence of a common set of open ITS standards and specifications in Europe, and the prevalence of closed, proprietary systems within the market.

Closed systems are commonplace and mean that technologies produced by different suppliers cannot (easily) interoperate within a system due to the specific way in which a technology has been designed.

Closed systems have also led to a situation of vendor lock-in for public authorities. For example, once an authority has acquired a basic urban traffic control (UTC) system to manage its traffic signals, it may be unable to buy a bus priority system or a car park guidance system from a different supplier without replacing the UTC system too. Technologies purchased from different suppliers are rarely able to operate with each

The benefits and challenges of adopting open specifications and standards

It is not always easy to capture in numbers the benefits of adopting an open systems framework, such as UTMC and OCIT/OTS, due to their flexible nature (ie, users can choose which 'parts' of UTMC and OCIT/OTS to adopt) and the different contextual framework of the users (eg, systems deployed, skills available, resources, etc) and the market situation (eg, culture of cooperation). Many 'less quantifiable' benefits have nonetheless emerged over the years and these have been confirmed in the interviews undertaken for the POSSE 'End user study'. Benefits accrue for both the customer (ie, transport authority) as well as the supplier (ie, industry). But there are also challenges for both too.

While most users agree that the ease of integration and the opportunity to operate in a mixed vendor environment and to bring down costs – the main rationale behind UTMC and OCIT/OTS – have been beneficial, users have also pointed to a number of other advantages, notably more efficient traffic operations, simplified procurement, improved customer-supplier relationship and future proofing investments. These benefits are described below, mainly from the perspective of the customer (traffic authority) except where stated. It should be highlighted that not all benefits have been experienced by both UTMC and OCIT/OTS. This is mainly due to the different starting points, driving forces and market culture behind the respective initiatives.

○ **More efficient traffic operations:** Open specifications and standards allow a better integration of ITS which enable a more holistic view of the traffic situation, a greater use of automatic responses during key events (stadium, concerts, etc), a better understanding of how systems work together and how to resolve problems as they occur (introduction of distributed systems, avoidance of traffic information silos, etc), and greater flexibility in terms of mixing and matching solutions.

○ **Cost reductions:** The impact of adopting open standards has actually been measured in financial terms within the OCIT/OTS community. A fall in the cost of buying traffic signals of up to 80% in the early beginning has been recorded, in the recent years up to 40%. Within the UTMC community, savings on capital investments and annual revenue costs have been estimated as follows: (i) a capital investment saving per authority for establishing the core regional UTMC system is in the region of 30%; (ii) ongoing annual revenue saving per authority for maintenance of a UTMC system of around 40%; and (iii) potential staff saving for operations in the region of 1.5-3.5 persons.

○ **Simplified and structured procurement:** The technical specifications are impartial and readily available for use in procurement, which can simplify greatly the tendering

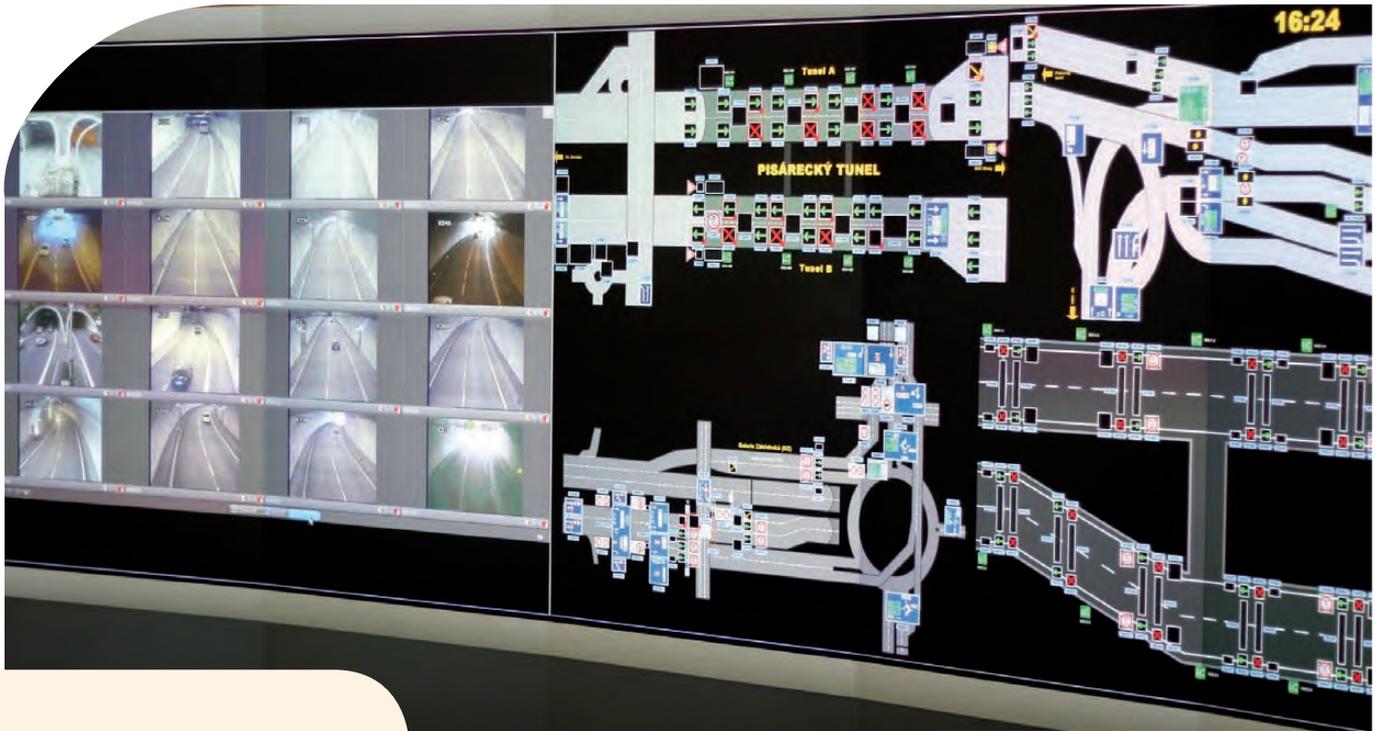
procedures. Tendering procedures are common to all; therefore, an authority can make use of another authority's specifications and tendering document.

○ **Promoting innovation:** Open systems have scope for flexibility and evolution to keep up with technology and policy developments; the open systems framework provides a simple structure for the addition of new technology. By working together, local authorities can create enough market pull to drive industry developments, which is not achievable alone, except in the case of very large authorities. Finally, the market can increase in size, especially among outsiders and in new business areas generated by open specifications and standards.

○ **Better customer-supplier relationship:** Traffic managers know what is technically reasonable and available and can better articulate the solutions sought from industry. Industry has a better understanding of the traffic managers' needs. Clarity of technical requirements helps dialogue between buyer and suppliers – they can talk the same language in procurement specifications.

○ **Greater marketplace stability and investment safeguards:** Open interfaces support the future proofing of systems and overcome the risk of legacy systems for the traffic authorities. Integrating products

Photo: Christian Lügges



Brno Traffic Control Centre is the most advanced one in the Czech Republic

into client systems is easier as well as upgrading existing compliant products. The risks in deployment and integration have lowered significantly for suppliers.

While open specifications and standards bring many benefits, there are also some challenges:

- Legacy systems: Integrating compliant systems with legacy systems is still difficult
- Skills' changes: An open systems framework is technical by nature and can be daunting to learn about. Once this first hurdle is overcome, the framework is not difficult to work with.
- Rogue suppliers: some suppliers may claim that a product is compliant but it is not. This creates confusion and additional costs/efforts for the customer. The introduction of certification processes and interoperability testing could be a way around this.
- Challenging economic situation: cheaper proprietary systems may tempt authorities to acquire them without fully appreciating the higher costs of maintenance, upgrades and expansion associated with such systems
- Resources: maintaining and developing further an open specifications and standards framework requires resources. Quantifying the benefits, in terms of cost savings, would be beneficial.

The absence of open specifications and standards in ITS also perpetuates the monopoly that some suppliers have in a number of member states

other as they are designed to different, proprietary, specifications.

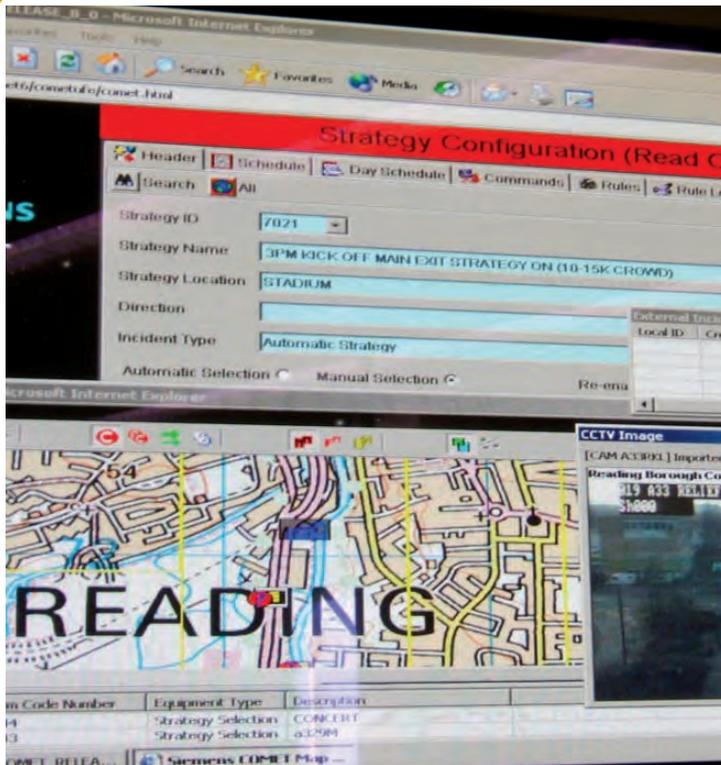
This creates an anti-competitive situation that has implications for both the public authority and the suppliers in terms of higher cost, loss of operational efficiency and lack of incentive to innovate. The absence of open specifications and standards in ITS also perpetuates the monopoly that some suppliers have in a number of member states.

OVERCOMING CLOSED ITS SYSTEMS

Two national-oriented initiatives were launched over a decade ago to overcome the closed-system nature of traffic management and ITS; they

are UTMC in the United Kingdom and OCIT/OTS in the German-speaking part of Europe. Polis invited both initiatives to a Polis members meeting in 2010 in order to learn more about them and to ascertain the interest of cities and regions elsewhere in Europe in the open systems approach. The meeting revealed that the problems of system fragmentation, vendor lock-in and market monopoly are widespread throughout the continent. Consequently, Polis decided to make this a priority topic. This led to the POSSE project supported by the EU's INTERREG IVC programme.

The main aim of POSSE is to raise awareness of the need for open



Reading Borough Council in Berkshire, UK, is the coordinator of POSSE

The city of Brno, Czech Republic, is one of the city transfer sites



Photo: Christian Lügges

Statements from selected partners

OCA

Involvement in POSSE is part of OCA's strategy to raise its international presence and awareness, to liaise with similar communities (UTMC, POLIS) and to keep in touch with the European Commission.

Through POSSE, transfer sites are able to learn from OCA's experience in using open standards and specifications (ie, OCIT, OTS, DATEX II) within their traffic management architectures. OCA is also able to obtain feedback from POSSE, mainly in relation to the specific views and needs of transfer sites, which is useful to enhance and improve the standards used and the accompanying documentation, ie, OCA's OTS Guidance, the OCIT Guidance, the Procurement Model (OCA Process Model) and the OTS-System Model considering new technology.

UTMC

UTMC is a UK-based initiative to create and sustain practical open standards for ITS, by bringing together local authorities and the supply industry. In this way, system management, integration and operation are all made more flexible and effective,

while the competitive environment creates more innovation and better prices.

UTMC has always looked to European standards as a starting point, but POSSE has provided an opportunity to engage with cities at a much more detailed level. We wanted to share our experience of creating and using open standards with non-UK cities; in the process, the UTMC framework aims to adapt to the requirements of local authorities outside the UK.

It has become clear that the European ITS market is not uniform, in many ways: political priority, levels of ITS deployment, supply market dynamics, etc. This is both a challenge and an opportunity. Specific technical aspects of UTMC may be usable, or may need to be adapted to local non-UK circumstances; equally the UTMC framework could gain significant new strength from alignment with the different perspectives in, say, Norway or the Czech Republic.

Municipality of La Spezia

La Spezia is a fast growing city with regard to ITS and wishes to bring existing ITS together with new systems and services.

Some have been in operation since 1996 (Urban Traffic Management Centre) and others are very recent and innovative (access control, parking information with on road parking slots controlled by specific sensors), a new infomobility platform for traveller information services, and a contactless smart card including bike sharing, park and ride and public transport.

The overall objective of the city is to use open specifications and standards in future ITS development specifically in relation to the open data concept (making most of the data in the ITS systems available for public use). POSSE has so far contributed to kicking off the discussion on the open ITS and the open data concept.

La Spezia is designing its own open ITS and open data implementation plan including awareness-raising measures, setting up the basic requirements for the city strategy on open ITS and open data, undertaking a feasibility analysis about existing infomobility systems in order to assess their potential to become open and to make their data open and developing the "open" reference specifications for future ITS tenders.



specifications and standards and to share the experiences of existing open system frameworks in Europe. A central objective of the project is to build the capacity of transport authorities to implement open specifications and standards. To this end, POSSE is facilitating knowledge transfer between UTMC and OCIT/OTS and public authorities wishing to move towards open systems (referred to as Transfer Sites): the cities of Burgos (Spain), Pisa and La Spezia (Italy) and Klaipeda (Lithuania), the Norwegian Public Roads Administration and the Czech Transport Research Centre (CDV). With the expertise of the main technical partners, they are each developing a plan for implementing open standards and specifications.

In addition, POSSE is drawing up a good practice guide for the implementation of open specifications and standards, covering aspects such as

the reasons for Open Specifications and Standards, a description and history of the development and implementation of UTMC and OCIT/OTS, the lessons learnt and the transferability issues drawing on the knowledge transfer in the POSSE project. The guide will be issued in the middle of 2014 taking into account the experiences of the Transfer Sites in drawing up a plan to implement open systems, and in a few cases, the actual adoption of open specifications and standards in national law and/or national ITS strategy.

ENGAGING LOCAL STAKEHOLDERS IN MAKING OPEN ITS SYSTEMS A REALITY

The Transfer Sites are currently promoting the concept of open ITS systems locally or nationally and are engaging with the key stakeholders to make open systems happen. To facilitate this dialogue, POSSE

literature and activities (leaflet, website, workshops, etc) are conducted in the vernacular. To enable a wider group of stakeholders to benefit from the knowledge sharing within POSSE, particularly in those countries not represented by the POSSE partners, the POSSE Forum has been set up and has now close to 20 affiliated members drawn primarily from organisations representing national and local transport authorities.

In addition to knowledge sharing about POSSE, the Forum is also proving useful in uncovering other relevant initiatives in Europe and promoting discussion on what role should be played by the EU (if any) in promoting open specifications and standards. 

Norwegian Public Roads Administration

The Norwegian Public Roads Administration (NPRA) recognises the importance of open specifications and standards and the POSSE project is enabling it to learn more about existing open system approaches. The use of international standards and specifications will be central to the NPRA's ITS strategy and ITS action plan, which are important tools for the further development of ITS in Norway.

Open specifications and standards are closely linked to the definition and use of ICT- and ITS architecture. ARKTRANS, the Norwegian Framework for interoperability in the transport sector, will be adopted as the reference architecture for ITS in the strategy and the action plan. The use of ARKTRANS is a natural part of the NPRA's engagement in the POSSE project.

NPRA is planning a workshop to discuss connections and similarities between ARKTRANS and the structure of UTMC and OCIT/OTS. A goal could be "when specifications are in line with ARKTRANS they also should be POSSE compatible".

CDV/Czech Transport Research Centre (representing the city of Brno)

CDV has been promoting open specifications in ITS implementation in Czech cities. The city of Brno, as the Transfer Site of the project, has identified two main fields of interest: traffic control at crossroads and parking management. Brno is already using OCIT communication between controllers and the centre so the focus has been directed at parking. In 2012, Brno carried out a parking management analysis in the city and is currently defining next steps, including the design of a parking strategy.

CDV has introduced the project POSSE to other cities too. Karlovy Vary has decided to investigate further the potential of new emerging technologies and CDV has provided a feasibility study for on street parking management in the town centre that was delivered in October 2013. This offers an opportunity to promote open specifications using DATEX II for the data output of the future system.



FYI

Suzanne Hoadley leads Polis' Working Group on Traffic Efficiency and Mobility

shoadley@polisnetwork.eu

www.polisnetwork.eu

The next 12 months will see many POSSE tasks come to fruition and the project will culminate in the final conference at the end of 2014. To keep abreast of POSSE news and events, please register for the POSSE newsletter via the POSSE website (www.openits-posses.eu) or contact Suzanne Hoadley by email.

POSSE is coordinated by Reading Borough Council. The other partners are: UTMC Ltd, OCA e.V., Polis, the cities of Pisa, Burgos, Klaipeda and La Spezia, the Norwegian Public Roads Administration and the Czech Transport Research Centre (CDV). POSSE is an INTERREG IVC project running from January 2012 until December 2014.

Mobility on the agenda

Enabling sustainable mobility with alliances at the regional level, by **Reha Tözün** and **Bart Kamp**



Projekt NETZ-E2R provides a sustainable and convenient “e-bike-based last-mile-home mobility solution” available at the train stations, especially in rural areas. Booking is possible around the clock via smart phones or the call centre, and users of the system are most welcome to keep the e-bikes overnight. The e-bikes are hosted at dedicated energy-autonomous hire points located at the stations of the regional train network



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Never before have cities had so much know-how and so many capable tools at their disposal to develop sustainable mobility systems. The current state of commercially available technologies is sufficient to provide for a wide range of new sustainable urban mobility solutions, which create new mobility services that together enable the altered mobility patterns – with unprecedented capacity in revealing and steering user behavior in view of, for example, lower environmental impacts. A shining example is the floating carsharing deployment in the city of Stuttgart based on a 450-strong fleet of Smart fortwo electric vehicles. Eight months after its launch, the customer base reached 20,000 and over 1m km were driven on pure battery power.

Yet, we have to admit that electrical vehicles still have trouble competing with conventional vehicles in terms of sales. While manufacturing an electrical vehicle (“internal costs”) is more costly than a conventional car and thus comes to market at a higher price, electric vehicles are competing

with a disadvantage as long as the “external costs” of established transport modes are not fully internalized into their cost structures. Moreover, the cult of ownership of cars that has become installed in the mind of the average (European) car driver holds many citizens back to embrace car-sharing concepts. As a consequence, structural and behavioural lock-ins continue to make it difficult to change established mobility patterns and users’ choices.

To overcome this kind of “dead-lock”, it is indicated to provide facilities both for vehicle sharing and for multimodality to make different transport modes interoperable and interconnected (e.g. via “transferia” and other multimodal hubs). In several larger cities in Europe and especially for younger age groups this scenario is turning into a reality, and passengers enjoy a new kind of liberty: freed from the chores and costs of owning a car in urban areas while remaining mobile. Nevertheless, many urban areas are yet to launch new mobility services. To achieve this, the public sector cannot and

should not develop or impose these solutions on its own and private/market actors have to be involved from the beginning as co-creator and user. In particular private enterprises have to invest in new mobility solutions, despite the entry costs they may bring along and the requirement to engage in new partnerships with actors from unfamiliar business domains. The difficulty here is to overcome the vested interests and network that barriers hamper the cooperative action.

SPECTRUM ANALYSIS

The spectrum of essential stakeholders in furthering these new sustainable mobility systems is quite vast: local authorities, vehicle manufacturers, technology suppliers, utility providers, mobility management firms and academic institutions, to name a few. These actors often come in from significantly different backgrounds and have limited prior experience with each other in the given context.

Even when all parties are convinced of the necessity of an act, it

may not suffice to move the group in the same direction and at the same pace. For instance, utility firms and vehicle manufactures have since decades been tied to each other as the former supplied the latter with energy resources to feed the needs of automotive factories. However, this relationship had more of an input supply character and less one of co-development or co-makership. In the present context, both parties are bound to try and develop seamless and affordable ways of supplying power to electrical vehicle owners through roadside charging infrastructure. To get there will take time, effort and moderation in order to put all the pieces together and make them fall into the right place.

More importantly, sustainable mobility solutions require actors to accept new solutions and modus operandi that differ significantly from their existing ones, where the risk of cannibalizing their current earnings model is a serious one. Predictably, this new path may eventually lead to changes in the power balance between established actors and allow complete newcomers to come to the scene. This brings us to the age-old dilemma of how and why established firms place their bets or not on potentially disruptive innovations.

The Stuttgart Region shows how – despite these barriers – a sustainable mobility agenda can be implemented at the regional level. In spite of being a location where deeply woven economical and organizational interests are vested in the combustion engine technology, the Stuttgart region has been developing itself as one of the most active locations for sustainable mobility in Germany, if not in Europe.

In practice, the region has been putting together the pieces of a small but diversified “lead market”. Over 50 projects on electromobility and sustainable mobility are currently implemented with federal, state and

A welcome side-effect of the institutionalized and nurtured regional social capital is how it quickens the location’s responses to economic and technological challenges



The seamless and affordable supply of power via roadside charging infrastructure is vital

regional co-funding, covering a broad spectrum of themes, for instance intermodality (“VWS-Mobilpass” and “Stuttgart services”), integration of zero-emission vehicles in public and private fleets, last-mile-home solutions (“NETZ-E2R”), integration of electric vehicles in homes and districts, to name a few. Here, not only the stakeholders from public, private and research domains work

together, but also the different levels of the decentralized political landscape in Germany cooperate.

The example of Stuttgart Region reveals that three key ingredients are necessary to overcome prevailing market and network barriers: political intent across the different spatial levels of governance, financial incentives for the supply side and social capital at the regional level borne

VVS-Mobilpass

This smart card based solution serves as a common access system to the multimodal public and private transport services. With the help of these multifunctional cards the public transport users get a seamless access to and special benefits for the solutions offered by cooperation partners, e.g. DB Rent (Call a Bike, E-bikes, Flinkster carsharing system) and car2go. A follow-up project, “Stuttgart Services” will capitalize on the VVS-Mobilpass and add a variety of additional services, for instance for leisure time purposes.



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FROM VISION TO REALITY

Based on what the Stuttgart Region and other member cities and regions of the Polis network show, it becomes clear that there is an impressive amount of effort in Europe to turn encompassing visions for sustainable and clean mobility into reality. Some serious challenges remain, for instance a ground-breaking disruptive innovation in battery-tech is yet to appear in full effect. Nevertheless, an impressive mix of technologies is now within reach, most importantly in connectivity, which should make it possible to realize many of the advanced urban mobility visions that have been shaped over the years.

The bigger task is to win people over, not only because raising their awareness of acting against climate change becomes an imperative, but also on account of the effectiveness and reliability of the new sustainable mobility modes that are coming to market. Last but not least, European enterprises can find in new mobility demand a market that can lay the basis for co-developing new business models, with substantial potential for subsequent global roll-out. 

by institutionalized relations of trust and functioning networks.

The diversity of the issues at stake makes it near impossible for a single – national or regional – level of politics to deal with them appropriately. While the support from national politics creates a (“policy structuring” or “agenda-setting”) momentum for the topic in society, the many practical issues relating to implementing electromobility demand a steadfast (“actor-structuring” or “network-fostering”) political backing at the regional level. Furthermore, the financial incentives addressed through cooperative projects and innovation support measures help to overcome the reluctance for investment in the matters at stake and create an ecosystem of research projects and teams, where different stakeholder groups interact and co-learn.

Finally, the trust capital of a region is a critical component for stimulating the formation of alliances and to avoid and moderate possible destructive conflicts that arise during the initial implementation of disruptive technologies and business models. A welcome side-effect of the institutionalized and nurtured regional social capital is how it quickens the location’s responses to economic and

technological challenges in that it enables the involved actors to pursue shared objectives more effectively. Social capital can be “actively and purposely shaped” by network and cluster facilitators.

In Stuttgart Region’s example, it is the yield of decade-long efforts in cluster building activities, with an emphasis on creating local relations that can act as a catalyst and node for the development of trust and alliances across different stakeholder groups, hence helping to overcome network failures with regards to technology development.

As mentioned earlier, it is crucial that passengers are willing to adopt new forms of mobility behavior and to this end it is essential to create easy entry-points to new mobility patterns. In Stuttgart Region it is already possible to use publicly and privately managed modes of mobility, like the bus and tramlines as well as car-sharing services, by means of a new smart-card “VVS-Mobilpass”.

A follow-up project “Stuttgart Services” is currently expanding on these services with an ambitious platform, where even non-mobility added value services will be made available to all users of public transport in Stuttgart Region.

FYI

Reha Tözün, PhD, is Project Manager, Stuttgart Region Economic Development Corporation, Stuttgart, Germany.

reha.toezuen@region-stuttgart.de

Bart Kamp, PhD, is Head of Strategy Department at the Basque Institute of Competitiveness – ORKESTRA, Université Catholique de Louvain-la-Neuve – Louvain School of Management (IAG), San Sebastian, Spain

bart.kamp@orkestra.deusto.es

Niche work if you can get it

Alan Williams, Neil Hoose and Andy Graham take a look at business models and products focused at improving mobility, comparing city authorities with automotive providers and suggest that perhaps there is a trend emerging that will have implications for all providers of mobility infrastructure and services

One key aspect of the ubiquitous IT we all now have is the ability to provide services and products much more tailored to individual preferences. This leads to the creation of “niche” products and services, eg ride sharing and car clubs. We foresee a need to knit these niches together and create the ability for “dynamic niches” (think of biological cellular structures – nature is good at this) capable of forming and reforming, evolving and growing as the need and location changes linking to the other major factors driving the modern world. Deteriorating mobility hugely impacts on the modern world and has a major economic impact on most parts of our lives.

“Mobility”, “future cities”, “big data” “connected vehicles” and various other terms are starting to dominate the ITS landscape, and in many cases the technology is coming to maturity. But what still seems to be the “Emperor’s new clothes” question is “who wants them, and who will pay for them”? In other words – what is the business case for the smart city?

We have spent many years and many projects considering this issue – especially recently through the review of each of the recent Future Cities bids made by Local Authorities

in the UK for the Technology Strategy Board (TSB) and also from an automotive/vehicle perspective, reflecting the authors’ diverse backgrounds.

The conclusions we have come to contrast with the “top down” architecture seen by many especially in the future cities arena, and also the “provide access to data and people will create apps” approaches of some of the big data community. Instead we see that “mobility” is becoming more a collection of transport themed “niches” rather than a single integrated system (at least in the developed world). And our argument is that mobility – for individuals and cities alike,

comes from the way these existing and emerging transport niches can be designed as dynamic structures that mould, change and link to suit circumstances and how they are woven together to deliver benefits at the larger scale.

A few examples we have found



For cities, there is a real gap between the top down context of holistic policies driven by the main political and economic needs of the city, and the delivery of benefit in the real world through the emerging niche applications

demonstrate this idea of a “niche”. Let’s look at individual users first.

IDENTIFY YOUR NICHE

Firstly, the deployment of apps and web services is very locally tailored – for example in London there are over 20 Barclays Bike (known to Londoners as the Boris Bike although Barclays have announced that they are ending their sponsorship) hire apps, but we know of no UK-wide – let alone Europe-wide – app. The appearance on the roads of the USA of the fully automated car raises some interesting benefits for car owners. The task of driving in onerous or tedious situations can be safely undertaken by the automatic system relieving the driver of stress, the automated system can achieve better fuel economy and such cars

offer mobility for those for whom normal driving is physically difficult but who otherwise are perfectly capable of supervising an automated vehicle. However, recent surveys including the “Driverless car” by the AA – the UK’s largest automobile club – suggesting that the majority of drivers currently don’t want automated vehicles (although the desire varies with the age profile). Clearly in the short term full automation will be one niche within the overall automotive market.

While we have to respect the point made by Apple and Sony and the projects being developed by Google that people don’t know what they want until they can get their hands on it and see the benefits, (although this has proven to be the case in many areas of technology – the computer, the mobile telephone for example) this sort of approach doesn’t encourage building a business case for an automated vehicle.

But look under the bonnet and various niche applications are starting to take market hold – the parking sensors we all like are now moving to auto park, and the cruise control to collision avoidance. These are great examples of niche technology applications being drawn together for a more significant benefit – particularly in safety and convenience – development of technology and business roadmaps driven by market needs and desires are really helpful for predicting and planning the “eventual” outcomes – function and business.

Drivers may not want a fully self-driving car – but many would be happy for it to self-drive in niche when a significant need arises.

Additionally, most people travel in a local area for most of the time, so the need for pan-European journey planners is not as strong in their mind as knowing that a temporal incident such as tree across the road or an accident on the way to work 4km away. Facebook and Twitter are starting to become the way for geographical niche information tailored to the user, apparently delivered free of charge. Local bus, train and airport apps are widely available, but very few people want to know the status of every bus in London – they want tailoring to the bus they are waiting for. Likewise car clubs and van clubs allow more tailored access to vehicles and ride- and load-sharing apps allow the capacity of a vehicle to be better used.

So for the individual user, we simply won’t have a top down plan of what we need for mobility. An example of this is parkatmyhouse.com. This is a neat idea – people can sell on a market spaces in their drives that would otherwise be empty and require drivers to find a public parking space. But take a look at its investors – they include BMW. This is indeed clever – BMW have found a niche they can exploit that doesn’t require the user to have a BMW, can add value to BMW owners and move into the mobility space, without a great risk or huge investment and with a clear business case. Other vehicle makers are doing



The question for cities is; can they themselves also identify these gaps in between niches and enable them to be filled by making clear requirements for the market?

the same. Travellers are able to pick and choose the bits that offer them the benefits they want, and smart businesses will offer the ability to “pick and mix” rather than sell an all singing, all dancing service.

There is an opportunity through clever marketing and exchange of data to tie these transport niches into a mobility approach without users noticing. In the automotive sector, there are already middle players taking data and analysing and repackaging it as information, making the most of the networks we have. INRIX, Mediamobile and Trafficmaster to

name but a few collect data and add value, and have a business model that has adapted over many years. What is interesting is vehicle makers, pay-as-you-go insurance and other service providers also providing niche products. We will wait and see what the plans are for joining them up, or if a pick and mix model remains.

A HOLISTIC APPROACH

The challenge comes when you try to match the impact of niche products on the overall mobility of a wider area. For cities, there is a real gap

between the top-down context of holistic policies driven by the main political and economic needs of the city, and the delivery of benefit in the real world through the emerging niche applications. This is because the current thinking lacks real tools and “levers” that turn the data collected and channels provided by the niche services into policy related benefits.

We are yet to see in mobility a practical bridge between the two sides of the river that say “collect lots of data and derive analytics from it” and “save operational expenditure in the delivery of policies”. There is a need for an equivalent of the middle players we already have in automotive to make that span and also make it at a price cities can afford, as it offers them a clear benefit. Such middle players have the ability to realise economies of scale by working across multiple cities and regions. In today’s world that really means cash saving, and so it means making better use of what assets we have. A city has to justify investment in this area against filling potholes, reducing speed camera revenue or subsidised travel. It needs to see hard benefit!

The good news is that relatively cheap IT allows these city niches and more importantly the gaps between them to be identified. The market will work out what data to combine and how to package it to meet the top down plan, but simply badging technology as “mobility” doesn’t stand up to scrutiny – what is needed is a set of tools for not just intelligent



Barclays Bank have ended their sponsorship of London's bike share scheme, in part due to them becoming so widely referred to as Boris Bikes after Mayor of London Boris Johnson

analysis of the data and conversion into useful information, defining what data is available and where the gaps are, but what to do differently – what road junctions need redesigning, what bus routes need changing, what cycle hire stations need moving, what car parks need a different charging regime? This really resonates with the “better use of what we have” agenda.

The question for cities is; can they themselves also identify these gaps in between niches and enable them to be filled by making clear requirements for the market? This would allow the gaps and inefficiencies in the overall network to be exploited and hence improve overall mobility in line with policy. They need to see that the niche applications can be evolved in to something larger and the market needs to provide products that are transferable/repeatable to similar applications.

But there are also perhaps inherent dangers to overall mobility if one niche is overly successful and demand for that niche can only be met by taking capacity away from elsewhere. There are also potential social and environmental impacts that may be negligible at the “niche” level but become significant if the thing grows too big. Car clubs are more or less invisible when there are only a small number of cars waiting for users but what happens when they become a main user of parking spaces? How can “Boris” bike schemes ensure there are sufficient bays available at the popular destinations without starting to have a serious impact on the local environment? If large numbers of automated cars are sold what is the impact on driver training and licensing?

So we do need a top down plan, and we do need the niches of mobility that are merging, but the way they fit together needs more work. The lesson here is that the business model is changing as the more, specialised



What is the business case for installing a dedicated GPS unit to a bus when its passengers carry them in great numbers?

suppliers deliver into a fragmented market of customers with particular preferences.

The niche model does work to bring a bigger connected world – would we have the iPhone if it weren't for iTunes? Would we have Twitter without SMS? But there was never a grand plan – the market and clever, responsive marketing made it happen. SMS was after all an afterthought on mobile phones for engineers to contact one another, not a key USP of a mobile phone.

JOINING NICHES

So our message to the market is to find/look for niches and exploit them, but also take a view of how they can be added together to make really useful tools for people who run cities day to day. There are some great niche examples happening – for reporting

roads faults, public transport information via apps (why fit a dedicated GPS unit to a bus when your passengers carry lots of them for free?) and the parking we mentioned. And there is lots happening in big data and future city integration. We will have a true mobility approach when we connect the two, both operationally and with a business case. Until then it may be a bridge too far. ☺

FYI

Alan Williams, Neil Hoose and Andy Graham are the co-founders of CHASE.

alan.williams@ceruleanvisions.plus.com
neil@bittern-its.com
andy@whitewillow.biz

A virtuous cycle

Susan M. Grant-Muller and **Ayelet Gal-Tzur** discuss the role of social media in the service of transport authorities where quantity is the basis for quality

The use of social media by transport authorities and by transport operators as a way of communicating with the traveling public is already a daily reality. However this raises the question of how those involved in the transport sector can encourage the public to offer more voluntary comments, feedback and engagement in improving transport services via social media. In other words, how can the social media asset be used to the maximum potential by the transport sector.

Probably the most common social media applications that transport authorities and operators use to communicate with travellers are Facebook and Twitter. Out of the seven categories of social media defined by Sterne (ie Forums and Messages Boards, Review and Opinion Sites, Social Networks, Blogging, Micro Blogging, Bookmarking and Media Sharing), Facebook belongs to the Social Networks category whilst Twitter belongs in the Micro Blogging section.

The widespread use of these two types of social media is supported by the findings of a survey conducted in 2012 by Bregman (*Uses of Social Media in Public Transportation*, TCRP SYNTHESIS 99). Bregman's survey of 34 transport providers known to use one or more social media platforms in the United States and Canada also revealed that the vast majority of social media activity by transport agencies concerned information dissemination. In particular, the sharing of news and service alerts was

found to be the most common type of activity.

As important as these two activities are, they are not maximizing the potential of social media as a means for two-way communication between the transport sector and its customers, ie the travelling public. There is enormous potential to use the transport-related information captured by applications such as Facebook and Twitter that has been posted by the travelling public. This can act as a rich source of information concerning experiences and opinions that would traditionally be collected through other means (such as surveys) but which would require substantive resources. This is not to say that traditional surveys have lost their role in transport decision-making, but rather to regard social media as a new and unique source of complementary information.

TEXTUAL HEALING

The willingness of the public to provide transport-related content through social media means has already been demonstrated through an exploratory study focusing on transport-related Twitter messages regarding transport services to and from Liverpool Football Club matches (Gal-Tzur, Grant-Muller, Minkov, Nocera, *The Impact of Social Media Usage on Transport Policy: Issues, Challenges and Recommendations*, forthcoming in *Procedia Social and Behavioral Sciences*). This study showed that travelers voluntarily post a vast amount of messages regarding their traveling

needs, transport-related events they encounter (traffic jams, overcrowded trains and so on) and opinions regarding the quality of service of public transport.

However, a number of challenges remain in order to transform textual messages written by the users of the transport system into concrete,



A number of challenges remain in order to transform textual messages written by the users of the transport system into concrete, reliable and useful input for decision-making processes

reliable and useful input for decision-making processes. Techniques developed in text mining within other sectors (such as the semi-automated annotation of messages to categorize them by topic) are being gradually adapted for transport sector purposes. These techniques are the key for processing massive amounts

of textual information without the need for unreasonable amounts of human effort.

One of the key factors in the ability to further explore this potential and move from the research phase to the deployment phase is leveraging a high volume of user-generated transport relevant content. The larger

the corpus of messages written by the travelling public is, the higher the chances of identifying common needs and common preferences between clusters of travelers.

The inevitable question is what actions transport authorities can take to increase the size of this corpus. The most accessible and straightforward source of information is the social media accounts of the authority itself. Increasing the volume of messages posted within these accounts should therefore be the primary target of an authority wishing to exercise a fruitful bi-directional communication with the public. The most basic, yet effective measure to do so is to reply to users' messages. The one-to-one reply that takes place in the context of traditional written communication (letters between the public and the authority) doesn't necessarily apply in the social media context. For example, several messages addressing a similar topic can be answered by a single post by the authority.

Nevertheless, responding to messages posted by the public is only the most apparent means to maintain an active exchange of information with the citizens. Another means to encourage the public to post messages is to incorporate "fun" activities into the social media sites. Such activities attract people to enter the account and whilst already logged in, to take a short further step in posting a message. Such measures can span from simple features like incorporating fun videos into the sites (created by the authority itself or contributed



The one-to-one reply that takes place in the context of traditional written communication doesn't necessarily apply in the social media context



21st Century transport agencies and authorities can leverage a high volume of user-generated transport-relevant content

by the public) to more sophisticated means of transport-related games. Serious games – meaning games designed for purposes beyond sheer entertainment – is an emerging trend in many areas. Such games can serve to provide transport related ‘education’ and at the same time attract users to repeatedly enter the social media account. Contests within the social media account can also be a useful in attracting the public to be active through social media.

One example of the use of a contest by a transport authority, described in Bregmans’ report, is the one initiated by the South Coast British Columbia, known as TransLink. The agency began to use Facebook as a way to generate interest in the agency’s new fare card by holding a contest for a new name. Encouraging people to post attractive or amusing images and vote for the best image is a means already used by various bodies as an incentive to engage, and this could easily be adopted by transport authorities.

ULTIMATELY REWARDING

Rewards can also be innovative and cost effective, for example using “fame” by publicizing the contributor of the winning image may be an effective motivator.

The dedicated social media accounts of the transport agency are only one source of relevant

information on users’ needs and preferences. The second source is social media accounts handled by related bodies. Accounts of transport operators and transport-related NGOs in the vicinity of the transport authority are also likely to provide relevant and valuable information.

As the essence of social media is a means of voluntary cooperation between people for the good of all individuals engaged in this arena, it would only be natural to expand this concept to the cooperation between bodies for the common good. One of the first measures that can be taken by authorities is to become “social” with other transport-related organizations. Transport operators and transport-related NGOs who already use dedicated social media accounts to communicate with the public, are the most apparent candidates for such cooperation. Combining the transport related content held in separate social media accounts of the various bodies into one corpus will readily result in a broader and more solid foundation from which to analyse user’s perceptions of the transport system and of the quality of transport services.

The idea of cooperation with other key partners to promote transport policy goals has already been applied in other areas of transport. For example, as part of the SUNSET EU project, key partners were identified

to promote the use of the Tripzoom journey planner aimed at encouraging the use of sustainable transport modes. Finding the grounds for a win-win cooperation is the key for a successful long lasting collaboration between these partners. Ensuring the benefits for each key partner, whether a transport operator or an NGO organization, is a process based on the understanding of the goals and concerns of each.

The key message is that where both parties gain by engaging more via social media – whether they are members of travelling public, transport authorities or other third parties – social media use enters a virtuous cycle and the potential of this modern asset is more fully realized. 🔄

FYI

Susan M. Grant-Muller

is Senior Lecturer at the Institute for Transport Studies, University of Leeds, UK

Ayelet Gal-Tzur is Head of Traffic Management Research at Technion – Israel Institute of Technology, Haifa, Israel

S.M.Grant-Muller@its.leeds.ac.uk

galtzur@cv.technion.ac.il

www.its.leeds.ac.uk

www.technion.ac.il

Social and Economic Challenges of Transport

This section focuses on mobility for urban economic development and social policy. This includes accessibility of transport for the mobility impaired and accessibility to basic services (health centres, shops, culture, etc) for everyone; the financing of public transport and transport projects (including road infrastructure) generally; and regulation, planning and governance.

- o Barcelona, Spain – innovation in parking policy
- o Toyota City, Japan – Smart Mobility Society
- o London, UK – universal transit systems
- o Dortmund, Germany – the space race
- o Parking – policy focus
- o Funding – cities strategy



How can we make on-street parking a success?

On-street parking management can create policy paradoxes at the city level. Often local parking policy is aimed at promoting the use of off-street parking facilities in order to keep on-street parking reduced to a minimum. Increasing the service aspects of on-street parking could create ambiguity about the actual objectives of the local parking policy. Why invest in the on-street parking client if you actually want to promote off-street parking? Cities such as Barcelona prove that systems based on the integral management of on-street parking can perfectly compete with other solutions (such as urban road user charging) to tackle congestion, bringing much added value to the cities and its citizens.

The Third EPA-Polis policy paper on parking develops this idea further:

- What are the on-street parking user groups?
- What are the service elements to be covered?
- And how can we shape transition?

Download the paper at www.polisnetwork.eu/parking

“Parking is one of the big tools we use in Barcelona to control and regulate the demand of traffic in the city centre” See page 108

Keeping the value of public space

Allocating street space to parking has become a sensitive process. On-street parking is increasingly being regulated in Europe's cities as it competes with alternative uses of public space by pedestrians, cyclists and public transport, by cafés, green space or any other human activity. **Antoni Roig Alegre** is director of the parking division at Barcelona City Hall and talks about his city's strategy to manage on-street parking and where parking regulation is necessary with **Dagmar Röller**

Mr. Roig, you manage 54,000 on-street parking spaces in Barcelona. Doesn't this make quite a powerful tool for demand management in your city?

Yes, parking is one of the big tools we use in Barcelona to control and regulate the demand of traffic in the city centre. However, Barcelona's main problem in terms of parking is that too many people commute to work by car from the surrounding towns. We need to improve the park and ride system and put more parking facilities around Barcelona for people to change to public transport for the last part of their journey into the city.

How is this theory being put in practice?

We face two major problems here: First, we are not rich enough to implement car parks in neighbouring cities and pay for that. Secondly, we would be even poorer if we had to finance the capacity increase of public transport services to be able to carry all these extra people. So it is quite difficult to solve.

What, in practical terms, are you aiming to achieve with on-street parking regulations?

We have four objectives. Objective number one is to keep traffic congestion under control. We want to avoid congestion becoming a bigger problem and we would like to have less congestion than we have at the moment, although congestion in Barcelona is actually not that bad compared with other cities. The second goal of our work is to keep parking indiscipline in the city at a low level. The third objective we follow is to secure residents' access to on-street parking spaces. Instead of reserved spaces for residents we define tariffs that favour residents. Finally, a fourth objective, it is very important to keep the value of public space. We know the street is not only for parking, but for many other things.

Does Barcelona suffer from a "wild" parking culture?

We are talking about parking in double lanes, at pedestrian crossings

Antoni Roig Alegre is

director of the parking division at Barcelona de Serveis Municipals (B:SM), a company fully



owned by the municipality of Barcelona. B:SM manages and controls parking on Barcelona's public street network with a professional work force of 390 people. In his position at B:SM Roig is in charge of on-street parking regulation where he manages 54,000 parking spaces on Barcelona's streets. He also manages B:SM's off-street parking unit, which looks after a part of the city's off-street stock consisting of 55 publicly managed car parks.

or on curb sides, in loading zones or in disabled spaces or in hospitals, taxi stops, or even in bike, bus or taxi lanes. We are spending a lot of money to avoid indiscipline. Why? Indiscipline by itself is nothing but it creates insecurity and disturbs traffic fluidity that leads to congestion with all its negative implications. So if we control indiscipline we avoid insecure situations and we have the benefit of having a better traffic flow and much less congestion.

We are not rich enough to implement car parks in neighbouring cities and pay for that. Secondly, we were even poorer if we had to finance the capacity increase of public transport services to be able to carry all these extra people

Has the value of public space changed?

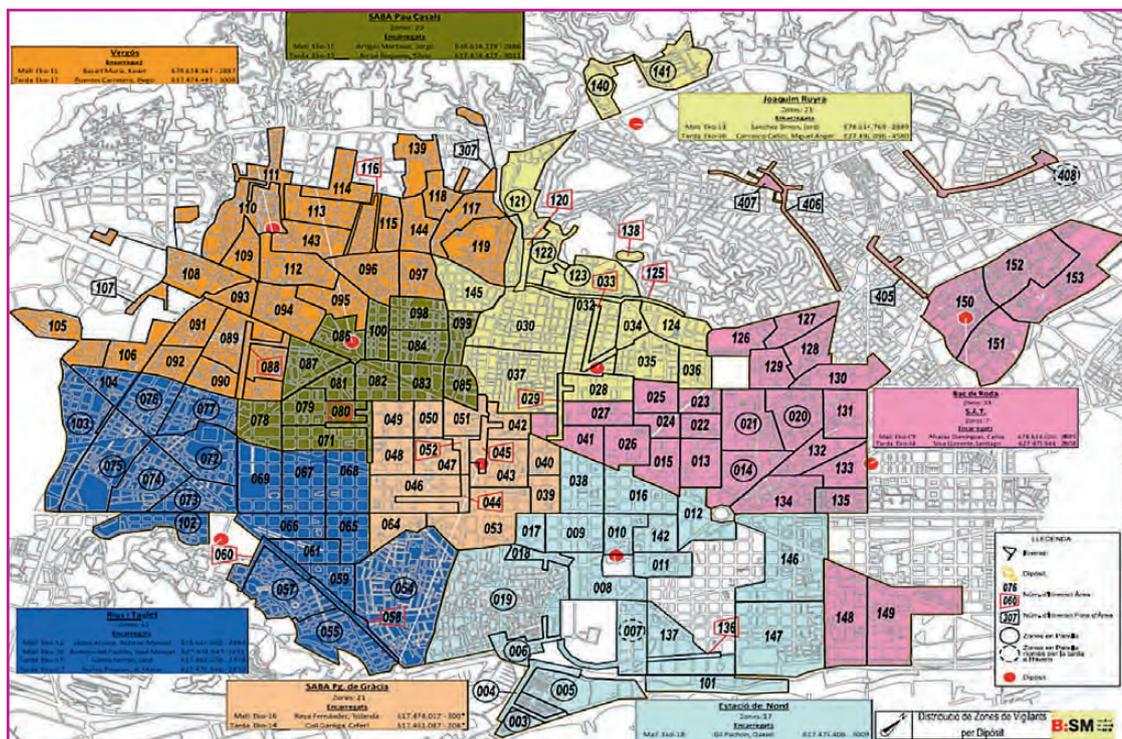
Public space, more and more, serves many more purposes than just on-street parking: pedestrians, public transport, bike lanes and so on. The remaining stock of on-street parking spaces should be used in the best way possible. Once 10 or so spaces are left for parking for example we have to see if it should be used for residents, for loading, etc. and we try to decide on the best use according to the specific demand of each single concerned area.

Which principles do you address when deciding whether or not to regulate on-street parking in a neighbourhood?

We analyse three factors. First, the degree of congestion of the detailed zone. Second is the demand of parking created by shopping or business. Residential demand is the third point: we have to see the residential parking deficit, for example if residents do not have car parks below their buildings we allocate space where residents are more favoured for parking.

Generating traffic when searching for a parking space

Barcelona is one of few cities in the world with in-depth knowledge of 'cruising'. In 2010 Barcelona measured that 17.8% of traffic in the city is caused by people searching for parking. Despite a lack of accurate data it is widely assumed that up to 30% of traffic in many big cities is due to cruising.



Map of the regulated area in the city of Barcelona. All parking spaces are regulated inside: not a single free space there. No one can expect to drive into the centre and park for free: therefore, it really acts as a congestion tax! Colors and subdivisions are only related to areas of surveillance.

Is on-street parking in Barcelona today fully regulated?

Barcelona's city centre is fully regulated, it means you will not find any parking space for which no payment is demanded or which is not dedicated for any other kind of purpose. When we started this system back in 2005, none of the districts or indeed the residents wanted to be regulated. We faced political barriers and had many local protests going on against us. It was very difficult to start.

Do you face the same barriers today?

After the first residential zones had been regulated residents realized that finding parking had actually become easier. Now we face the opposite issue where neighborhoods ask us for regulation of on-street parking because they know they will have possibilities to get their cars parked on the street. This is now the opposite problem as we are being asked to regulate little places where there is no conflict between different users. So the barriers and the tensions we have found during this process have changed dramatically from complete opposition against regulating on-street parking to asking us to regulate, even it makes no sense to do it!

Presumably people driving around searching for car park spaces a big burden on Barcelona's transport system?

I measured this in 2010 and the figures still remain valid. We measured cruising, the percentage of traffic searching for parking, and found

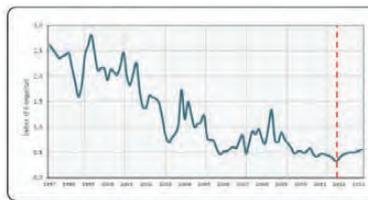
We want to make sure that the remaining stock of on-street parking spaces is used in the best way possible

an average figure of cruising at that time of 17.8%. It means that almost 18% of traffic on the road is searching for a parking space, either on- or off-street. These 18% were divided into approximately 12% of private cars and the rest were vans looking for space to do their delivery. It is

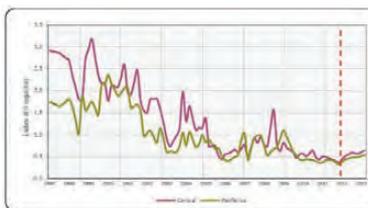
widely assumed that many of the big cities in the world have 30% of cruising. However, not many cities have figures as precise as we do.

What is your vision of Barcelona's centre with regards to parking?

Barcelona is a noisy city with dense traffic, however, the overall picture is quite normal for a city of this size and parking is not especially difficult. If you compare it with cities like Berlin it is another story though as Berlin has much quieter traffic. However, this is not only the result of management - a city's historic development and the street network have a big impact. We have been lucky in Barcelona and the large number of car parks in the city helps to meet the demand for parking. What I would do in the city centre is to better connect the off-street car parks and on-street parking in terms of tariffs and timing. ☺



Parking indiscipline in Bcn 1997-2013. Measured every 2 months



Units are cars illegally parked on the streets each 100 meters. There has been an impressive reduction since the regulation started!

Public space, more and more, serves many more purposes than only on-street parking

FYI

Antoni Roig Alegre is director of the parking division at Barcelona de Serveis Municipals (B:SM)

Dagmar Rölller is communications manager for Polis

comunicacio@bsmsa.cat

droeller@polisnetwork.eu

www.bsmsa.es

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www.areaverda.cat

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EUROPEAN CYCLING CHALLENGE 2014



A stronger voice for cities and regions

Today's cities build networks across Europe to make transport more sustainable

It was in 2012 that the city of Bologna initiated the playful and effective European Cycling Challenge: European cities challenge each other by forming groups of cyclists who track their trips and quantify CO₂ savings. "The 'challenge mechanism' motivates individuals to join the initiative and be proud of their contribution to making the city more liveable", says Dora Ramazotti from SRM Bologna.

In 2013, over 3,000 people from 12 cities joined the Cycling Challenge and cycled more than 310,000 km. At the end, team Tallinn preceded Lille and Bologna and won the challenge. The 2014 edition will be carried out throughout the month of May, and already twice as many cities engaged with Bologna to join the challenge.

WHY NETWORK?

Bologna also exchanges with other cities to identify solutions that can help to achieve a more liveable city or region with a more sustainable transport system. They meet in Polis, the network of cities and regions working towards sustainable mobility. Together, cities and regions have a strong voice towards the European Institutions and best access to network with peers and strategic players in the transport sector.

Polis membership is open to local and regional authorities and to their transport authorities, mobility agencies and local public transport organisations.

MORE INFORMATION:

The Polis network: <http://www.polisnetwork.eu/become-member>

The European Cycling Challenge: www.ecc2014.eu

www.ecc2014.eu.



THINKING Aloud in the city

Following on from the success of Thinking Aloud, the *Thinking Highways* magazine podcast, Paul Hutton and Kevin Borrás bring you news, interviews and opinions from the smart transport for cities and regions sector in a new monthly internet radio show.

Episode one features interviews with Polis' Sylvain Haon and *Thinking Cities* contributors smart city pioneer Larry Yermack and TRL's Denis Naberezhnykh.

Go to www.thinkingcities.com or download from iTunes



Mobility in harmony

Toshiya Hayata and **Stéphane Péan** explain the thinking behind Toyota's Smart Mobility Society and the company's long-term commitment to sustainable mobility

The fast pace of urbanization and the metropolitan development trend is prompting public and private stakeholders to tackle cities issues – congestion, safety, pollution, greenhouse gas emissions and energy saving – in a more comprehensive, integrated and sustainable approach.

Since automotive companies cannot accomplish this on their own, a process is needed for studying the relevant issues through dialogues with local authorities and civil society. Indeed, cities and regions have undeniably gained leadership thanks to greater than ever institutional and political capacity.

Nevertheless, times have changed and due to some limitations (space, budget), it is now far more complicated to expand road and transport infrastructures than in the past. Therefore, new innovative solutions should be implemented to optimize the whole existing transportation system and reduce drawbacks to society.

Through local initiatives in the four major areas of next-generation telematics, cooperative Intelligent

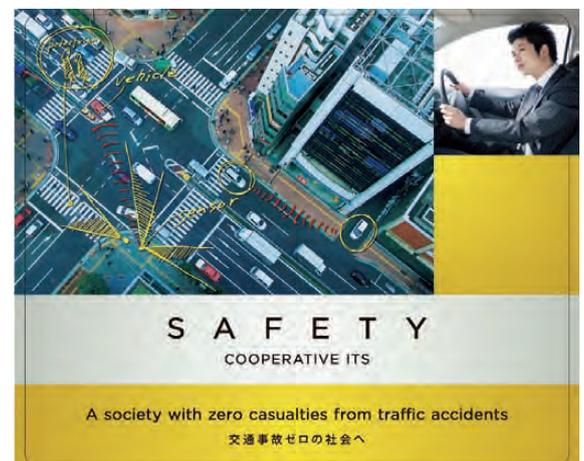
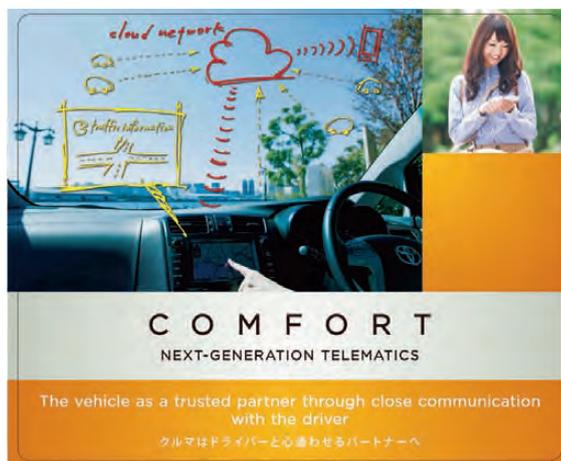
Transport Systems (ITS), new urban transportation system and energy management, Toyota is committed to enriching the lives of communities, as stated in its "Toyota Global Vision". It undertakes these projects by always taking into consideration local needs and circumstances.

SUSTAINABLE MOBILITY: A LONG-TERM RELATIONSHIP

For almost 20 years, Toyota has been a member of the Geneva-headquartered World Business Council for Sustainable Development (WBCSD), co-chairing the Sustainable Mobility Project (SMP) that concluded in 2004 that mobility would not become sustainable if current trends continue.

In 2010, WBCSD published its "Vision 2050" that describes successful progress for sustainable mobility as "near universal access to reliable and low carbon mobility, infrastructure and information". Three years later, it launched the Sustainable Mobility Project 2.0, a major new initiative that brings global and cross-sectoral companies from

Toyota's Smart Mobility Society is divided into four pillars: Comfort, Safety, Convenience and Ecology



Cities and regions have undeniably gained leadership thanks to greater than ever institutional and political capacity

mobility-related industries together with other stakeholders to accelerate progress towards sustainable mobility and define the ideal future mobility society. This three-year research initiative (2013-2015) aims to speed- and scale-up the implementation of sustainable mobility solutions.

A GLOBAL VISION TO LEAD THE FUTURE OF MOBILITY

In March 2011, Toyota unveiled its new “Toyota Global Vision” stating: “Toyota will lead the way to the future of mobility, enriching lives around the world with the safest and most responsible ways of moving people”.

Toyota will lead industry in tackling technological advances that will spawn next-generation mobility. It will explore new possibilities in personal mobility, the convergence of information technology for automobiles and “smart grids” for optimizing energy generation and consumption.

Toyota will undertake such leading edge R&D with an eye to adapting products and services to each market. Moreover, Toyota will develop low-carbon technologies and technologies for maximizing safety through interaction with the transport infrastructure to lay a foundation for sustainable and

amenable future mobility. The company will work in this and other ways to support new kinds of lifestyles, while propagating technologies for preserving environmental quality.

SMART MOBILITY SOCIETY: A COMPREHENSIVE AND INTEGRATED APPROACH

Toyota aims to create a smart mobility society that connects people, cars and the community so as to pursue society in harmony, collecting and integrating “big data” from its four potential business areas: next generation telematics (comfort), cooperative ITS (safety), new urban transportation system (convenience) and energy management (ecology). Big data is collected by the vehicle data management system (VDMS), the traffic data management system (TDMS) and the energy data management system (EDMS). Developed internally by Toyota, they compose the Toyota Smart Center, which is able to provide comprehensive and integrated solutions.

○ **Next generation telematics:** the vehicle will become a trusted partner through close communication with the driver thanks to cloud based interactive-type services that ensure comfortable

CONVENIENCE
NEW URBAN TRANSPORTATION SYSTEM

A traffic environment where everyone can move around as they wish
思い通り移動できる交通社会へ

ECOLOGY
ENERGY MANAGEMENT

Eco-friendly lifestyles with high quality of life
無理なく質の高いエコライフへ

car living. Toyota provides big data traffic information to local authorities and businesses, sent automatically by vehicles (floating car data) or manually by drivers (crowdsourcing) equipped with telematics service;

- **Cooperative ITS:** those systems provide support for safer driving. In Japan, services are being expanded with some already in operation (road-to-vehicle cooperation) or will be introduced shortly (vehicle-to-vehicle and pedestrian-to-vehicle cooperation);
- **New urban transportation system:** this stress-free, safe and eco-friendly transportation solution suggests the optimal route to the user thanks to a multimodal route guidance and provides a short distance mobility sharing service based on ultra compact electric vehicles;
- **Energy management:** it aims for optimized energy use in all areas of society by using information that links together homes, convenience stores, schools or industrial parks as well as vehicles (plug-in hybrids electric vehicles and pure electric vehicles) or transportation network in order to coordinate a balance of supply and demand for electrical power.

SMART MOBILITY & ENERGY LIFE IN TOYOTA CITY PROJECT

In November 2009, Japan's Ministry of Economy, Trade and Industry (METI) established the Conference on the Next-generation Energy and Social System that solicited applications from cities

willing to be sites for the testing of smart grid and smart city-related systems and technologies but also business models. Four cities have been selected for five-year operational tests (2010-2014): City of Yokohama, Keihanna Science City, City of Kitakyushu and Toyota City.

Toyota City, a rural city located in Aichi Prefecture and home to the Toyota headquarters, established the Low-Carbon Society Verification Promotion Council gathering 50 entities, including Toyota City and private companies. It supervises the "Smart Mobility & Energy Life in Toyota City Project" ("Smart Melit" or merit) that focuses on energy management and a new multimodal urban transportation system.

The House energy management system (HEMS) links energy-generating devices (fuel cell) and energy storage devices (battery) in the home with plug-in hybrid vehicles and intelligent household appliances to optimize and make possible visualization of electric-power supply and demand and control of individual household devices. Storage batteries connected to and controlled by the HEMS support low-cost and low-carbon energy consumption in the home and can serve as an emergency power source.

The supply of electric power from vehicle batteries to the home is also tested. During normal times, vehicle batteries can store excess power from the home and from the community, contributing to efficient energy usage.

On the community level, the EDMS coordinates the balance of the electric power supply and demand within the region with the aim of achieving local production of energy for local consumption by the community. For example, if a shortage of power generated by solar panels in the community is predicted, residents will be advised to limit their energy consumption.

EDMS will also connect transportation network with the purpose to lower overall its energy use. Eventually it will enable transportation route calculations by considering the vehicle battery status, as well as regional electric power demand.

In conjunction, Smart Melit Project deploys IT and ITS technologies in order to efficiently integrate cars and public transportation for commuting and other travel purposes with the aim of reducing CO2 emissions in the transport sector by 40%. This is the purpose of the optimized multimodal transportation system known as the Harmonious Mobility Network (Ha:mo).

Ha:mo Ride is Toyota's single-journey electric vehicle sharing service



Ha:mo Navi is a smartphone service that provides multimodal route guidance



HARMONIOUS MOBILITY NETWORK (HA:MO)

Ha:mo Network is a research project that aims at testing the TDMS in urban area. This expert system optimizes the combination of public transportation and private vehicles use based on the operational status of public transport systems and traffic conditions. It collects mobility and weather data in order to create forecasts of transportation demand and congestion. Accordingly, the system can also provide appropriate recommendations to local mobility operators.

The research project focuses particularly on two Ha:mo's end-users services: a multimodal transportation information service (Ha:mo Navi) and an ultra-compact electric vehicles sharing service designed to accommodate short-distance in urban areas (Ha:mo Ride).

HA:MO NAVI : MULTIMODAL TRANSPORT INFORMATION SERVICE

Ha:mo Navi is a service based on smartphones that provides a multimodal route guidance enabling searches with the optimal combination of multiple means of transport such as walking, cars, trains, buses and taxis. It also suggests the car sharing service Ha:mo Ride as an alternative mode of transport.

By voluntarily taking into consideration cars and traffic congestion in the journey calculation, Ha:mo Navi encourages modal shift to public transportation. For the same reason, it also includes the provision of park-and-ride facility information (such as parking space availability) and enables allocation of "eco-points" based on park-and-ride facility, public transportation or car sharing use.

The scalability is the key as the more users join Ha:mo Navi the more positive effects will be made on and for the community.

HA:MO RIDE: "ONE WAY" ELECTRIC VEHICLES SHARING SERVICE FOR SHORT DISTANCE

Ha:mo Ride seeks to provide both transport convenience for users and benefit for society by supporting the optimal use of vehicle and public transportation

for short-distance travel (within a few kilometers) from a train station to the user's destination through the sharing of ultra-compact electric vehicles. Those personal mobility vehicles (PMV) have been adapted specifically for urban driving, efficient use of parking spaces, and for "last mile" mobility needs.

Above all, it is a one-way-travel car-sharing service where the user can leave the vehicle at their destination. Vehicle reservation is done with a smartphone and IC cards are used to access the vehicle. Ha:mo Ride is technically based on the one mile mobility system (OMMS), developed internally by Toyota. It is a comprehensive IT system that remotely provides reservation, billing and also fleet and charging infrastructure management operations.

HA:MO FIELD-TESTS IN JAPAN AND EUROPE

In Japan, verification testing began in October 2012 as part of the Smart Mobility & Energy Life in Toyota City Project.

After a first free-of-charge trial phase in cooperation with Chukyo University (four stations, 10

Toyota aims to create a smart mobility society that connects people, cars and the community so as to pursue society in harmony



Above: Toyota launched its iRoad mobility concept vehicle at the 2013 Geneva Motor Show

Left: Toyota's single-seater COMS vehicles are an integral part of the Ha:mo Network

vehicles and around 100 users), the Ha:mo Ride car sharing service has extended in Toyota City, just one year later (21 stations, 100 vehicles and 1000 expected first users), shifting to a fee-based service (200 yen or €1.50 for the first 10 minutes then 20 yen per minute thereafter). Incentives have been introduced to encourage users to commute and leave the vehicle at home at (with a cost of 1 yen per minute).

Concerning Ha:mo Navi, several thousand users have already registered for free to the service. However, the advanced route guidance supported by the TDMS is at present only available within the Toyota City area although a simple route calculation can still be carried out nationally. In 2014, Toyota plans to provide recommendations based on TDMS forecasts to mobility operators.

Ha:mo Network will be also replicated in France. In March 2013, Toyota signed a Memorandum of Understanding with both local authorities City of Grenoble and Grenoble-Alpes Métropole, the car-sharing service operator Cité lib (Citiz Network) and the French energy provider Électricité de France (EDF) to implement a French version of Ha:mo Network by the end of 2014. This will be a three-year project.



Representatives from Toyota, City of Grenoble and Grenoble-Alpes Métropole, Cité lib and EDF at the March 2013 signing of the Ha:mo MoU From right: Michel Gardel, Vice President of TME; Marc Baitto, President of Grenoble-Alpes Métropole; Michel Destot, Mayor of Grenoble

Toyota plans to supply 70 ultra-compact electric vehicles, including a fleet of single-seater COMS and a new PMV based on the concept car iROAD, unveiled at the last Geneva Motor Show. Besides, EDF will provide the charging infrastructure based on a network of around 25 stations, located mostly in the City of Grenoble but also further in the

metropolitan area close to railway stations and Park & Ride facilities.

The Grenoble project differs slightly to the Toyota City initiative due to its more complex organizational environment. Indeed, the number of partners and the diverse systems locally in operation require Toyota to interface its own systems such as the OMMS.

Moreover, Toyota cannot directly supply Ha:mo Navi and has to connect to “Station Mobile”, a multi-modal information service already locally developed by Grenoble-Alpes Métropole.

TESTING TIMES

Field operational tests enable Toyota to acquire knowledge and know-how, and particularly devise new business models. Indeed, its purpose is to create new businesses by developing new sustainable mobility needs, taking into consideration the diversity of cities and regions.

Toyota fully intends to expand the Ha:mo Network as a commercial service to communities in Japan, Europe and into Asia and North America. By then, new trial tests might be considered. 🌐

FYI

Toshiya Hayata is Group Manager, Transportation Solutions Group, Smart Community Department, IT & ITS Planning Division, Toyota Motor Corporation

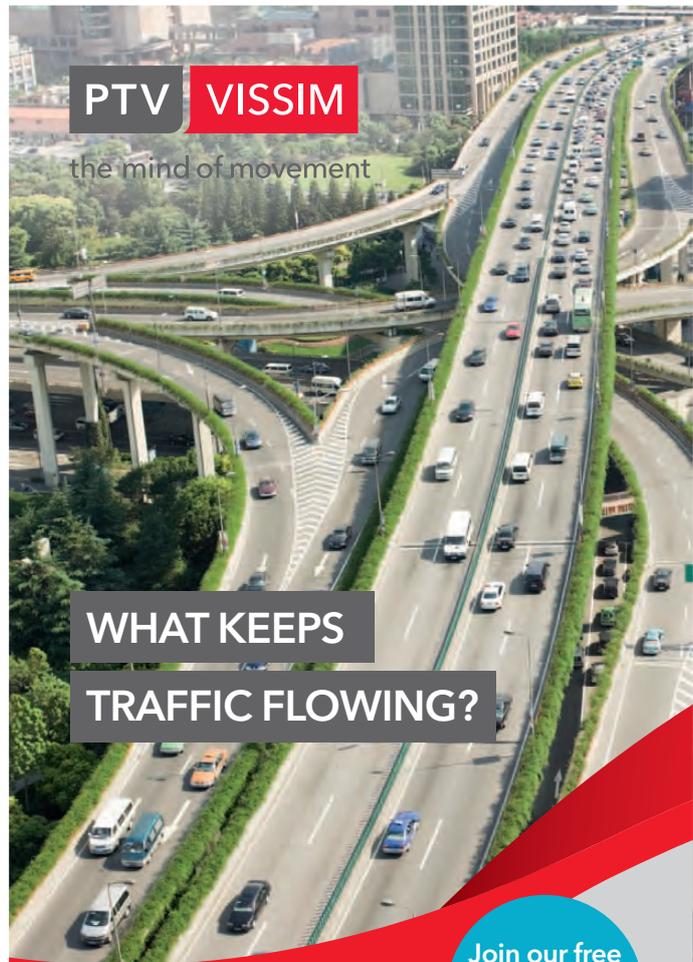
Stéphane Péan is Project Manager, Transportation Solutions Group, Smart Community Department, IT & ITS Planning Division, Toyota Motor Corporation

toshiya_hayata@mail.toyota.co.jp
stephane_pean@mail.toyota.co.jp

www.toyota-global.com

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Capital gains

Get smart? We already are. Intelligent cities are open for business with universal transit systems, says **Will Judge**



More than 85% of all public transport journeys in London are made using the Oyster card

Over the decade in which contactless smartcard ticketing has become widespread there has also been a convergence of the ticketing and the payments industries



Contactless smartcards for public transport ticketing have become part of the normal fabric of life in many large European cities over the past decade. Ask a Londoner how his or her Oyster card works, and the chances are that they will understand the question and that you will get an answer that is correct, at least in part. Oyster cards are used for more than 85% of journeys on London's public transport system, so it should come as no surprise to hear that almost everyone who lives in London has got one and knows how to use it; for buying their preferred travel product, loading it onto their card and using it.

But ask the same Londoner about Oyster's equivalents in Europe such as the OV-Chipkaart or Navigo or Leap and they will probably look at you blankly. Which is curious, because out of the many European city transit smartcards that we could have chosen for this thought experiment, it would have been reasonable to expect that the ones provided for public transport users in Amsterdam, Paris and Dublin respectively – cities with direct connections to London and visited by hundreds (if not thousands) of Londoners every day – have a better chance than most of entering the average Londoner's consciousness.

However, they do not seem to have done so and this is a pattern that is replicated across Europe. A quick check on Wikipedia reveals that across the EU-28 there are more than 100 national or city transport smartcard schemes in operation. It is likely that each one has delivered

on its own business case and has enhanced the efficiency and appeal of public transport in its own area. But for the typical European citizen this is an aspect of life which works solely at the local level: familiarity with the locally-provided transport smartcard is high, but it is less common to find people who have devoted time and energy to getting and understanding the equivalent cards provided by cities and countries beyond their immediate locality.

IMPACTS AND IMPLICATIONS

What are the implications of this fragmented market for European cities and the public transport networks within them? The primary consequence is that cities everywhere bear the adverse effects of a lack of interoperability between contactless ticketing smartcards. Although most Europeans pass most of their time in their home city, most do travel to other cities and countries from time to time and in doing so generate very large aggregate visitor flows. As would be expected given their role as creative, leisure and business hubs, cities attract a high share of these visitor journeys and bear the brunt of the adverse effects:

- **Lost public transport revenues** – many visitors arriving in cities are people who routinely and enthusiastically use public transport in their home city but find the challenge of engaging with and understanding a new city's transport system too taxing to be worth the investment of time. These travellers can be found in the queue for

taxis at the city's airport or principal railway station and by virtue of their choice to avoid the complexity of an unfamiliar transport system they perpetuate the twin urban challenges of road congestion and worsening air quality in cities.

- **Lost business activity and revenue** – the complexity of understanding a new ticketing system not only deters people from choosing public transport at all, but also deters those who invest time in getting and understanding the ticketing smartcard from visiting all the places they might have visited during their stay. At the margin, some visitors will be put off from making shorter, additional journeys to places of interest, cultural and leisure venues or business contacts during their stay by their anxiety about navigating the ticketing system correctly. In this sense, the openness and ease of understanding a city's public transport ticketing system can be thought of as one contributing factor to the overall sense in which a city is an attractive business and leisure destination compared with others.
- **Unproductive staff time** – almost every city's public transport system is characterised by a hard-pressed work force kept busy by the challenge of maintaining good quality, reliable services in the face of every-growing ridership and a complex interdependent set of system assets. These workers' time

is a scarce, expert resource. But all too often staff members have to be assigned to customer service and ticket sales roles to meet the needs of people arriving in the city and requesting comprehensive explanations of the public transport system and its associated smartcard. The pay-off from these tasks is high when the customer being served is a new resident: in this case, the orientation provided may result in the public transport system gaining a new, loyal and enduring customer. But for visitors spending just a short time in the city the pay-off is low or zero, as many visitors – especially those travelling for leisure or cultural pursuits – do not return often, or at all.

- **Wasted investment in smartcards** – linked to the second effect is the frequency with which contactless smartcards are purchased by a city's public transport system and issued to a visitor for whom the effective operating life of the card is measured merely in days. To illustrate this point, Transport for London's public statements indicate that since the start of the Oyster programme they have issued more than 50m smartcards despite the fact that the population of the city is only about 8m (although TfL statistics show that there are over 17m unused Oyster cards in the capital with over £55m left on them in unused credit). The explanation for this difference is



that there is a constantly churning incremental population of visitors in the city, many of whom want to use the public transport system and hence get an Oyster card. While on any given day the visitor increment on the population of residents is relatively small, the number of people who have ever been a visitor to London rises rapidly over time given the rapid turnover of people within this group, and as a result so does the number of smartcards ever issued to visitors.

Some 8,500 London buses are able to accept fare payments using the Oyster card and also contactless payment cards



Over 50m Oyster Cards have been issued since the scheme was introduced in 2003



WE (DON'T) HAVE CONTACT

Is there an alternative approach to public transport fare collection in cities that generates fewer adverse effects? Such an approach would need to meet the critical requirements of public transport operators that have driven them to adopt contactless smartcard ticketing – principally speed/throughput and the ability to support distance-based pricing by using a “check-in check-out” model.

Over the decade in which contactless smartcard ticketing has become widespread there has also been a convergence of the ticketing and the payments industries, primarily caused by the adoption of contactless technology on payment cards issued by banks. In Europe, this trend is well-established: MasterCard’s contactless payment technology has been included in cards issued by banks in 29 European countries and

more than a million retail outlets worldwide are ready to accept contactless payments.

If we consider these products against the two critical requirements of public transport operators there is actually a good match: the contactless technology allows the cards to be used at speed for low-value payments, and recent work in London and elsewhere has resulted in the creation of a set of transaction rules specifically for public transport operators that allow for distance-based pricing. And these cards are issued within the global framework for payment cards, so they benefit from global interoperability – a card issued in a person’s home city will interact correctly with a terminal device in a different city as long as both card

How aware are travellers of the other smart cards available across Europe?

Visitors to London from 30 different countries have used their own payment cards to pay for transit fares

and terminal bear the right scheme branding marks.

If European cities were to decide to extend the range of contactless cards they accept for fare payment on their public transport systems to include contactless payment cards, they would be able to significantly reduce the four adverse impacts described above:

- Many visitors arriving in the city would already possess a contactless payment card that is globally interoperable and would be able to immediately “check-in” to the public transport system where they see the right payment scheme branding without having to invest time in getting a local city card and load a product onto it;
- Such visitors would be able to make spontaneous or additional trips quickly and without hassle while they are in the city;
- Public transport staff members would spend less time issuing local city cards to visitors and explaining how they function; and
- The volume of local city cards procured and issued to visitors would fall, resulting in efficiency savings for the city transport authority or operators.

Acceptance of contactless payment cards for public transport fare collection can be introduced alongside continued acceptance of existing contactless ticketing smartcards.

Arrivals from continental Europe should be able to access public transport without having to change their payment method



London has already implemented this model on its 8,500 buses, which are able to accept fare payments using the Oyster card and also contactless payment cards.

So far, visitors to the city from more than 30 different countries have used their own payment cards to pay fares this way, without needing to get an Oyster card beforehand. The next step is to extend the model to the whole public transport network in the city. Doing so will be a concrete step by the city’s transport authorities to reduce the barriers to riding the system perceived by visitors and to positioning the city as a place that is keen to attract business

and leisure visitors from elsewhere in Europe.

Every other European city could capture the same benefits by taking this approach, and in doing so would enhance the degree of practical interoperability in urban public transport enjoyed by European citizens. 

FYI

Will Judge is Senior Business Leader, Global Strategic Alliances, at Mastercard

will_judge@mastercard.com

www.mastercard.com

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See the possibilities

From the outside in

Eberhard Buhl in conversation with **Martin Krieg** from the city of Dortmund, on how the space requirements for individual motorized transport will develop in the city of the future



Dortmund is one of many cities attempting to lean the modal split in favour of public transport

Martin Krieg is head of planning at the civil engineering department of the city of Dortmund in Germany and is responsible for urban planning as well as traffic engineering. In the 1990s he managed a project for accelerating tram traffic on tram lines and feeder lines for the light rail system. Later he was involved in the preparation efforts for the FIFA World Cup 2006 as traffic coordinator for Dortmund, where the Westfalenstadion was the venue for several matches, including Germany v Poland in the group stages and the host nation's 0-2 defeat to Italy in the first semi-final.

Mr. Krieg, for some time now, many traffic experts have pointed out that traffic is taking up too much space in modern cities. What conclusions do those in charge in local authorities draw from this?

For a long time now the general trend in large cities has certainly been towards reducing the space for private motorized transport. This is especially true in residential areas, where more and more attempts have been made to slow down traffic, but in inner cities as well, where the stationary traffic is increasingly stacked in parking garages or relegated to the basement in underground garages. Of course, there are also sustained efforts being made in most cities to shift the modal split in favour of public transport and non-motorized ways of locomotion such as cycling.

When such matters are being considered, is it transport efficiency or the environment that comes first?

Both. First of all, it is easy to figure out that cars consume much more area in relation to their transport capacity than, for example, rail-based public



The Dortmund Tower is one of the most famous landmarks in the city

transport. Secondly, environmental aspects also play a role of course. However, when talking about the speed at which the so-called modal shift is taking place, one must never

In contrast to pilot projects in China or elsewhere, we are not planning on a greenfield site, we are working within an existing infrastructure situation

forget one vital fact: in contrast to pilot projects in China or elsewhere, we are not planning on a greenfield site, we are working within an existing infrastructure situation.

In other words, we should not expect any miracles?

Precisely. As the starting point of our planning efforts, we always have to take real traffic flows and real demand, which of course cannot simply be pushed somewhere else on the spot. We can only offer new transport ways and means and hope that they will be accepted. Here in Dortmund, for example, for many years our cycling facilities have not been planned on a needs basis, but rather on a capacity basis. In principle, a change of strategy is possible: not from the inside to the outside anymore, but rather the reverse. That is



Public transport plays a huge part in Dortmund's efforts to become a truly smart city, transportationally speaking

to say, previously the area made available for moving traffic was optimized and then the remaining space was spread between the other uses. From

an environmental point of view, we should proceed the other way round. Initially – assuming a ribbon development – the demand for space for non-motorized transport on both sides of the street would be determined and then the planners would look to see whether the space left in between was sufficient to handle the traffic that would be absolutely necessary, for instance for waste removal, deliveries or rescue services.

Are you, as a local authority, free to decide as to how the space is used, or are you bound by specific requirements laid down by the state, the Federal Government or the European Union?

Basically, land use planning is one of those areas in which the cities in Germany have autonomy. But of course we always have to consider interregional objectives such as reduced air pollution.



Dortmund is making a sustained effort to tempt people out of their cars and onto their bikes

How many years ahead do you plan your land use?

When it comes to major strategic decisions regarding mobility, some farsightedness is required. Generally speaking, we look ahead 20 or 30 years. However, when it comes to implementing concrete measures, it is often all about speed. Here, the time windows are rarely more than two or three years.

And what are the primary factors you consider in your long-term plans?

First and foremost, of course, we look at the well known socio-demographic parameters – i.e. the forecast answers to questions such as: How are the population numbers changing? How many working people, how many students, how many businesses will there be and where exactly? When, where and why do people want to travel, and how will they get there? All this must then be matched to, for example, the Federal Transport Infrastructure Plan – and also and in particular to the objectives that each local authority has set in terms of its targeted modal split.

Do these goals vary from city to city?

Yes, they do indeed. For example, our target is to increase the share of cycling to 15% over the next few years. For us, this is an ambitious undertaking, but for Munster it would be a significant step backwards. As I said earlier, one must always see everything in context.

Some transport experts fear that the implementation of modern car-sharing concepts could become difficult because the cities may perceive the new providers as being competition for public transport operators and therefore only give them a limited number of parking spaces. Are such concerns justified?

To be honest, I cannot understand such fears. Personally, I do not see car-sharing as being in competition



The City of Dortmund is always open to innovative methods of transportation...



At the Audi Urban Future Award 2012, the winner was a US architects' office that submitted a concept in which the 'classic' road was replaced by "Tripanels": rotating elements with three different surfaces – asphalt, green spaces or solar panels. The areas could thus be alternately used as a football pitch, for generating power or as a regular road. Is that a purely Utopian vision or an idea that could be of interest to you?

I see my role as one that is operating closer to the practical end of the food chain. But in my position I not only find it interesting to take an occasional look over the professional fence, but important as well. Such approaches often provide a valuable stimulation to practical thinking. In any case, those of us who take responsibility for transport in Dortmund are always open to innovative ideas... and if a concept seems plausible and promising to us, we are happy to test it out in a pilot application. ☺

FYI

Martin Kreig is head of planning at the civil engineering department of the city of Dortmund

MKreig@stadt.do.de

www.dortmund.de

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Parking Space - the final frontier

Richard Harris looks at how smart parking systems, an integral part of the Thinking City, add to the overall customer experience



The first parking meters in England were installed in London in 1958

On 10 July 1958, the first parking meter in England was installed in London. The charge was 6d (2½p or €0.04) an hour for the first two hours, 10 shillings for the next two hours, and £2 after that. By 1961 both Manchester and Bristol had installed parking meters and deployed traffic wardens as enforcement officers.

Many of the 750,000 parking meters once installed in Britain have now been replaced by pay and display machines, cashless meters operated via a mobile phone or credit card and/or pay-by-phone via text message quoting registration plate and parking bay number.

PARKING – COMPONENTS

Parking is not just the time it takes to park, but the time it takes to deal with the process. There are four major components to a parking programme that determine its effectiveness:

- Customer Experience
- Street Operations
- System Support & Analytics
- Compliance

Customer Experience

Parking should be a non-event for drivers – where it's so easy and painless that it is no longer an issue. This means reducing unnecessary circling around looking for parking spaces and ensuring that payment systems are easy and reliable.

Reducing travel time mitigates congestion and improves air quality while keeping people happy and moving quickly from one destination to another.

The data from wireless sensors drive analytics for dynamic pricing strategies and enables guided parking through the city and straight to available parking

Street Operations

Street operations which should optimize space utilization and revenue; have appropriate meter technology by area; include device management (meters, sensors, etc.); and enable stakeholder integration (residents, merchants, etc.).

System Support & Analytics

Every parking operation generates a tremendous amount of data—everything from paid parking transactions to violation transactions. Using appropriate system support and analysis should help reduce costs by boosting productivity; provide management dashboard views and reports. These tools help handle critical performance data such as:

- Parking meter revenue, maintenance, and occupancy by city, area and device
- Enforcement metrics including hourly ticket issuance, payment and dismissal rates, accuracy, and collectability.

Compliance

Parking management should encourage compliance through convenient payment options, efficient ticket issuance, and optimised collections.

INTEGRATION

Effective integration of all the elements that make up a modern parking system provides additional value as efficiency gains are achieved, revenue is safeguarded and enforcement is fair transparent and effective. These elements include:

- Access and revenue control
- Entry and exit terminals
- Pay-on-foot machines
- Payment/cashier terminals
- On-site maintenance
- Customer service & technical support
- Centralised network management systems
- Count, way-finding and space monitoring
- License plate recognition (LPR)
- Pass-card validators
- Contactless access control
- Pre-book system
- Redundant server solutions
- Compliance to the Payment Card Industry Data Security Standards

In addition to these parking specific components, once integrated, authorities can further integrate them into an overall coordinated management information approach along with other services. This integrated environment then has the potential to increase the performance of the entire jurisdiction by sharing data, enabling coordination of information and management services to support overall policy objectives.

USING ITS TO IMPROVE PARKING OPERATIONS

We have seen the introduction of new technology to parking over the years. These range from parking availability information signing, empty space identification, payment systems and security solutions. However, when it comes to on-street parking we have (apart from payment options)

not made many changes since the introduction of the parking meter. But things are changing and a new approach is already underway.

Wireless Sensor Integration

On-street wireless vehicle sensors enable real-time monitoring of a parking space occupancy status. Within a parking management system, this data is integrated with data from meters, enforcement, guidance, and analytical subsystems to maintain a comprehensive model. When integrated with the payment status data from meters, the data from wireless sensors drive analytics for dynamic pricing strategies and enables guided parking via a parking guidance system – through the city and straight to available parking.

Parking Guidance

The transportation industry has made great strides in recent years in distributing traffic information to the public through a variety of means. The public's interest and demand for traffic data is quite evident in how freely available this information has become.

Parking Guidance Systems (PGS) integrated with wireless sensors provide information to motorists regarding parking options at their destinations pre-trip as well as en-route. They are able to check parking options, locations, rates, and optimal parking before they leave the house or en route via dynamic message signs installed on roadsides, through navigation systems

in their cars, and through smart phone applications. Parking guidance reduces the time spent searching for available spaces, reduces congestion and pollution and provides improved service for users.

Mobile Payment Technology

Mobile phones have become a convenient payment option for parking. Pay-by-phone technology offers the public an easy way to pay for parking curbside and/or extend their parking time from a remote location.

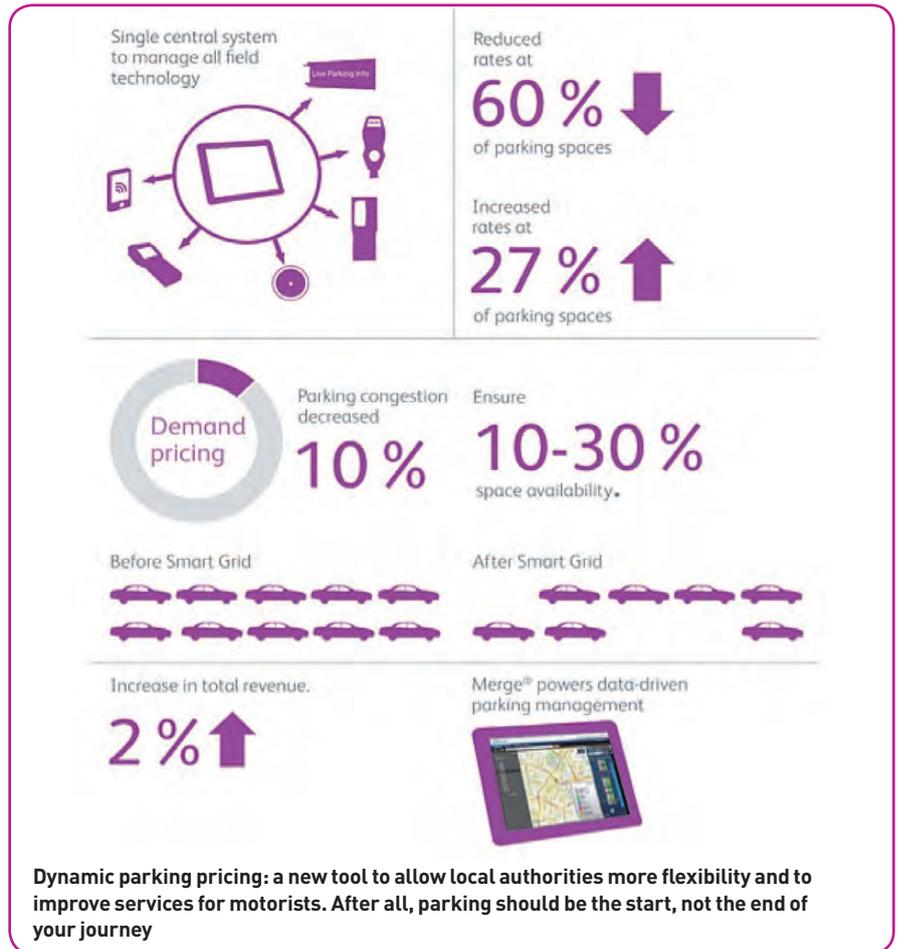
Pay-by-phone technology is an innovative parking payment method that can be used in both on-street and off-street environments. The technology leverages a city's existing mobile phone infrastructure and can seamlessly integrate into existing parking and enforcement programs or where new parking programs are being introduced without requiring significant capital investment.

The system can support multiple languages. It can restrict people from "re-metering" by locking an account after the maximum time allowed has expired. Completely cashless, it reduces time spent paying at the meter or returning to your car before time runs out.

Meter Integration

Effective parking meter management is driven by revenue collections, improved productivity, operational savings, and on-street compliance. But the benefit of increased revenues and reduced costs can easily be lost on motorists because they can't see how this directly affects their daily experience. Successful metered parking programmes align the goals of both the city and its customers.

The main purpose of meter technology, wireless sensors, parking guidance, or mobile payment technology is to save time. As technology improves, motorists expect more convenient, reliable, and high-speed transaction processing.



DEMAND MANAGEMENT

Parking policy also plays a key role in traffic management and can directly influence traveler behavior through pricing and space availability.

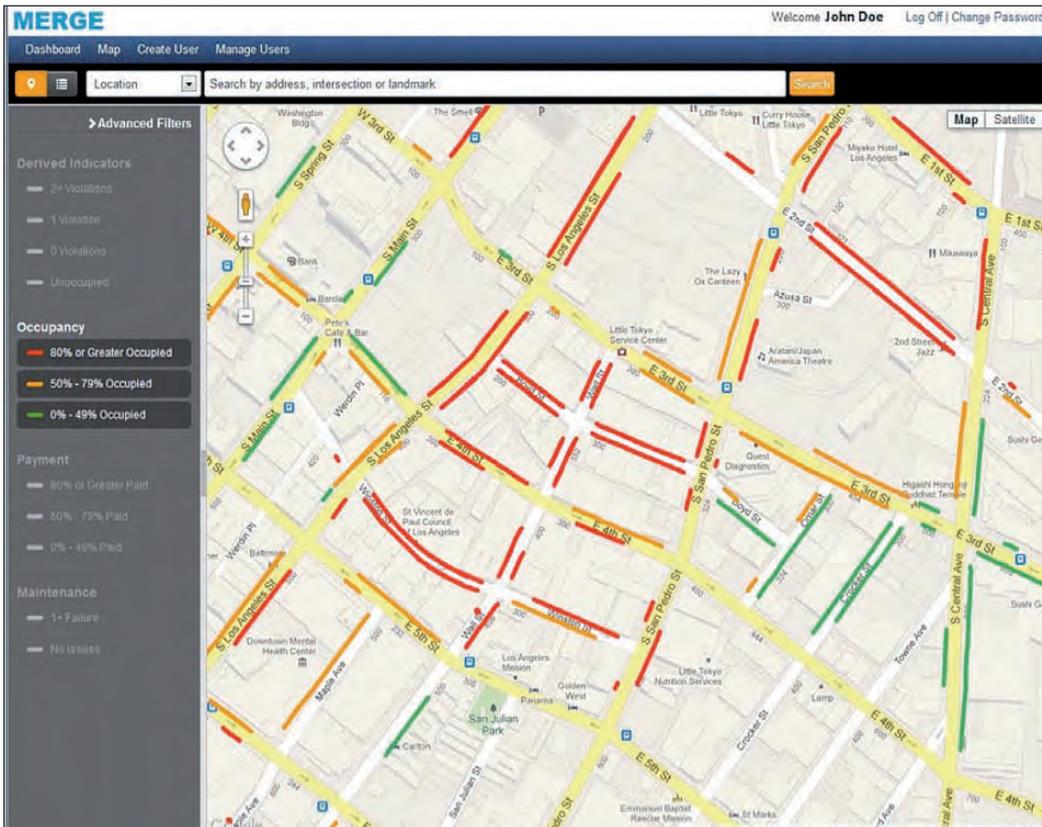
Parking is a scarce resource, especially on-street parking. On-street parking rates are generally just a fraction of the cost of garage parking. Consequently, demand has outpaced supply. Motorists are more likely to cruise, circling continually for an available space –exacerbating traffic and adding to air pollution. Properly priced, however, parking meters manage consumer demand. The resulting reduction in demand increases productivity, eases traffic congestion, trims travel times, and improves air quality.

One of the key benefits of ITS is to provide flexibility allowing

policy adjustments to be introduced. Researchers from Xerox have been working on parking solutions in recent years. The result is a new approach to on-street parking which provides the authorities with increased information and flexibility to implement and achieve policy objectives.

Varying rates by location and time of day creates availability, and those vacancies reduce the time spent (and fuel consumed) searching for on-street parking and ensure that motorists are drawn to businesses served by parking meters. The introduction of dynamic parking pricing for on-street parking spaces provides an intelligence based approach which can be locally calibrated. A solution that can better influence demand and adapt to situations while optimising parking capacity. This in turn can

The dynamic parking pricing system has been trialed successfully in Los Angeles and Washington and is one of the key applications being promoted through the European Commission supported and POLIS Network lead project TIDE.



As technology improves, motorists expect more convenient, reliable, and high-speed transaction processing

better achieve revenue targets, maximise policy outcomes and improve services.

By using sensors, cameras or smart parking meters data is collected and analyzed, patterns are identified and occupancy and variable rates determined. This results in data which feeds into a pricing engine that enables decision makers to exert more control and influence over behavior and that can enable policy outcomes to be realized. Rates can be updated on a regular or irregular basis and users are informed of the rates that apply. This is particularly useful when a major event or some disruption like

roadwork's are scheduled. An example display of on-street parking occupancy based on sensor information is shown above.

Los Angeles faced the same challenges affecting every city:

- Congestion and emission
- 20-30% of circulating traffic is cruising looking for a space
- Time wasted circling for a space
- Disparate technology
- Manual and burdensome processes

Professor Donald Shoup said "The High Cost of Free Parking" congestion is caused by drivers searching for a place to park. Varying metered

parking rates by location and time of day to create availability, aiming at 85% (about 7 cars for every 8 spaces is the optimum') to reduce congestion.

The results from LA are positive. The Xerox Merge system enables management of the parking areas and control over the assets enabling the city to remain in control and to adapt prices and availability to help achieve policy objectives. Dynamic pricing is well received in LA. The Merge system has raised the political decision about pricing to a higher level. Directing motorists to under-utilized parking spaces reduces travel time. Real time reporting for maintenance and enforcement improve efficiency and availability for end users. ☺

FYI

Richard Harris, Solution Director, Xerox

richard.harris@xerox.com

Reduce, rethink, reform

Parking policy and technology are evolving to offer four key promises: reduced urban traffic congestion, reduced enforcement costs, increased convenience for parkers, and increased retained revenues for municipalities. This bodes well for a healthier downtown, says **Bern Grush**

Under-priced street parking contributes significantly to traffic congestion. It creates over-demand for street parking and encourages circling for cheap spots. In order to get a car to a parking spot, it has to be driven on streets and highways creating congestion far from the target parking spot. This simple consequence is too-seldom considered in our anti-congestion defense of road pricing for our highways or investment in more transit for our cities. Underpriced parking does more to promote automobile use than good transit does to discourage it. We spend considerable effort arguing for road use charging for the 5 per cent of the time the car is moving, but little effort on demand management – or the revenue potential – of the other 95 per cent of the time when vehicles are parked. Working tirelessly to build and promote transit that too few elect to use, struggling to find ways to have people pay for roads in ways they don't wish to pay for, and then subsidizing parking – sometimes quite heavily – is self-defeating. The fact that some cities or regions do all three is an indictment of transportation planning.

A key parking policy reform would move our cities toward market



pricing, variable pricing, and progressive pricing. We would use pricing rather than citations to manage parking turnover as Albany, Los Angeles, San Francisco, and others are already starting to do. We can use parking revenue to fund transit or other transportation programs.

PART I: CURRENT POLICY AND TECHNOLOGY

Parking reforms comprise a combination of changing management policies as enabled by digital technologies. These reforms, which have taken an upswing in the past few

There are many reasons people use cars in our cities, and systems to manage them have grown in complexity and expense



“...parking demand management is effectively a form of congestion pricing and can be coupled with progressive pricing to reduce enforcement costs and increase net municipal revenues, often without the costing the parker more”

years, could lead to far-reaching transportation management gains: calming gridlock, greening streets, and contributing to transportation funding shortfalls. Let’s look at the current state.

Policy

Policy refers to matters such as pricing, the number or portion of spots under management, whether this management is by time constraint or pricing or both, parking cash-outs, taxation, whether pricing is fixed, variable, graduated, or free for an hour, and, of course, how aggressively the rules are enforced. Also critical is how and why municipalities arrive at policy decisions and then manage their deployment. Or how parking decisions are interwoven with

other transportation or city-building programs. Some cities have council decide these things in detail, others delegate to their traffic department within a guideline. Many of them take input from local business associations – sometimes to that city’s long-term detriment.

Policy varies considerably from city to city. Policy may be designed to satisfy local retail associations, which would tend to keep parking prices low, and congestion worse than otherwise. Prices can remain fixed (i.e., low) for years, as Toronto has done until a couple of years ago, or they may change monthly as Los Angeles has been experimenting with demand pricing for over a year.¹ Turnover management can change from time constraint (citation controlled) to progressive pricing, as Albany, New York has recently done.² Some cities, such as Chicago and a few others, have outsourced parking management to private operators.³ Still others, such as Springfield, Missouri, removed their parking meters to rely on free, time-limited parking and tire chalking – a temporary retail boon but a long-term taxpayer and environmental burden.

Sometimes a prevailing anti-car attitude constrains the number of available parking spaces in order to discourage automobile use and encourage transit or bike use. But any environmental advantage can be reduced or wiped out by encouraging shopping in suburban malls. As well, anything that discourages shoppers from driving downtown can incite the retail association to lobby city council to get rid of parking pricing, as happened in Springfield. Cities have many differing policies – evidence that perhaps few or none are optimal. In a handful of cities, parking pricing is set to achieve a certain occupancy performance – perhaps 85 per cent, as propounded by UCLA’s Donald Shoup⁴ and others before him.⁵ Such parking demand management is effectively a form of congestion pricing and can be coupled with progressive pricing to reduce enforcement costs and increase net municipal revenues, often without costing the parker more.

No parking policy has been found to delight everyone, but policies that make parking easily available and with little chance of ticketing or towing are more acceptable, in spite of the fact



NOTE

- 1 Daniel Mitchell, Peer Ghent, *ExpressPark: An Intelligent Parking Management System for Downtown Los Angeles*, 2013
- 2 Michael Klein, *To Market, To Market*, The Parking Professional, International Parking Institute, May 2013, p.26
- 3 Reason Foundation, *Annual Privatization Report: Local Government Privatization*, 2013
- 4 Donald Shoup, *The High Cost of Free Parking*, APA, 2005
- 5 Gabriel Roth, *Paying for Parking*, Institute of Economic Affairs, London, 1965

that parking fees may be increased in order to achieve this. Interestingly, the Albany Parking Authority was able to reduce enforcement costs and increase revenues, with a minuscule rate change as they switched from time limits to progressive rates. Michael Klein, the APA executive director responsible for this change, recognized a simple, documented⁶ fact: parkers want *freedom to park* even more than they want *free parking*. This implies that market pricing and extended stays (without reducing turnover) can mean lower enforcement costs and increased revenue – a nice financial return from treating parking spots as market commodities rather than as a combination of shopping enticements and ticket-traps. It would be more honest and equitable to allow retailers to pay for shoppers to park, than to use the low-fee-plus-citation business process with which many cities burden themselves. New technologies can make this easy, as well.

It is common to see varied interests pulling in multiple directions: local politicians, local retail associations, urban planners, urban activists, and transportation planners each argue for more or less parking or for higher or lower fees. Some years ago Springfield abolished parking meters for fear that pricing was driving shoppers away. More recently, several US cities have outsourced parking management, which has generally resulted in increased fees and more effective enforcement. In the 2008-2010 timeframe several city councils looked to parking pricing as a way to fund municipal pension program deficits in the wake of the 2008 financial failures.

Many cities have central districts with a chronic shortage of street parking often coupled with underpricing. It is as though the shortage of spaces were a conspiracy to satisfy those who would prefer fewer private vehicles downtown, and that



As this 1935 illustration shows, parking has long been managed with low prices and by time constraint, but a shift to managing via demand pricing and with progressive pricing to lower enforcement costs has already proven effective and acceptable

underpricing was a counterbalancing conspiracy to please downtown merchants. But the truth is often otherwise: cities really do run out of on-street parking spaces as they build density, or commit to more cyclist or pedestrian infrastructure. And cities often set low prices because, since 1935, they have mostly designed parking pricing (and ticketing) as a way to be inviting to shoppers, then to manage turnover by time constraint, rather than managing parking demand or raising municipal revenue. This approach is left over from an era of inflexible parking meters and is being critically reconsidered only recently.

The combination of underpricing and too few spaces is disastrous for the environment, traffic congestion, drivers, cyclists, pedestrians, transit, and municipal coffers. But now there is no longer a technology excuse to use pre-WWII parking policies.

Technology

Technology refers to payment collection methods as well as the enforcement methods that make sure parkers pay. Until a little over a decade ago, the collection emphasis has been on capturing coin-based payment in a pole-mounted box next to the parker's vehicle. With rising parking fees many coins are needed, which is indeed inconvenient, hence collection technology has been changing to capture payment from credit cards – still touted as something of a technology revolution by parking authorities just making the transition. At first this was a very expensive proposition, so the multi-space meter was developed. One collection machine costing perhaps US\$10,000 to US\$15,000 can service eight or 10 parking spaces. Even more recently, single space meters that accept credit cards have appeared, creating a modest resurgence in single space meter installations.

As well, since 1935 enforcement emphasis has been on issuing citations that would be modest enough not to be onerous, but stinging enough to encourage you to pay more attention next time. Little has changed in 79 years. Here, a combination of low prices, fixed, short time slices and labour-intensive ticketing to ensure turnover means that the total system is relatively expensive for all participants: parker, municipal parking department, police, taxpayer, traffic throughput, and the environment.

The history of the curbside, multi-space machine has been as varied as it has been short. Pay-and-display, pay-by-spot, pay-by-licence plate all have a few things in common: one machine serves many spots, the parker must interact with the machine, and the machines (usually) take credit cards as well as cash. The machine in majority use – pay-and-display – requires the driver to

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“The digital payment credential slashes multi-space machine costs since the number of pay-by-license machines needed is about 60 per cent of the number required for pay-and-display”

return to her vehicle to display a payment credential to be checked by a human, car by parked car, for correct payment.

PART II: THE EVOLUTION OF MUNICIPAL PARKING

The reform of municipal parking means the co-evolution of its policies and technologies. It would be difficult to imagine a significant change in one without a concomitant change in the other.

Policy

The fundamental policy change afoot is the shift from the reliance on the citation to force turnover to a reliance on pricing to encourage turnover. The net turnover effect of pricing versus the citation can be arranged to be the same, and even improved, but the profound difference is in reduced operational expense and increased retained revenue.

The execution principle is to set system performance goals related to turnover, occupancy, circling and other measurable system behaviours and to price to achieve that performance. Enforcement will still be necessary, but its methods and purpose will change significantly, even removing 90–95 per cent of parkers from the shadow of its tyranny, provided they adopt the technologies that can now make payment easier

to the point of full automation (more below).

Turnover, as a performance goal, is not a bad thing. It promotes sharing of access as well as commerce-good things for cities. As well, pricing that reduces circling can encourage parkers to use off-street facilities, park on-street a block or two further away, other modes of travel, or other times to visit. These shifts combine to help meet additional congestion and liveability goals, meaning parking reform can be green for both the environment as well as for municipal coffers. If transparent transportation goals are promoted for that revenue, even more can be achieved.

Technology

The fundamental technology change enabling this policy change is the digital parking credential. For 65 years, starting in 1935, the gold standard in payment credentials was the red expiry flag on a single-space parking meter, or the coveted handicap placard. Over the past 15 years, the standard has become the paper credential that the parker takes from a pay-and-display machine to place on the dashboard. The handicapped placard remains coveted and increasingly abused.⁷

Now, the rise of the digital credential is an even more important city enabler. The use of mobile phone

apps to establish payment for a parking session keyed to a particular location, time, and vehicle was the initial breakthrough technology for digital parking. There is no need for paper or other physical indicator on or near the vehicle to show payment has been made. Within seconds of establishing payment via a smartphone, the appropriate vehicle, location and payment are registered against the number plate of the vehicle and available wirelessly to enforcement personnel who can see instantaneously whether payment is current. In fact, mobile license plate recognition means that this process has the potential to soon end the requirement for an enforcement officer to peer into each vehicle windshield-by-windshield.

But this is just the beginning. The pay-by-license plate multi-space machine, unknown a few years ago is rapidly changing parking management in cities such as Calgary and Pittsburgh where they are deployed city-wide.⁸ Because they also issue a digital credential, payment enforcement systems need not be concerned whether the credential was established via a pay-by-license machine or a smartphone. A few weeks ago I parked in a lot in Toronto that served several businesses, including a restaurant I planned to use. A sign on the pay-by-license machine advised me not to pay if I was patronizing the restaurant, but to instead enter my plate number on the iPad at the restaurant's coat-check for free parking.

The digital payment credential slashes multi-space machine costs

NOTE

6 Glendale Downtown Mobility Study, 2007, pg 5-13,14

7 Kim Fernandez, *Crack Down*, The Parking Professional, International Parking Institute, September 2013, p.26

8 David Onorato, *Spreading the Word*, *The Parking Professional*, January 2014, p.36

since the number of pay-by-license machines needed is about 60 per cent of the number required for pay-and-display.

Since there is no need for the driver to return a paper credential to the vehicle, machines can be more sparsely distributed. And as more drivers turn to smartphone apps and self-pay meters, even these fewer

Charge smarter, fine less

According to Paul Sorensen, a senior operations researcher at RAND, "It seems likely that most cities, in the spirit of working in the interests of their residents and striving for a well-functioning municipality, would prefer a parking management regime with high compliance and a low rate of fines for violations as opposed to a situation characterized by low compliance and high citations. To begin with, nobody likes worrying about parking tickets, and those who choose to follow parking regulations will be justifiably frustrated if they perceive that many others are not paying the required fees or adhering to parking time limits due to infrequent or seemingly arbitrary enforcement. Additionally, issuing high fines is unlikely to raise much revenue in comparison to standard meter fees. As parking violation fines increase or the perceived risk of being issued a citation increases, drivers will be more apt to pay the appropriate parking fees to begin with or to stay within the required time limits. This ultimately constrains the amount of revenue that could potentially be raised from violation fees."

on-street machines will see a drop in transaction counts.

The current technology edge enabled by the digital credential is the self-paying meter.⁹ Designed for the frequent parker, it detects legal parking commencement, makes payment from a pre-arranged account and registers a digital credential – all without driver intervention. This especially addresses payment compliance for the urban commercial fleet of delivery and service vehicles that incur the majority of parking citations in most cities. This means that a huge enforcement burden can be replaced with 100 per cent payment compliance. One of the better service offerings to incentivize this approach is automated payment by the minute, which is especially suitable to frequent parkers that stay six to 20 minutes each session.

Already, the digital credential enables asset-free parking zones where smartphone, web, and self-paying in-car meters can handle all payments. In fact, many now recognize that the digital parking credential spells the end of the curb-side parking meter meaning that not only can enforcement costs be slashed, but so too can collection costs.

AN EVEN BIGGER PICTURE

Three changes: [1] from management-by-citation to management-by-price; [2] from on-street payment machines to the digital credential; and [3] and from walk-around enforcement to high-speed license-plate enforcement support farther-reaching policy changes such as:

- Shifting from time constraints (such as one-hour free parking) followed by ticketing to permitting parkers to pay for an extended

stay after the free-period, means a reduction in time-chalking costs, an increase in revenue and a relief-valve to reduce street parking demand on arterials. By tailoring prices accordingly, the number of vehicles entering downtown can be held steady or reduced, but congestion due to circling will diminish as a benefit even if vehicle count is not reduced. Since the driver prefers the freedom to park over free parking, the driver also enjoys a benefit.

- Relying on location- and time-sensitive parking demand analytics to tune prices for optimal turnover performance rather than setting/retaining prices for reasons of political expediency, means that a municipality can choose to balance demand, reduce circling, and maximize revenue (within occupancy performance and access goals). This was used with considerable success in the Los Angeles ExpressPark project mentioned above.
- Providing fee-for-service rather than denial-of-service as a parking management paradigm: services can be as simple as parking finders and navigators to time extensions via smart phone app. Or as motivating as off-peak parking discounts in return for not utilizing on-street parking during peak times. Even the simple progressive rate scheme used in Albany is highly desirable and service-oriented. More valuable still would be automated pricing extensions in lieu of citations (right now the Albany parker needs to guess when she will return to her vehicle; she would likely pay a premium to have that concern removed).

NOTE

- ⁹ PayBySky is one example. It uses a small in-vehicle meter including a display to show the place and expiry time for the credential. It detects when a vehicle parks in a payable spot and arranges for the driver's parking account to be debited automatically and a monthly statement to be provided.

“If drivers insist on driving, the sensible thing to do is to manage parking demand transparently for environmental and municipal benefit rather than punish errors at taxpayer expense”

- Providing for retailer involvement by permitting retailers to deposit shopper rewards in the form of parking credits directly into a parker’s parking account. Retailers would appreciate the marketing opportunity and parkers the perk—all while payment friction into municipal transportation coffers is further reduced.
- Providing for better (and fairer) management of handicapped access. Cities have several ways to manage disabled parking including reserved spaces, grace periods, and in some cases free parking. Placard abuse is a major difficulty. This can be largely curbed with digital credentials.

All of these changes can promote smarter use of parking supply, revenue optimization, relative cost reduction by way of more spaces under management with the same enforcement staff, and a greater sense of welcome in our cities—all while reducing underpriced parking which is a magnet for excessive congestion and abuse.

If drivers insist on driving, the sensible thing to do is to manage parking demand transparently for environmental and municipal benefit rather than punish errors at taxpayer expense.

SUMMARY

We are in the process of evolving away from a turnover-focused, underpriced, high citation approach toward a service-focused, market-priced,



A fee-for-service approach, rather than one focussing on denial of service, would allow different ways of managing parking, for example automated pricing extensions in lieu of citations

higher revenue, lower-citation approach to parking management. Cities such as Albany, Calgary, Los Angeles, and Pittsburgh are pointing the way.

There are four credential elements provided by digital enabling technologies: pay-by-license for the occasional parker, pay-by-phone for the regular parker, self-pay in-vehicle meters for the frequent parker, and retail-pay for the shopping parker. Feeding the demand analytics available from these four technologies permits optimal pricing, parking finders, and many additional services.

Furthermore, each of these can be optimized with flexible pricing regimes while payment is secured via by a single enforcement system. Hence a municipality can outsource payment collection while retaining (or outsourcing) enforcement and citation processing. 🔄

FYI

Bern Grush is Vice President of Applied Telematics Inc
www.PayBySky.com
bgrush@atimetrics.com

A cohesive strategy

The details of the EU's policy and funding for ICT and cities in 2014–2020 have been released. **Margaret A Pettit** crunches the numbers

There will be a refocusing of EU Cohesion Policy, under DG Regional and Urban Policy, with a total budget allocation of €351.8 billion for European Structural and Investment Funds. Together with access to the budget of DG Research

and Innovation, there are new and conventional measures for cities and information and communications technologies (ICT).

REGIONAL AND URBAN POLICY

New Funding for Urban Projects

During the period 2007–13, about €92 billion (nearly 40% of the total European Regional Development Fund (ERDF) budget) have been allocated to cities but urban authorities have previously had little input. So, it is encouraging to learn that proposals for the reform of cohesion policy (approved by the European Council)

of the DG for Regional & Urban Policy for the next Multi-Annual Framework 2014–2020 include specific and increased funding for integrated sustainable urban development. A minimum of 5% (there is no upper limit) of the overall ERDF budget – that ERDF budget will be around €190 billion over 2014–2020 – is to be spent on sustainable urban development, with urban authorities having increased involvement in programming and implementation of funds.

In addition to this 5%, a further €330 million will be allocated to innovative actions for sustainable urban development directly for urban



The new cohesion policy addresses problems such as sustainable transport and multi-modal public transport systems as something of a priority



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It is encouraging to learn that proposals for the reform of cohesion policy... include specific and increased funding for integrated sustainable urban development

authorities. The European Commission will directly manage this allocation through Europe-wide calls for proposals for funding.

Cohesion Fund

The Cohesion Fund traditionally will be funding trans-European transport links and environmental infrastructure projects, with a budget of around €63 billion over 2014–2020.

Other Instruments

The Connecting Europe Facility is planned to proceed (previously reported on by this author in *Thinking Highways* March/April 2012) and the usual Cross-border Cooperation.

Europe 2020 Strategy

Recognising that cities are an important factor in the economy of their region, especially major cities in the role of innovation, the Commission has made smart, sustainable and inclusive growth in the regions, and particularly in cities, key policies in the Europe 2020 Strategy, with innovation at its heart.

As cities grow, suburbanisation naturally increases, as we know, creating complex problems requiring integrated solutions in the movement of transport and people. Around 70% of the EU population live in cities and that figure is rising.

We do not need reminding of the function of cities and the movement of traffic and people – business, commerce, day-to-day living, cultural tourism, leisure, travel interchange and more. In fact, a conglomeration of people-movements and traffic chaos, increasing the need for

organisation. Obviously clustering of all activities by type, where possible, is a key approach and that leads us on to smart and sustainable growth.

• Smart Growth

Smart growth policy aims to improve the economies of cities and regions through specialisation of expertise and skills. This is about a city within its region concentrating on its competitive advantage, such as innovative technologies, research and development (R&D) and information and communications technologies (ICT). Smart specialisation strategies involve innovation clusters of business, financial services and R&D. This should avoid various cities all providing the same facilities. High value-added activities are considered to offer the most opportunity for increasing a region's competitiveness.

• Sustainable Growth

Sustainable Growth, or Smart Environment, in the new cohesion policy mainly addresses carbon free energy systems, environmental protection and sustainable transport. Over a decade ago, the Commission mooted the concept of the Cities of Tomorrow. This addresses all the problems facing cities in the EU and offers some remedial measures. For the ITS sector, it will come as no surprise that multi-modal public transport systems are high on the list along with concentration of brownfield development and energy efficient living towards a zero carbon city, requiring multi-level governance.

RESEARCH AND INNOVATION

Horizon 2020 Financial Instrument

Cohesion Policy will connect with the DG Research and Innovation's Horizon 2020 under the Competitiveness and Innovation Framework Programme (CIP). With a total budget of €80 billion, Horizon 2020 will bring together all existing EU research and innovation funding currently provided through the Framework Programme for Research and Technological Development (FP), the CIP and the European Institute of Innovation and Technology.

The CIP provides equity, networking facilities and one-off grants for potentially viable projects. Horizon 2020 will provide funding for every stage of the innovation process from basic research to market uptake, in line with the EU's commitments under the Innovation Union.

Information and Communications Technologies in Horizon 2020

Horizon 2020 will support ICT research and innovation in science and industry and will include intelligent transport.

Details on opportunities arising out of the reform of the cohesion policy will be reported in the next issue of *Thinking Cities*. 

FYI

Margaret A Pettit is an EU transport funding expert and principal of CLEMATIS Consulting
margaret.pettit@btinternet.com

Safety and Security in Transport

This section addresses road safety and the security of transport systems. It covers road safety policies, addressing all categories of road users and supporting the development of innovative solutions. It also covers technological innovations contributing to the improvement of road safety

- o **Frankfurt, Germany** – tackling cyclist and pedestrian fatalities
- o **Fraunhofer Institute** – Dr Wolfgang Schade interview
- o **Victoria, Australia** – innovations in level crossing safety
- o **Big Data** – implications for smart public transport
- o **Monitoring** – creating a safer city



“A city’s video surveillance system should be seen as a tool that makes for a smarter, more secure city” See page 164

The soft bulletin

How a German city is tackling the problem of cyclist and pedestrian fatalities head-on, by **Sonja Koesling**

Speeding, driving under the influence of alcohol or without wearing a seat belt, disregarding traffic lights or zebra crossings – carelessness and lack of consideration are the main causes of traffic accidents and all too often lead innocent bystanders to their peril. Some 1.24m people die annually as a result of a traffic accident – an alarming figure and one that creates awareness for improving road safety.

Worldwide, the subject is a growing priority. The European Union has announced the goal of halving the number of fatalities in Europe by 2020. By 2050, it should be reduced to nearly zero. Legal requirements such as wearing seat belts, alcohol limits and penalties for speeding have proved successful. Nevertheless, these measures alone are not enough to make “Vision Zero” a reality. Therefore cities and municipalities rely more and more on road safety works in the strategic planning process, as well as the awareness of all road users. Particular attention is paid to unprotected, often referred to as soft, users of the road, such as pedestrians and cyclists and this is certainly the case in Frankfurt.

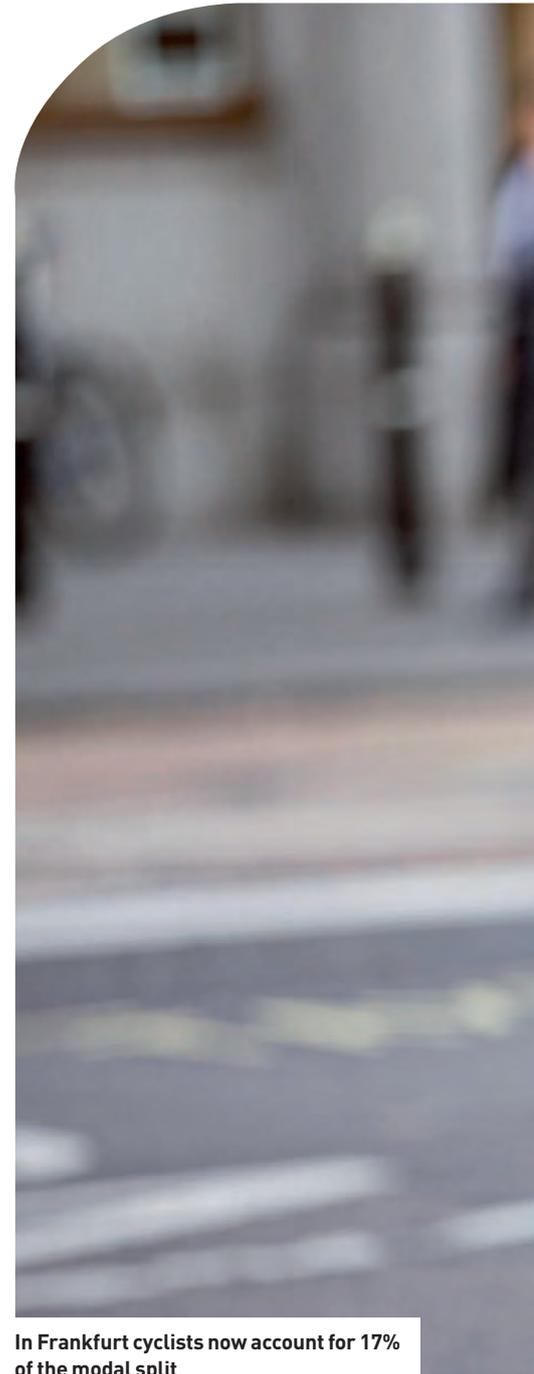
As in many other cities, the proportion of cyclists in Frankfurt has increased steadily. Today it accounts

for around 17% of the modal split and has thus nearly tripled in 15 years. The city supports this development and promotes city cycling in order to maintain valuable reserves in the road network for the future. Improving road safety – an important issue. Establishing a positive cycling atmosphere plays an essential role.

“Motor traffic is relatively easy to regulate: You can monitor speed with cameras and penalise violations or issue parking tickets for bad parking,” says Ingmar Bolle, personal advisor to Stefan Majer, departmental head of Frankfurt transport. “But for cyclists, it is more difficult.” Cyclists usually know what is permitted and what is not. So the trick is to make them understand that traffic rules are for their own safety.

MORE THAN JUST MONITORING AND FINES

In Frankfurt, communication with cyclists is improved by means of campaigns. “We show our presence on the road, for example, integrating checks and technical inspections”, says Bolle. If cyclists are stopped, they have the opportunity to resolve technical issues right on the spot. In this case, the transport department employs a sympathetic response and clarification. “Experience shows that



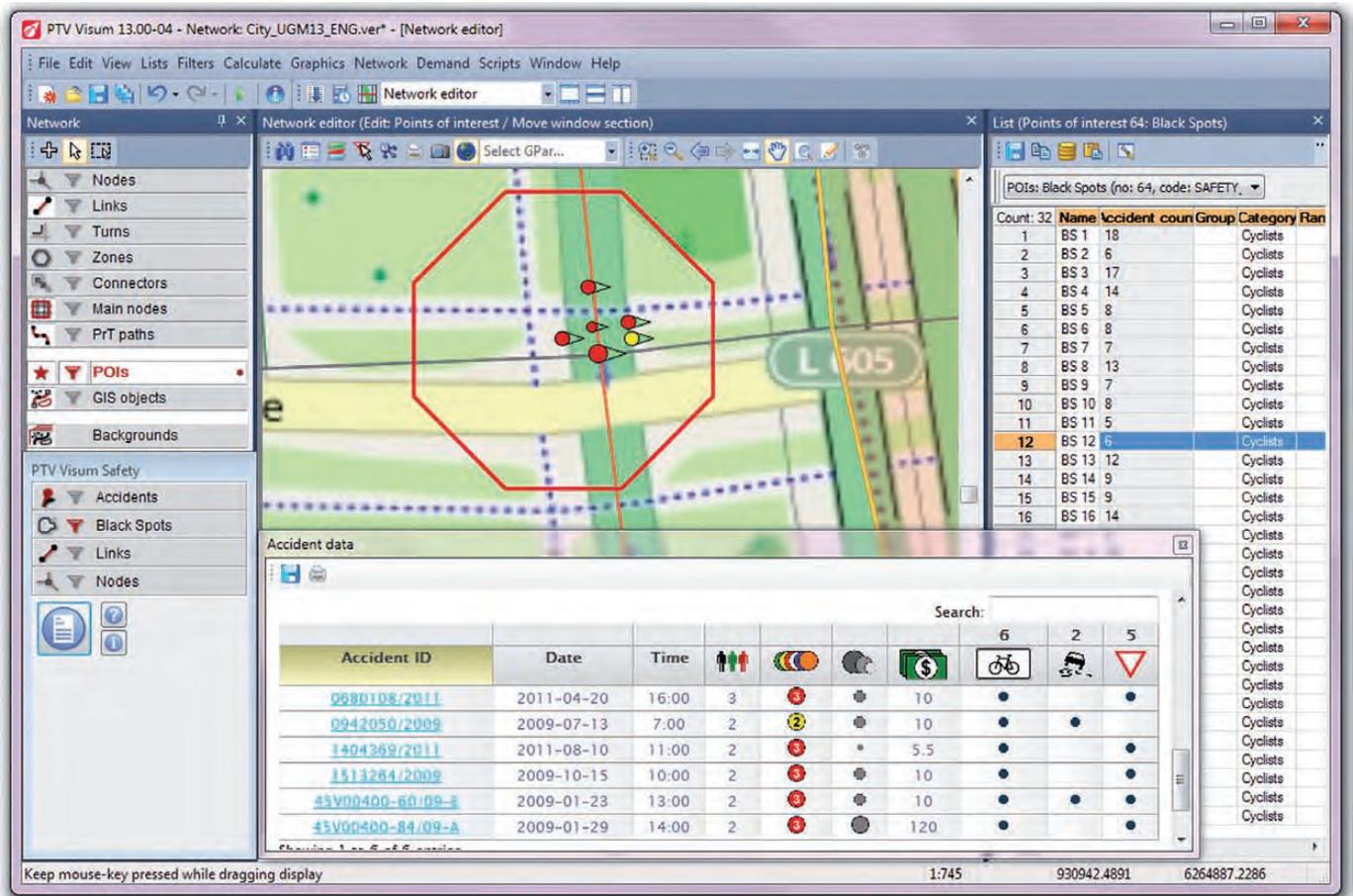
In Frankfurt cyclists now account for 17% of the modal split

Frankfurt supports and promotes city cycling in order to maintain valuable reserves in the road network for the future



FRANKFURT, GERMANY





PTV Visum Safety enables transport planners and authorities to identify and analyse the black spots of their networks – by filtering specific aspects such as cycling

good cycling conditions make for better safety awareness on the part of cyclists, and also ensure that bicycle traffic is actually taken seriously as a mode of transport,” says the educator. Since then, Frankfurt has ranked in the top 10 in the Cycling Climate Test of the General German Bicycle Club (ADFC). Nevertheless, for Ingmar Bolle, there is still a lot to do in the area of cycling infrastructure.

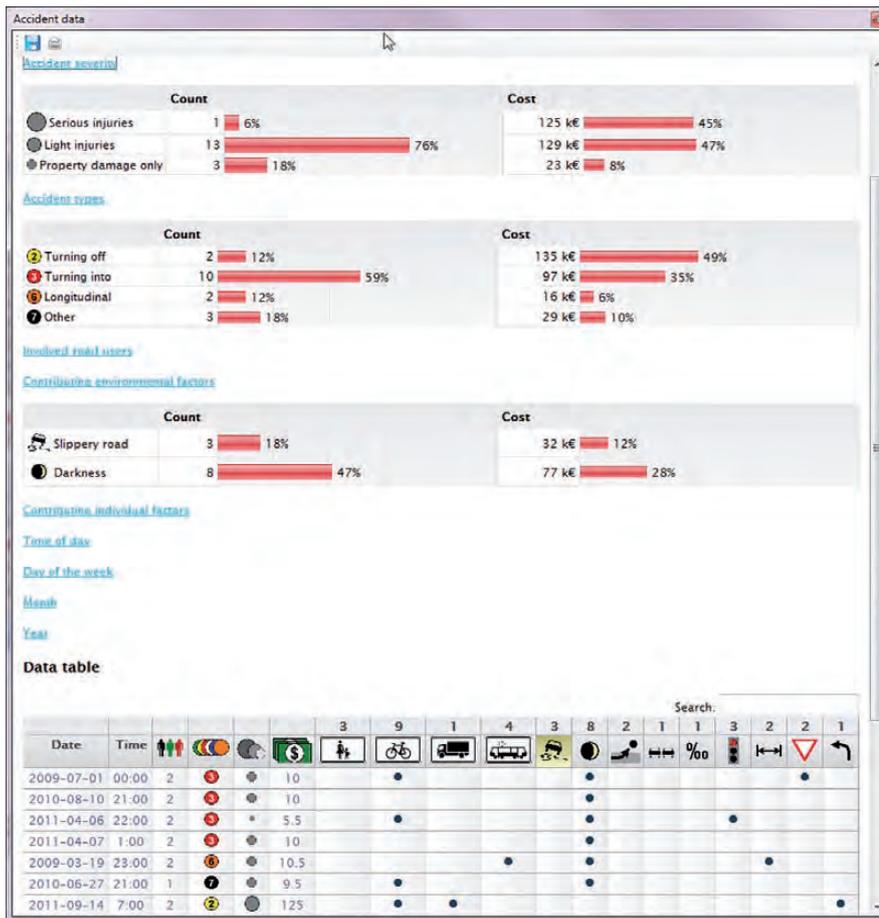
A paradigm shift has already taken

place here in Frankfurt: If roads are rebuilt or lanes are repaved, bike lanes are placed on the roadway. “In this way, we move the cyclists more into motorists’ field of vision, instead of letting them travel along behind parked cars,” says Bolle. Moreover, the city of Frankfurt puts special focus on improving existing infrastructure.

“In cycling, misconduct such as running red lights or driving on

A paradigm shift has already taken place here in Frankfurt: If roads are rebuilt or lanes are repaved, bike lanes are placed on the roadway

Analysing accident data with PTV Visum



the wrong side of the road is often encouraged by shortcomings in infrastructure – especially at intersections,” he maintains. Both of which, in Frankfurt, are the main cause of accidents involving cyclists.

To achieve improvements, Frankfurt integrates road safety work into the strategic planning process. The fact that the newly established Department of Traffic combined all responsibilities under a single political leadership in 2006 aids this project. The merging of the Office of Road Construction and Development with the Road Traffic Department and the Department for Mobility and Transport Planning into one department facilitates the exchange of knowledge and data. In this way, interactions can be better analysed and findings from the

Accident Commission can be directly involved in traffic planning. Here, PTV Euska is used, software that the PTV Group has developed for collaborative work between the police and municipal authorities in connection with the Accident Commission in Germany. Here the analytical expertise obtained has now also been incorporated into a new module of the transport planning software, PTV Visum, which the PTV Group marketed worldwide under the name of PTV Visum Safety.

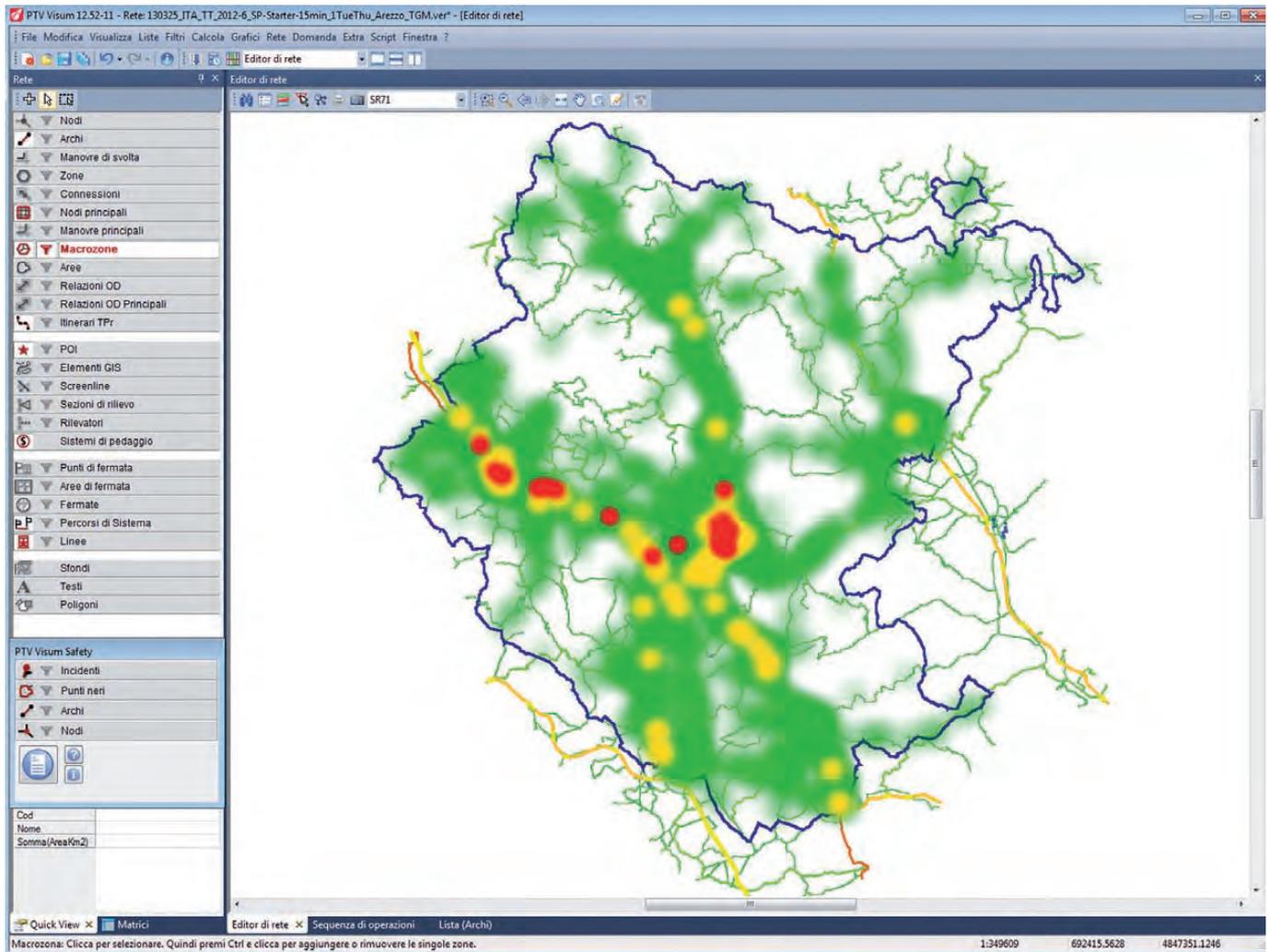
SOFTWARE IMPROVES ROAD SAFETY

PTV Visum Safety automatically recognises accident black spots based on accident data and lists them according to their severity. Depending on data availability, the planner can

retrieve detailed information for each accident and filter the accident data by attributes, e.g. accidents involving cyclists or pedestrians.

Within the module, thematic maps can be displayed: accident situation images that show the types of accidents, views with detailed accident data and so-called heat maps. These are digital maps that visually highlight roads and intersections that are particularly prone to accidents. Then in-depth analyses reveal distinctive similarities and enable the planners and traffic engineers to take targeted measures. For example, these include measures to improve the perception of cyclists and their safety, a separate signal phase for left turns at intersections, or crossing aids for pedestrians.

The software is also used in



Heat map in PTV Visum Safety

Frankfurt to identify and analyse accident black spots and accident hot spots. “Black Spot Management helps us to achieve improvements in the right places,” says Ingmar Bolle. Because there are network segments and nodes that operate accident free despite apparent poor planning, while in other places action is urgently needed. So the Traffic Department found in the analysis of accident data, for example, that in certain sections of the network, driving against the traffic is the number one cause of accidents and picked out these sites for targeted campaigns. “Thanks to combined communication and control measures,

we were able to reduce the accident rate on these network segments by between 20 and 55%,” he explains.

Based on the findings, the traffic department has developed a closing-the-gap programme, which incorporates statements and suggestions from citizens into the safety optimisation of transport infrastructure. The following applies: Improvements that are easy to achieve are to be implemented first, with safety deficiencies being given priority over issues regarding convenience.

Concludes Bolle: “PTV software aids us when evaluating and enables us to process all defects step by step in a sensible order”. 🗣️

FYI

Sonja Koesling is Manager PR & Marketing Traffic Software PTV Group

Sonja.Koesling@ptvgroup.com

www.ptvgroup.com

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Interlinked mobility, a matter of course...

It's a familiar scenario, yet there is no ultimate solution to the problem in sight: the growing influx of people into the cities thins out the rural areas while overstraining urban infrastructure. The mobility of the city dwellers bears the brunt of this trend. Is there a silver bullet – or at least a sustainable strategy? **Eberhard Buhl** talks to **Dr. Wolfgang Schade**, Head of the Business Unit Transport Systems at the Fraunhofer Institute for Systems and Innovation Research (ISI)

Autonomous driving could make a positive difference. You book a carsharing vehicle like a taxi and it comes right to your door without a driver

The major challenges of urbanization are familiar enough. In the world's megacities urban infrastructure, transport carriers and routes are often hopelessly overstrained. Getting anywhere fast is impossible. How can these problems be alleviated in the long term?

The mobility structures available worldwide vary a great deal. In China's megacities rapid urbanization is causing dynamic development with well-known problems: the cities are polluted, the traffic volume is growing all the time, and traffic jams are getting longer. What's more, this is all happening at breathtaking speed. It also means that the population continues to thin out in rural areas, so for the people that remain the car is often the only way to get around. However, this process is taking place largely unchecked, without strategic planning as to which regions can remain populated and developed and which might, for example, be restored to nature and used for tourism. Incidentally, these kinds of developments are not confined to China or developing countries.

Can urban mobility structures be expanded quickly enough in industrial nations like Germany?

Particularly in Germany there is perhaps not such a great need for expansion. Generally speaking, according to current transport forecasts we can say that individual passenger transport will not grow any more in the coming years, and goods transport will increase more slowly than we expected ten years ago. So new roads, for instance, are only required in certain cases. Moreover, people in urban regions are increasingly switching from cars to bicycles, carsharing and public transport. In places where these alternatives exist, more and more people have multimodal travel habits and the importance of the private car is on the decline. In Berlin, for example, today only around 35 per cent of residents have their own car, while the German average – including in rural areas – is around 54 per cent. In light of this trend, the problem of space on urban roads could gradually diminish.

For passenger transport the focus on cities is perfectly justifiable, but perhaps this is not the case for goods transport. Goods are increasingly being ordered online and sent back if they're not wanted, which generates additional distribution transport. Are you taking an overly optimistic view of the situation?

It's important to differentiate here. For instance, electromobility offers an alternative for distribution transport in particular. Using quiet and emission-free vehicles, deliveries can be made to particular companies or post office collection points between 4am and 6am. This can reduce the strain on the road infrastructure at the peak time in the morning. We are also seeing a renaissance of city logistics, which didn't manage to properly establish itself in the 1990s but is now coming to the fore with new delivery concepts, goods transport centres and trans-shipment terminals. This collaborative form of logistics, where several companies combine their various cargos on a shared vehicle, reduces the distribution journeys in busy city centers. However, it requires companies willing to cooperate, powerful IT systems to network transport requirements, and new logistics hubs as distribution infrastructure on the outskirts of the city.

The physical infrastructure within cities also needs to be modified and expanded to support more multimodal transport. For example, remodelling train stations as mobility hubs with additional space for electric vehicle charging stations at strategic locations. With this in mind, could electromobility in particular be seen as a counterproductive trend?

Regarding individual electromobility, a whole host of studies has shown that a large proportion of charging takes place using the charging points at home, particularly in the early phase. As for the public charging stations, we have ascertained that they are necessary for psychological reasons, but they need to be cross-financed by municipalities or transport operators, while the majority of charging is done at home. With an e-carsharing station this

may be different. Such a system is currently being trialed in Karlsruhe and I am looking forward to seeing the first results.

Nevertheless, mobility hubs are logically located in city centres where space is already at a premium. Some municipalities now also have preferential carsharing spaces – with or without charging stations. Does this aggravate the problem?

If fewer people park their own cars in city centres, the corresponding space should be available. There is also more talk of extremely space-efficient, fully automated vertical parking systems. And in the long term – the first serial models should be available by 2020 – autonomous driving could make a positive difference. You book a carsharing vehicle like a taxi and it comes right to your door without a driver. But we're talking about some way into the future until such a system can really work in practice.

Is this trend toward multimodality and the willingness to abandon private cars more or less a German phenomenon?

Of course there are corresponding trends in other countries – leaving aside cities like New York, where for many years around 55 percent of all households don't own their own car and people travel by taxi and subway. One well-known example in Europe is Paris with its extensive bikesharing system known as Vélib. This kind of project suddenly gives a notable proportion of bicycle traffic to a city that previously had practically no bikes on its roads, and now Paris is setting up a similar system of electric vehicles called Autolib.

These are all building blocks toward greater flexibility in networked mobility and how we travel. Generally less well known are the developments in China, where very successful bikesharing schemes have also been set up – in fact, based solely on the number of users, these are the largest schemes in the world. Since the proportion of car owners in China remains small to this day, bikesharing is really taking off. There are also concerted efforts to integrate bikesharing into the public transport system. In cities where buses form the backbone of the public transport system, the largest bike stations are located at the main bus stops. Huangzhou is a leading example, and it intends to expand its large bikesharing scheme even further. Here interoperable bicycles, also play a key role.

Bicycle travel even seems to be on the rise in certain places in the United States...

Portland, Oregon is one example of a city where bicycle use has increased in recent years. And we can expect to see such alternatives to car travel continue to develop, including in the United States – at least in the East Coast and West Coast regions and the area around the Great Lakes. This is also where you find Zipcar, the world's largest carsharing operator, and its 770,000 customers, the Zipsters.

However, sharing schemes are only attractive for customers if enough vehicles are available just around the corner. This costs money. A few weeks ago Zipcar was taken over by the rental agency Avis Budget, and in 2012 Zipcar made a profit for the first time in 12 years. In Germany all the major carsharing operators recently increased their prices significantly. So how profitable are they?

This kind of system is not profitable below a certain user threshold. Until this is reached, it won't pay for itself. However, there are already carsharing schemes that have been operating commercially for some time. We have collected data on carsharing projects from around 1991, some of which are still going. As early as the late 1980s some systems were set up as cooperatives or co-financed by cities. Eventually these were passed on to commercial owners and they remain active to this day, some of them as part of the Stadtmobil Group. So there are certainly functioning business models out there.

Though not necessarily with the option of also getting a car in another city – or even being able to use buses and trains with the same travel card...

Precisely! Because you only sign a contract with a single carsharing operator, you still have to make other arrangements for your other journeys. Integration with other modes of transport should actually bring about an additional boost in demand.

Could a completely networked mobility system be described as one-stop shop for mobile people?

Yes, of course. Networked mobility means that various modes of transport can be optimally linked together via an integrated platform. If there are various alternatives on a journey from A to B and a mobility provider offers information and billing for all modes of transport from a single source, this allows users to optimize each of their journeys – in terms of speed, price or environmental impact – and to simply receive a total bill for their mobility costs at the end of the month. A modern smartphone could provide a convenient way of checking in for any journey.

In addition to smartphones, there are already various forms of smartcards that grant access to transport carriers and offer payment functions. Which method do you think will become dominant?

The mobility card in its various guises of course offers an alternative to the smartphone app, and both systems will continue to operate in parallel in the future, as they each have different strengths. Some systems can handle cashless payment, others are prepaid cards. Cards with an RFID chip can check me in and out automatically while remaining in my pocket the entire time. Some of these systems are still in the trial phase, others in full operation, but it is still too early to say whether one method will prevail in the end. High-performance databases for handling the data in real time are still a challenge at the moment. Besides, integrated mobility is above all a question of optimal planning.

Alongside the technology and the networked, multimodal systems, is there also a demand for a new kind of mobility service?

Absolutely. All the concepts described here also involve particular business models. For instance, strategies as to how an automaker or a public transport operator can develop into a provider of networked mobility, offering car-, bike- and ride-sharing in real time from a single source.

This raises the question as to whether it would make sense, under certain circumstances, to offer additional mobility services such as rental bikes, reservations for parking or charging stations, and billing – and where new cooperation partners from sectors such as energy and IT would come into play. At Fraunhofer Institute for Systems and Innovation Research we are involved with developing such models of future mobility services. The technologies for equipment and software come from other Fraunhofer institutes or companies like Siemens.

Do policy-makers also play a role here?

We are also active in advising policy-makers. Just recently we carried out a project on the economic aspects of sustainable mobility for the European Parliament. This involved identifying the ten most important factors for sustainable transport – and these networked, multimodal mobility concepts belong to this category.

In concrete terms, what is currently lacking from the political side in terms of making networked mobility a reality?

Our study also included relevant recommendations

for standardization in the exchange of data. This is a particular area where a stronger political framework is required. From my point of view, it's important that access to these services and the information systems are standardized, allowing for roaming between various mobility integrators. This is something policy-makers in Europe should be pushing through.

Pushing through normally also means providing financial support.

In some cases the legal regulations are more important. For example, the applicable parking laws represent a hurdle for carsharing. The goal here shouldn't be permanent subsidization.

So do you believe networked mobility has a chance of becoming the norm for us one day?

From my point of view as an innovation researcher, we are currently still going through a very exciting trial phase, with innovative steps forward, new market ideas and pilot projects. Often this leads to the issue gaining a lot more momentum and eventually becoming part of everyday life.

I certainly believe this could happen for networked mobility. Indeed, it's already apparent that one day you will be able to sign a contract with the mobility association of your choice, like you can with today's mobile network operators, and then travel on the networks of other providers based on certain roaming conditions. ☺

FYI

Dr. Wolfgang Schade is Head of the Business Unit Transport Systems at the Fraunhofer Institute for Systems and Innovation Research (ISI).

<http://www.isi.fraunhofer.de/isi-en/profile/index.php>

Dr Schade has worked at the ISI in Karlsruhe since 2005, focusing primarily on the development and integrated evaluation of long-term political and economic strategies for the areas of transport, energy, climate, technology and employment. In 2008 he was appointed Head of the Business Unit Transportation Systems.

A different version of this article appeared in Issue 10 of *COMO* magazine. Thanks to Siemens for their permission to use and re-edit this article

Killers crossing

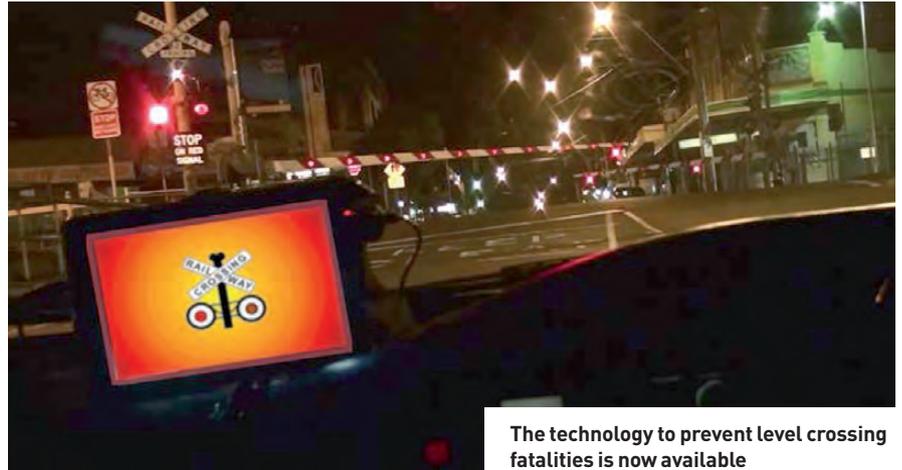
The extraordinary story of how smart Cooperative Intelligent Transport Systems are being deployed to improve safety at level crossings, by **Jack Singh**

According to the Australian Transport Safety Bureau (ATSB) between 2001 and 2009 over 630 road vehicle collisions occurred at level crossings in Australia with the state of Victoria alone accounting for 236 of these incidences. In addition to the financial loss of level crossing accidents, they have also resulted in high level of tragic fatalities (over 70 deaths between 1997 and 2002). Investigation by the ATSB into 12 level crossing accidents between April 2006 and December 2007 observed that nine of these incidences involved heavy road vehicles. These incidences resulted in 19 deaths and an estimated financial loss of over A\$100 million (£65 million), including a single incident near Karang, Victoria, where 11 people died.

The major factors that have accounted for collisions have included driver behaviour (and errors), poor communications, signalling difficulties and environmental conditions such as visibility. Existing approaches to improve safety include both passive and train activated warning signs and signalling systems. Although passive signs are economical to deploy, they can be less effective in addressing common causes of crossing incidences e.g. poor visibility, human errors due to fatigue or inappropriate driver behaviour. On the other hand, active warning systems such as boom gates can be expensive to deploy.

FATAL FLAW

Furthermore, the absence of active warning systems or the presence of



The technology to prevent level crossing fatalities is now available

adverse weather or road conditions are not always the primary factors behind level crossing incidences. According to a study of 87 level crossing accidents conducted by ATSB [9], over 80% of the fatal accidents at level crossings occurred in excellent driving conditions that included daylight (excluding dawn and dusk), fine weather and straight and dry road. In addition to this, at least half of the level crossings involved in these collisions employed some form of active warning system such as boom gates, flashing lights or barriers. Driver error was the most common cause of level crossing collisions accounting for 46% of all incidents. Errors, however, are not monocausal and range from attentional lapses to false expectations, inappropriate decision-making, driver mental overload and perceptual misjudgement.

Over the past few years, the Federal and State Governments of Australia have made several recommendations to improve safety at rail-road

crossings. Seven of these recommendations relate to the development and use of new Cooperative Intelligent Transport System (ITS) to improve safety at level crossings. The State Government of Victoria through the Public Transport Victoria and the Federal Government of Australia through the Cooperative Research Centre for Advanced Automotive Technology (AutoCRC) along with a number of key Universities and industry partners have cooperatively funded a new multi-million dollar project which aims at developing a co-operative Intelligent Transport System to improve safety at rail-road crossings. The specific aims within the scope of the project are to develop an Intelligent Transport System simulation platform for rail-road crossings based on 5.9GHz Dedicated Short Range Communication (DSRC) technology, to develop an ITS demonstrator system and to implement field trials with up to 100 vehicles at several level crossing interfaces.

HOW IT PLAYS ITS PART

The development of the DSRC standard by the IEEE has paved the way to efficiently implement a wireless ad-hoc network, which can be used for vehicle-to-vehicle (V2V) and vehicles-to-infrastructure (V2I) communication to facilitate the development of ITS. ITS enables applications across three main categories, with the potential to offer significant social, economic and environmental benefits, namely:

- Safety: ITS safety applications use the communication mechanism within DSRC to create complete situation awareness for vehicles.
- Mobility: ITS mobility applications include travel and route planning, traffic and congestion management including public transport, transport network productivity and reliability enhancement etc.
- Commercial: ITS can allow a very wide range of commercial applications ranging from next generation electronic toll collection (ETC) and fleet management to variety of data and infotainment applications.

The development of the DSRC standard has paved the way to implement a wireless network

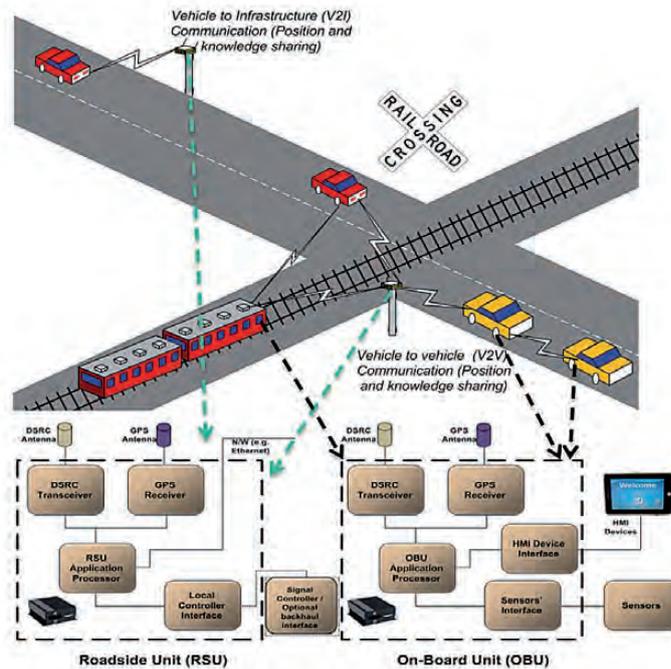


Figure 1: Architecture of DSRC-based ITS for Level Crossings

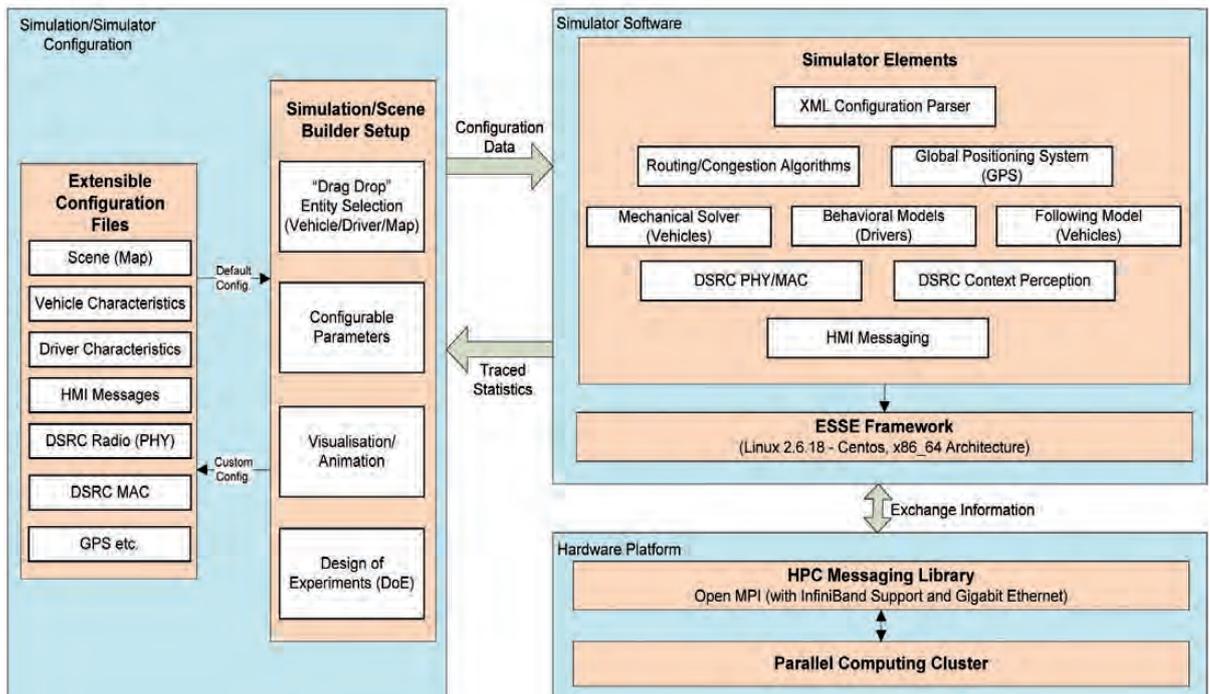
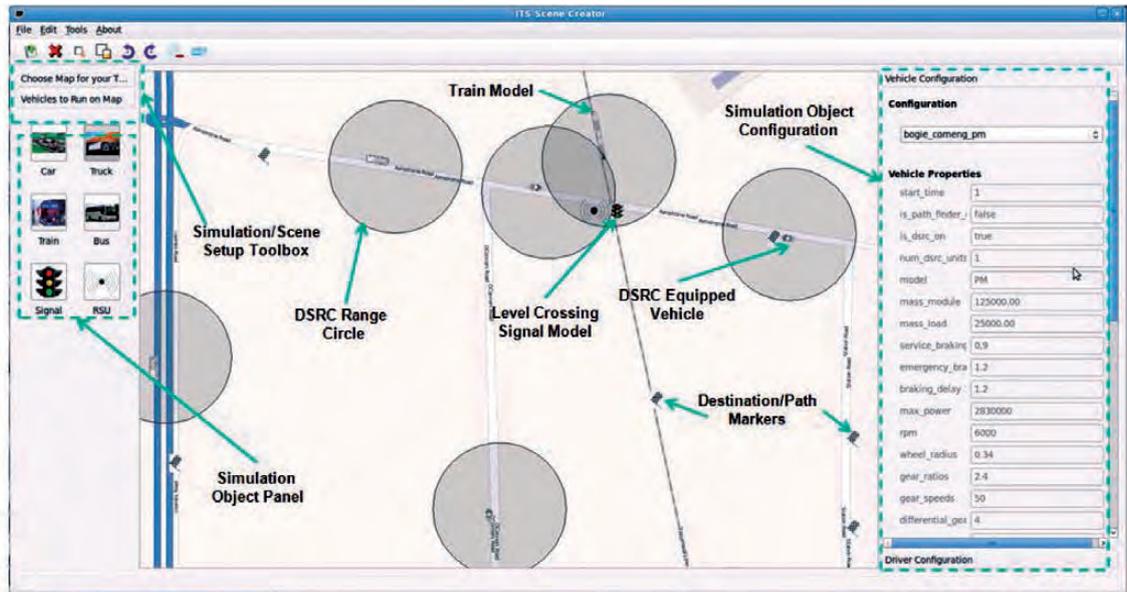


Figure 2: Simulation Platform Architecture

Figure 3
Graphical User Interface (GUI)



LEVEL PEGGING

The overall aim of the project was to research, develop, implement and trial a DSRC based ITS solution to improve safety at level crossings. The solution aims to reduce and potentially eliminate level crossing accidents by enabling dynamic V2V and V2I communications using DSRC technology. The specific aims within the scope of the project are:

- Phase 1: To develop an Intelligent Transport System (ITS) simulation platform for rail-road crossings based on 5.9GHz DSRC technology
- Phase 2: To develop an ITS demonstrator and Proof-of-Concept system
- Phase 3: To carry-out field trials at level crossing interfaces

Figure 1 illustrates the system architecture of the proposed DSRC based Cooperative Intelligent Transport System deployed at a level crossing. It is composed of DSRC enabled roadside units (RSUs) and on-board units (OBUs). The RSUs are placed at locations such as rail-road crossing active signs while the OBUs are installed in road vehicles and trains.

A DSRC based ITS at level crossing will enable communication between

infrastructure nodes and vehicles in the vicinity of the crossing including trains and road vehicles. This communication enables sharing abundant data between vehicles including basic information such as vehicle size and type, position and motion and other control information such as brake status, throttle, steering angle etc. Depending on various parameters and conditions, the information can be shared directly using V2V communication or indirectly using V2I communication. The information will be used by a specialised level crossing safety application to generating warning messages such as advice of an approaching train, advance indication of a potentially faulty crossing, expected delay at the level crossing, suggestion of alternate routes etc. The Human-Machine-Interface (HMI) used to communicate safety messages to drivers was developed to not only address the immediate safety requirements but also to promote overall long term behavioural change of drivers towards safety consciousness.

SIMULATION PLATFORM

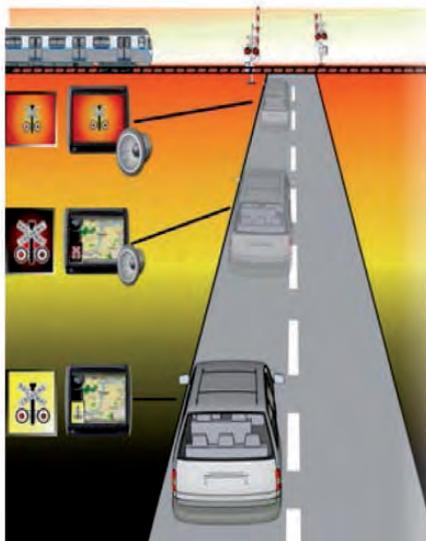
Existing simulation platforms/tools such as CarSim/TruckSim, Automated

Highway Simulations (AHS), are generally domain specific. Most high-end simulation platforms are commercial, closed-source projects and co-simulation can be extremely computation-intensive in nature. The overall result is a limited capacity for simulation systems to perform simulations on a larger scale in a respectable time that will allow real empirical evaluation of a system.

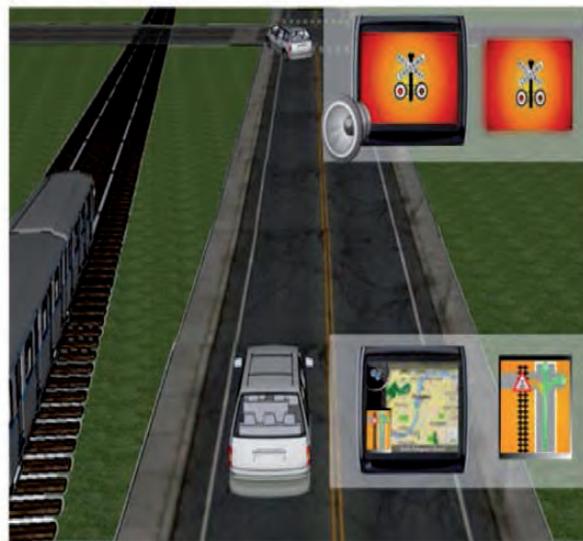
To address the limitations of existing solutions, this project involved the development of a DSRC based ITS simulation platform which can accurately simulate the mobility, DSRC communication and complete interaction of trains and road vehicles at a level crossing. Figure 2 illustrates the architecture and the elements of the simulation platform. The platform has been developed to allow simulation of all domains in a unified simulation environment that is specialised for level crossings.

The features of the simulation platform include:

- Distributed High Performance Computing (HPC) cluster based simulation environment;
- Scalable models of DSRC communication, GPS, intelligent collision avoidance applications, vehicle



(a)



(b)

Figure 4:
(a) Warning sequence on a direct approach to level crossing
(b) parallel approach to level crossing

models (articulated trains, buses, trucks, cars), mapping system models, and human behaviour models (driving behaviour and HMI);

- Flexible parameter configurability and efficient simulation trace/debugging/event filtering mechanisms for all models to allow Design of Experiment (DoE) and heuristic search;
- A complete simulation set-up/visualisation engine with graphical user interfaces that includes real-world map loading, drag and drop of element placements, optimal traffic routing and parameterisation of various elements.

The simulation platform allows detailed modelling and forecasting of the typical interactions between rail and road traffic. A simulator normed with complex empirically collected field trial data can be used to further the design of intelligent collision avoidance algorithms, and visually and intuitively evaluate system boundary conditions for safety factors such as the predicted motion paths of vehicles, different configurations of collision warning thresholds, and human behaviour variations on attributes such as reaction time,

driving style or attentiveness. With its high level of customisability, this platform has the potential to direct the design and implementation of practical DSRC road-safety infrastructures and mobile devices.

The Graphical User Interface (GUI) operating on a High Performance Computing (HPC) cluster is shown in Figure 3.

HUMAN MACHINE INTERFACE (HMI)

While there are already numerous in-vehicle HMI implementation in existing vehicles that address forward collision or lane departure, there is currently no system dedicated to provide timely and effective train warnings at rail level crossings.

In this project, the HMI was developed through a combination of focus groups, and experimental tests, and field trial feedback. Audio-visual warning messages, as shown in Figure 4, dynamically intensify on multiple dimensions (volume, pitch, semantic content, contrast, static versus dynamic image animation) as driver risk increases.

DEMONSTRATOR SYSTEM

A demonstrator system was developed using Cohda Wireless's 5.9GHz

DSRC radio platform. The main objective of this work was to establish a proof of concept through the development of a technology demonstrator based on 5.9 GHz DSRC technology. The most significant aspects of this work include:

- Development of optimised embedded software for DSRC-based safety applications based on intelligent new algorithms for proactive collision avoidance, human factor research outcomes, and with work leading towards congestion and emission reduction;
- The identification, development, and implementation of core technologies for HMI, including both functionality and display characteristics of HMIs and drivers' behaviour issues. The resultant HMI interface was designed to be scalable;

FIELD TRIALS

Phase 3 of the project involved conducting real-world field trials of the system with a large number of vehicles at level crossings in urban and rural locations to verify:

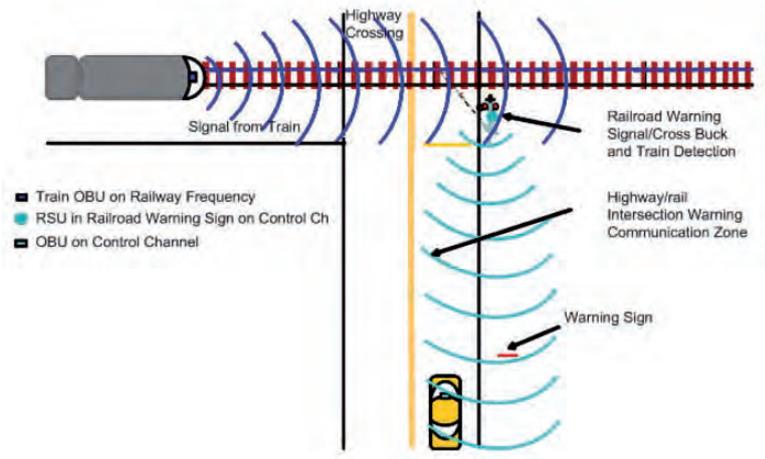
- Radio communication performance under adverse conditions including vehicular congestion, 'high' speed vehicular interactions, and built

environment operation;

- Key system performance factors including data rate, application response, multipath fading, Doppler effect, on-time reception of safety critical messages, and GPS positioning accuracy;
- Driver reaction (risk reduction) factors such as message effectiveness, usability of the HMI, and effect of a passenger on the driver.

In addition to the orchestrated trials, a six-week longitudinal trial was conducted at the two urban trial sites. Ten local drivers were recruited to drive across the level crossing as they normally would and 16 radios were fitted to eight live trains that passed through the DSRC controlled level crossing. The aim of this project phase was to gather data on alert adaptation over time, system acceptance and, if applicable, changes to driver behaviour as a result of exposure to warnings. 🕒

The main objective of the project was to establish a proof of concept through the development of a technology demonstrator based on 5.9 GHz DSRC technology



FYI

Prof Jagdutt “Jack” Singh is director of LaTrobe University’s Centre for Technology Infusion, based in Victoria, Australia
jack.singh@latrobe.edu.au
latrobe.edu.au/tech-infusion

Technology: Dedicated Short Range Communication (DSRC)

In late 1999 United States Federal Communications Commission (FCC) allocated a 75MHz spectrum for DSRC at 5.9GHz for use in Intelligent Transport System applications. The Australian Communication and Media Authority (ACMA) is in the final stage of allocating a similar frequency spectrum in Australia. The DSRC technology allows rapid and high speed communication between multiple vehicles and between vehicles and infrastructure to enable both safety and non-safety applications. This technology at 5.9 GHz offers 7 channels of 10 MHz each, allowing communication data rates of up to 27 Mbps, with communication capabilities at vehicle speeds up to 200 Km/h. This next generation 5.9 GHz DSRC technology is based around a set of standards being developed by the IEEE. Following is a summary of the key standards that are being developed to support this technology:

- IEEE 802.11p (Wireless LAN medium access control [MAC] and physical layer [PHY] specification for WAVE): The WAVE architecture uses an adaption of IEEE 802.11a Wireless LAN standard for supporting wireless communication in vehicular environments (initially developed in ASTM standard E2213-03). The IEEE 802.11p amendment to extend

the IEEE 802.11 standard is intended specifically towards addressing harsh vehicular ad-hoc network communication requirements - to enable rapid and reliable communication mechanism for dissemination of safety messages.

- 1609.1 (WAVE Resource Manager): This standard defines the WAVE “Resource Manager” application and specifies its services and interfaces. It allows multiplexing communications of multiple remote applications, each of which can interact with radio units in many vehicles.
- 1609.2 (WAVE Security Services): This standard defines the DSRC security services for applications and management messages (including secure message formats and processing) which are intended to provide anonymity, authenticity and confidentiality for the messages exchanged.
- 1609.3 (WAVE Networking Services): This standard defines network and transport layer services (including addressing and routing) in support of secure WAVE data exchange.
- 1609.4 (WAVE Multi-Channel Operation): This standard defines the multichannel wireless radio operation of WAVE. It is intended to tightly integrate with the IEEE 802.11p to manage the lower layer usage of DSRC channels.



Intelligent thermal sensor for traffic control



ThermiCam



Vehicle and bike presence detection and counting

FLIR's ThermiCam offers smart vehicle and bike presence detection and data collection for intersection applications. FLIR ThermiCam detects vehicles and bicycles at and nearby the stop bar. The intelligent ThermiCam sensor will transmit its detection information over contact closures or over IP to the traffic light controller and will thus allow a more dynamic control of traffic lights.

ThermiCam makes use of thermal video images to analyze the traffic scene. When it comes to intersection control, thermal imaging offers some undeniable benefits:

- Distinguish between vehicles and bikes
- Guaranteed detection, day and night
- Detection in difficult weather conditions



Bike and vehicle detection

Contact us for more information about ThermiCam:

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Intelligent Transportation Systems



FLIR ITS, intelligent systems for making traffic easier, safer, smoother.

The bigger the data, the smarter the city

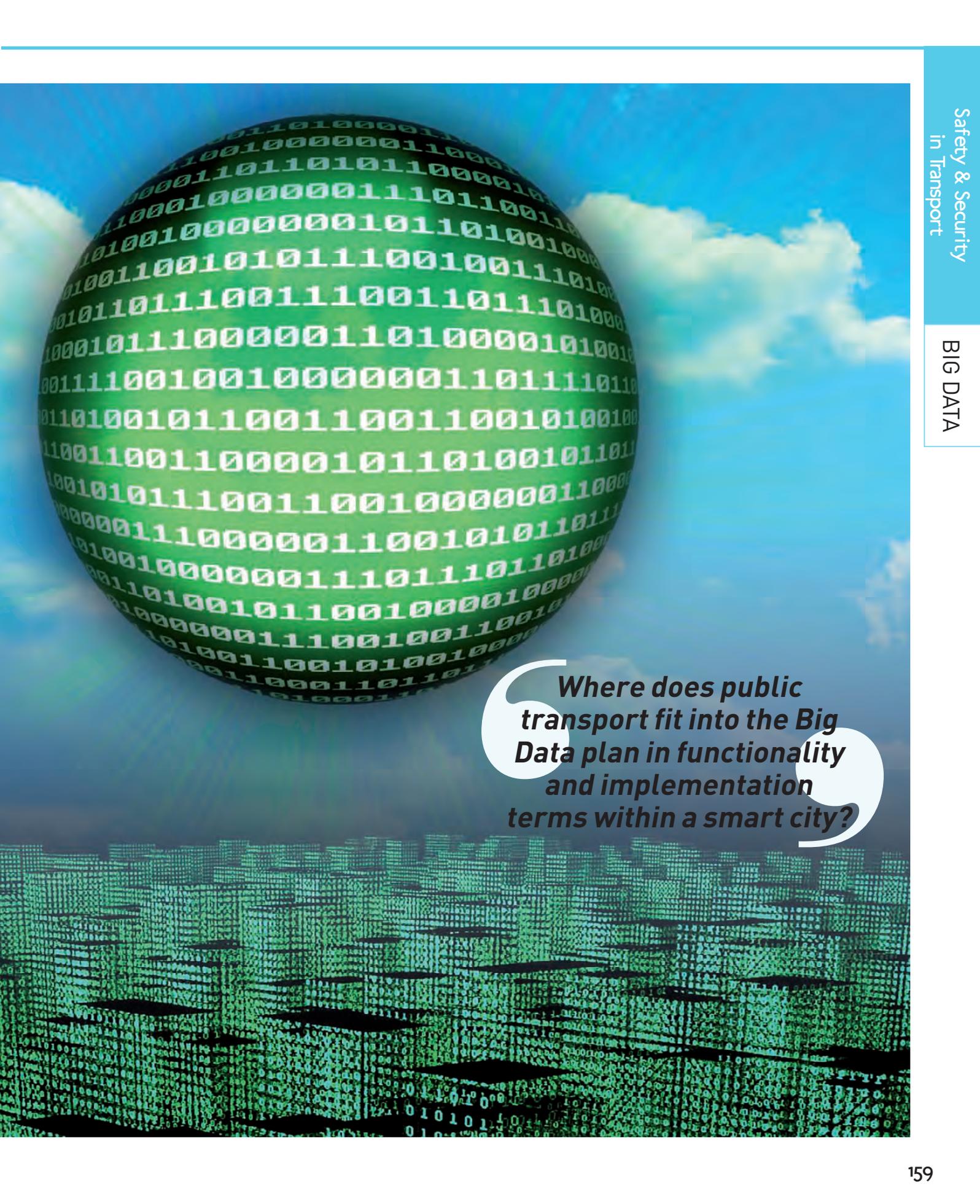
Kevin Pallett wonders how the dual concepts of big data and the thinking city work in tandem – or even individually, when used in a public transport context

Big Data. Smart Cities. These are two the latest buzzwords we keep reading about in magazines and online articles and also receiving in our twitter feeds from various priests of this new order. However, my question to these evangelists is quite simple: “where does public transport fit into this Big Data plan in actual design, functionality and implementation terms within a smart city digital environment?”

What do we want to achieve? What inputs do we need? What integration tools are required? What are the outputs?

Public Transport as we all know is fundamental in the efficient movement of people in a city or metropolitan area, and the systems behind public transport modes (all modes) are extremely complex in terms of the planning, operation and delivery of good transport services. But, if some of these tub-thumpers really came and had a closer look at what ITS and transportation specialists have done around the world, they





Where does public transport fit into the Big Data plan in functionality and implementation terms within a smart city?

might understand what data exists in public transport and ITS systems as well as its associated logic and, by doing this, see how far some cities and authorities have come in adapting, merging and using transport data in some wonderful ways.

The tools that have been used, the integration techniques, the lessons we have learned, these all could truly be adapted in this “Smart City” picture.

SOMETHING IN COMMON

Sadly, my first and last experience involving a smart city forum was disappointing as it was clear that market verticals/segments such as health, transport, finance, utilities and retail failed to find the common ground where a grand design in terms of a “smart city” could truly be employed. I mean with meaningful system logic, with “meat on the bone” in terms of creating a real city data hub or exchange, and the benefits that merging, adapting and mixing data from different sectors could achieve, not only for business but for the common citizen as well.

There needs to be a realization that a treasure trove of data exists and its potential for usability and some of the techniques used in ITS system deployment as well as other sectors should really be celebrated as well as more closely examined.

Transport, I fervently believe, is the backbone of any true “Smart City” not only now but for years to come, and I believe as technology advances we will see the imperceptible joining of previously disparate IT-related markets as naturally as transport and retail.

Whatever happens I know it will be interesting, exciting and probably challenging!

PROJECTING FORWARD

The following gives some quick examples of projects I have been involved in with a hope it not only

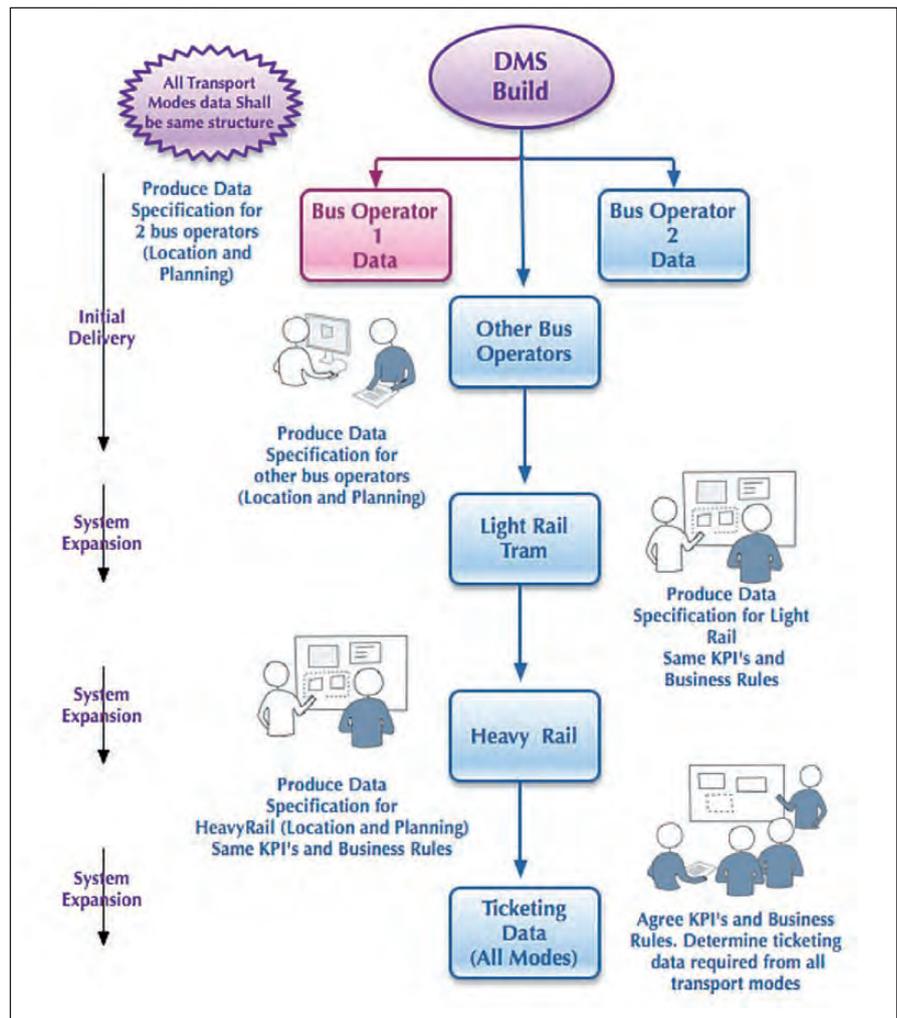


Figure 1: The Delivery Plan

demonstrates how forward-thinking clients are becoming in transport, but also triggers some thought on how we could approach “Smart City” projects by exploring what player industry’s have in data and design terms, and how this data can be merged/adapted and thus used for some useful projects and outputs.

Project Type: Provision of a Public Transport Operations Data Management System For Transport Authority.

Project Aim: An authority wanted to develop and implement a new Data Management System (DMS) to facilitate the monitoring and regulate the

performance of initially bus services operated under Public Service Contracts using location and planning system data with an expansion capability to incorporate heavy rail and light rail services. As well as monitoring bus operations, the DMS will play a key role in identifying infrastructure pinch points, using the same Timing Points and bus stop GPS data, from which bottleneck issues may be inferred. Ticketing data will also be incorporated at a later date for all transport modes.

Project Challenges: Bus Operators have different AVL systems, each mode has different planning/AVL data systems. No workflows identified.

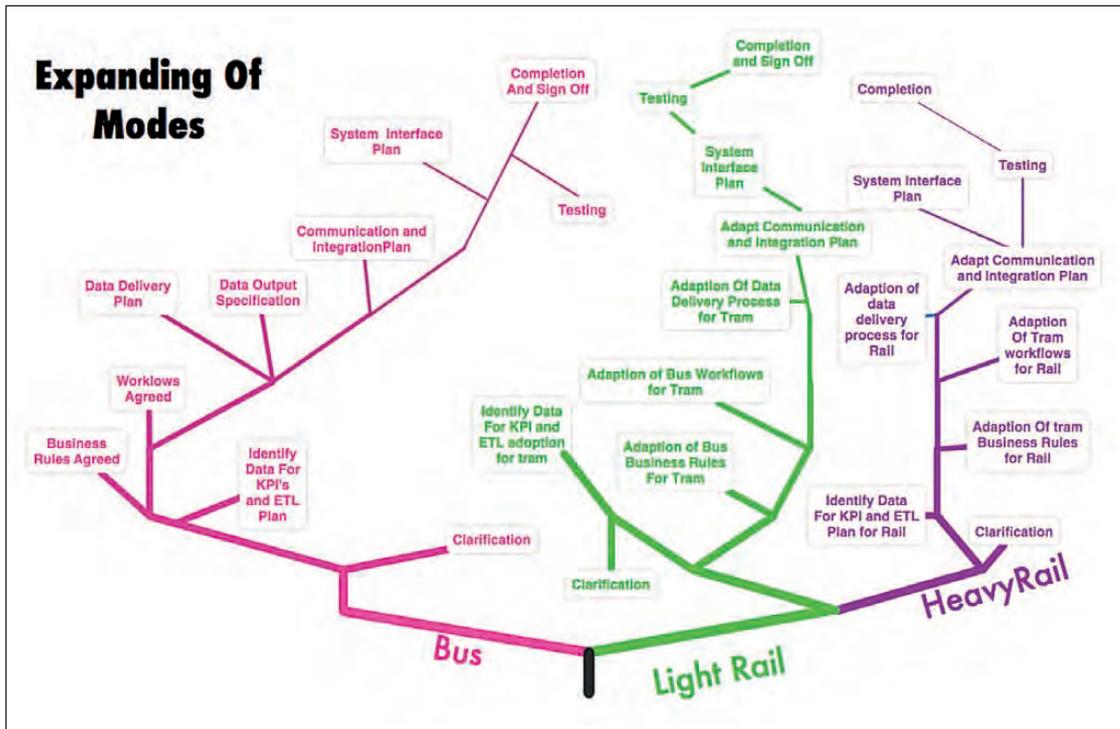


Figure 2:
Delivery Tree
Process

Approach: The approach was to effectively utilise two bus operators to shape business rules, data flows, delivery of data to a secure data landing area prior to ETL(Extract, transform and load) processes.

KPI (Key Performance Indicators) and monetisation rules as well as workflows for performance monitoring and payment were incorporated to make the system as automated as possible. The plan for delivery is shown in Figure 1.

It was felt that this approach was most logical as following DMS incorporation of the initial two Bus Operators, a reusable model and approach would then exist for new bus operators, and this approach could therefore be followed, albeit with data adaptations in the ETL process due to specific data associated with the other modes, eg. Light Rail and Heavy Rail.

It should be noted that our ultimate objective for national public transport monitoring, was that all multi-modal information within the DMS (both planned and actual location

data) should be of the same data format and structure. This would allow benefits in terms of measuring the inefficiency of service coordination between modes as well as the ability for data to be reused for more purposeful data visualisation techniques.

As KPIs, workflows and business rules would be common in data structure terms although configurable by each mode in regard to performance rules, therefore a standardised approach could also be adopted as modes are added to the system.

This standardising of processes in terms of the clarification, data identification and business rules are summed up in the following “delivery tree” diagram shown in Figure 2.

Project Type: Complete Information and IT Hub For Rail.

The aim of this project was to increase efficiency for a rail operator using a Service Oriented Architecture that incorporated use of data adaptors from various sub systems.

In effect this forward thinking

customer required a dynamic IT solution so their whole planning process (planning of duty rosters, rolling stock and timetables) was solved dynamically with the ability to optimise each individual planning process in real-time. All operational and business data would be gathered in a Management Information/business intelligence solution granting access to a diverse range of reports and templates as well as personal communication devices for mobile staff such as Train Drivers and Guards also interfacing to the system in real time when for example signing on for duty start.

The Management Information design put forward once again utilised a staging area design, although due to the number of subsystems that were to be utilised, this resulted in the system being sectionalised into 13 logical areas where each area had the ability to exchange and merge data with other areas thus creating dynamic reports through carefully designed templates, as well as with an additional benefit to create ad hoc



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Smarter cities = safer cities

Andrea Sorri on how the intelligent use of intelligent technology can transform a city into a safe place to be

Cities face many challenges today. With modern video surveillance technologies cities can track, analyze and respond to incidents as and when they occur. Security cameras have evolved to be much more than static devices. Video analytics software enables cameras to automatically send alerts, to count objects and people and to analyze movement patterns. These advanced functionalities are possible because of the move from analog to IP-based video surveillance systems. This allows city officials to find answers

to questions such as how parks and public areas are being used, what caused congestions and crowds and what measures to take against crime and vandalism. Cities become smarter and safer, by evaluating and analyzing video surveillance data from parks, squares, streets and public buildings.

SOMEONE TO WATCH OVER ME

The idea of an integrated video surveillance system watching over a city and taking care of its citizens is great in theory. The main challenge with

Citizens should have the right to feel safe in their own city without feeling they are under constant scrutiny



the execution of such a plan comes from the citizens themselves. It is a matter of public privacy versus the safety of a city and its citizens, who should have the right to feel safe and secure without feeling as though they are being monitored. However, this does not need to be an issue.

In a city being watched by security cameras they only need to be placed and directed at public spaces, not into homes and businesses. And in instances where there are sensitive areas, privacy masks can be used to exclude that area from the monitored field of view. It isn't necessary to invade the public's privacy in order to make a city smarter and safer. An integrated video surveillance system supports multiple stakeholders, giving each user only access to the information they are authorized to access and which is relevant to their role. Video surveillance implemented this way benefits both those who are responsible for the safety of cities as well as the citizens living in them.

Managing a city and all that it entails, from security to planning, is complex to say the least. From parks and squares to streets and public buildings, there are any number of incidents that could be taking place, from traffic congestion at a particular junction to crime against citizens.

LOCAL CHALLENGES

Squares and parking lots tend to be very wide and open areas with potentially many events taking place simultaneously. This type of installation requires both an overview as well as the ability to zoom in on details. Cameras with pan, tilt and



City of Medellín, Colombia: Integrated video surveillance system control room

zoom (PTZ) capabilities are the best fit for such areas. Even with shadows and light reflection, a powerful zoom can provide both an overview and the necessary detail for the entire field of view. Monitoring of wide areas is further enhanced when using cameras capturing video in 16:9 format in HDTV quality.

Similar to squares and parking lots, parks are typically large areas so video surveillance equipment needs to offer high-speed coverage with precise zoom, control of the area being viewed and auto tracking for when following the route of a specific object or person is necessary. Varying light conditions and restricted visibility due to trees and foliage can also make it difficult to recognize movements. Security cameras equipped with Lightfinder technology provide detailed color video, even in darkness. It is important that the cameras can be pointed at a specific person or object for identification purposes.

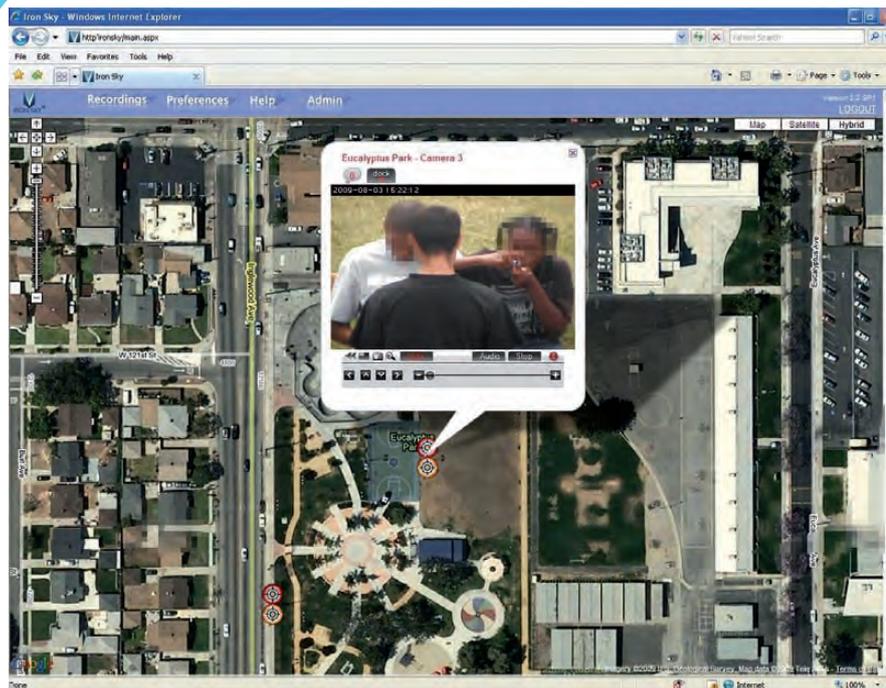
The heart of any city is its streets and intersections. If they are not flowing properly it could be detrimental, not only to the city's citizens

who may be struggling through congested roads, but also to the lifeblood of the city, its businesses. The state of the roads and traffic flow is also important when it comes to first responders and their ability to reach emergency situations as quickly as possible. Being able to receive clear images is key to the flow of the city but also for identification of faces and license plates in regards to specific instances. Installing security cameras that deliver clear images even at night or in adverse weather conditions gives the ability to identify vehicles and drivers. And with pre-sets such as wide view and optical zoom, security cameras are able to look into traffic, seeing cars head on at night. It is important in situations such as these to get both an overview and a detailed image with precise pinpointing on an object or person.

Whether it is the police or security managers who are monitoring the input from cameras, they need to be able to read license plates from a great distance and to have a quick focus on moving objects to keep track of activity in real-time as well as for post incident review.

Monitoring public buildings has its own set of challenges. Buildings tend to have large entrances, often-times with glass fronts that can make it difficult for cameras to get clear images due to the reflection off the glass and when incoming sunlight creates both very bright zones as well as very dark shadow areas. Security cameras with Wide Dynamic Range (WDR) technology provide homogeneous images without too dark or too bright zones allowing

Cities become smarter and safer, by evaluating and analyzing video surveillance data from parks, squares, streets and public buildings



City of Hawthorne, California, USA: Police officers can view video, point and zoom cameras, record events and search archived video footage using icons superimposed on a Google Maps satellite view

for clear identification of people and objects. For big spaces such as long corridors and halls within buildings, it is necessary to have cameras that can follow an object. In other parts of buildings cameras are needed to monitor gates, doors and vulnerable areas pointing in several directions, watching people and objects passing by slowly or quickly with precision.

ENABLING TECHNOLOGY

A city's video surveillance system should be seen as a tool that makes for a smarter, more secure city. For example, cameras placed in communal places such as parks and public buildings can in effect be an extension of the police force, working non-stop to support their efforts in both evidence collection but also as a real-time investigative tool. With one or more centralized control room cameras can provide access to clear images not only to city officials but also to police officers, which is particularly useful when cameras are placed in areas where police would like to be but can't due to limited resources. For example, if a police

With one or more centralized control room cameras can provide access to clear images not only to city officials but also to police officers

officer is on patrol they can view the feed coming from a park either on their smartphone or on their patrol car computer system to check if everything is OK or if their presence is needed. It is not necessary that the security cameras work with any sort of facial recognition system or pre-existing database. As long as the cameras installed have the ability to zoom in they can identify individuals. If a situation does arise, say there is incidence of violence in the park, police can look through the footage to identify suspects, where they may have gone, how they were travelling and who they may have been with.

Making cities smarter means making them safer. With modern video surveillance technologies city officials gain unprecedented insights

and are able to see what's going on. They can better understand what is happening and why. They can analyze patterns and hot spots.

An integrated video surveillance system can be shared seamlessly across departments and functions allowing city planners to retrieve the insights they need while enabling police officers and first responders in the field to view camera footage on their mobile devices. 📱

FYI

Andrea Sorri is Director of Business Development at Axis Communications in Turin, Italy
andrea.sorri@axis.com
www.axis.com

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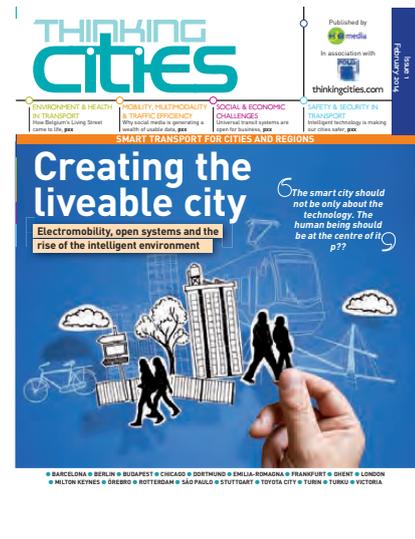
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