THINKING cities

Published by H8 media

In association with POLIS

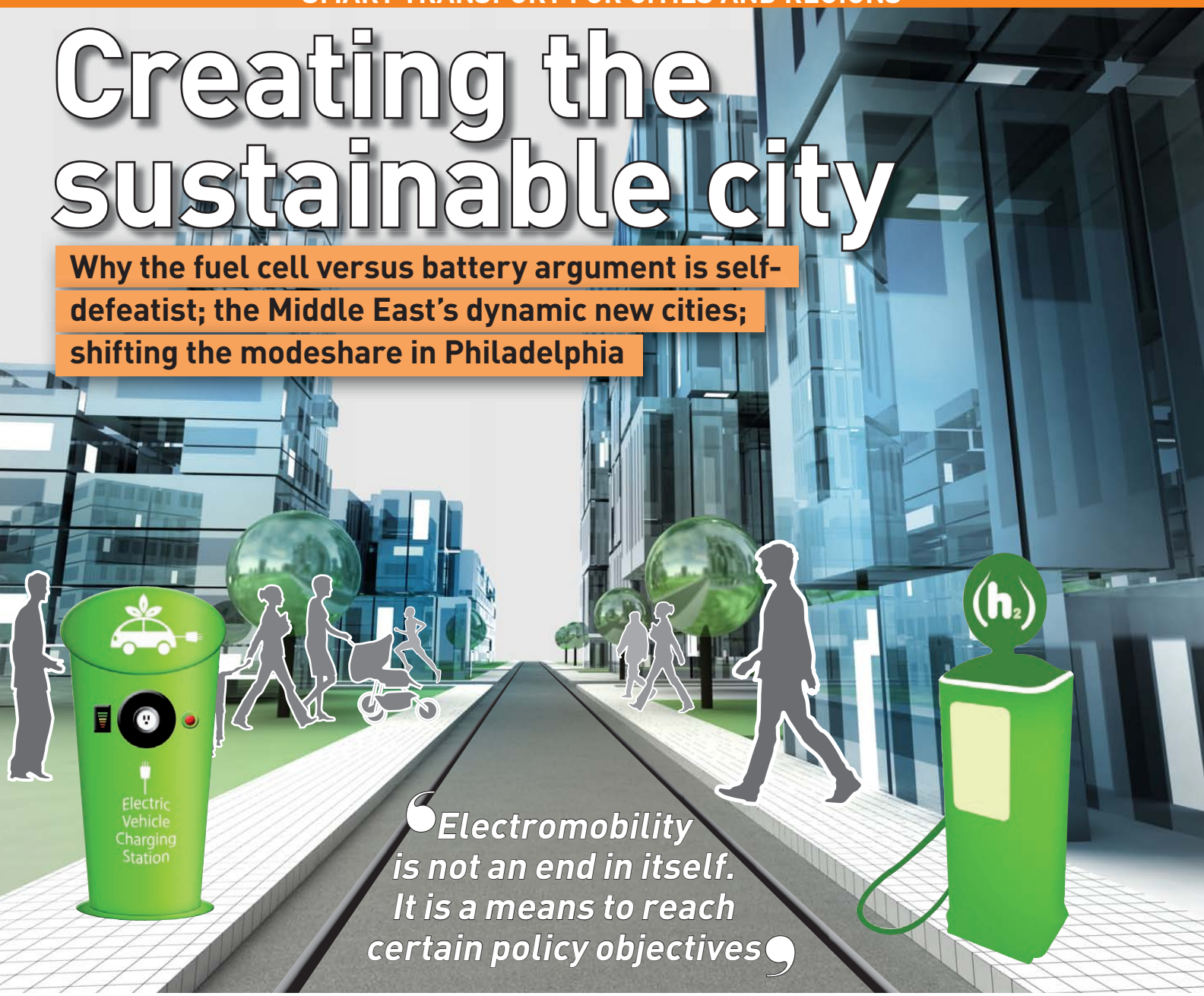
thinkingcities.com

Volume 1 • Issue 2
October 2014

SMART TRANSPORT FOR CITIES AND REGIONS

Creating the sustainable city

Why the fuel cell versus battery argument is self-defeatist; the Middle East's dynamic new cities; shifting the modeshare in Philadelphia



"Electromobility is not an end in itself. It is a means to reach certain policy objectives"

ABU DHABI ● BUCHAREST ● DOHA ● DUBAI ● FRANKFURT ● GLASGOW ● GOTHENBURG ● JEDDAH ● KAEC ● KINGDOM CITY ● LONDON ● LUSAIL CITY ● MADRID ● MALTA ● PHILADELPHIA ● QATAR ● RIYADH ● SAN DIEGO ● SAUDI ARABIA ● SOUTH AFRICA ● UAE

SIEMENS

A19100-V901-F114-X-7600

Convenient transfer from the subway to the tram. And on to the park.

Getting from point A to B, with intelligent integration.

siemens.com/mobility

Reliability, safety, and attractiveness play a crucial role in rail traffic – to ensure passenger satisfaction as well as competitive services. We offer you a unique integrated portfolio: consistent IT platforms to optimize train operations, reliable interlocking and level crossing technology, innovative ticketing systems, efficient rail vehicles, and customized services and consulting. And for us, integration goes even further. With our comprehensive expertise in optimizing rail and road traffic, we will always perfectly integrate all modes of transportation through intelligent IT – ensuring that travelers get from point A to point B even faster and more safely, and arrive more relaxed. The technologies are there. And the concepts, too. Let's work together to shape the mobility of tomorrow.
Experience integrated mobility.

Answers for infrastructure and cities.

Smart mobility, only more so

Kevin Borras and **Karen Vancluysen** on how defining what actually makes a city smart is getting more and more difficult...

In the two years since our idea of publishing a magazine about smart transport for cities and regions in collaboration with Polis became concrete, it has become apparent that the more thought-provoking articles that we receive, the wider the smart city envelope is pushed.

That make up this digital edition address this ever-more fascinating topic from a variety of different angles. So what is it that makes the definition of a smart city so hard to pin down? Maybe it's because just as what constitutes a traffic jam in one city is completely different in another, what constitutes a smart city may be completely different in a similar sized one on another continent.

Take the traffic jam theory – I live in London and have got all too used to sitting in my car, caught up in congestion. It's just a part of living where I do.

Go to a city such as Gothenburg and the traffic congestion is nowhere near as dense and lasts nothing like as long, seemingly, but that kilometre or two of non- or slow-moving traffic is as much an irritant to the residents of Gothenburg as 10km of first-gear crawl is to Londoners. So, if that theory holds true it may also be true of what makes a smart city or, as others have referred to it, the Ubiquitous City. Even before H3B Media and Polis joined forces we had discussed this seemingly far-fetched notion that seemed to encapsulate everything we could envisage as a topic for this fledging new media platform.

THE CONNECTED TRAVELLER

In the U-City, as we ended up calling it, the citizen was inextricably linked to the city by their smartphone. Notionally, at least, you were connected to the city from the moment you entered its boundaries until you left it. Interactive advertising spaces would react to your presence and would ping you things you were interested in or had searched for on Google or Amazon and to all intents and purposes U-City was personalising itself for you.

In essence that advertising hot spot would not show you a publicly viewable product placement (like you would see on a screen) but would send you information that you would want (things you might want to buy) or would need (tram times, for example) via your phone. This, we were told, was the future of urban mobility and was, more or less, the zenith for the traveller in the Ubiquitous City.

> ***The policy goal of many European cities is to work towards sustainable, healthy mobility and in that sense electromobility has a clear role to play as one part of the solution***

Karen Vancluysen is executive director of Polis

***Kevin Borras is editor-in-chief of* Thinking Cities**

But here we are, two years into our project, and although several articles may allude to something equitable with the basic premise of the U-City, we aren't really there yet. So, are we ever going to be truly and ubiquitously connected to every city? Do we want to be? Do we need to be? Moreover, how does it fit in with current thinking on electromobility...and is electromobility an end in itself?

A HEALTHY DOSE OF MOBILITY

Put simply, no it isn't. What it is, though, is a means to reach certain policy objectives. What we want for our cities, and particularly those within the Polis network is for them to be nice places to live in, where the air quality is good and it's pleasant for citizens to walk around, where they have a good quality of life. The policy goal of many European cities is to work towards sustainable, healthy mobility and in that sense electromobility has a clear role to play as one part of the solution.

Electromobility is also about innovation and about making those innovations more accessible to cities. Pioneers such as Rotterdam and Barcelona are taking the lead in implementing electromobility in their cities but we must ensure the road towards implementation is shortened for other cities. They can learn from the other cities by using the tools that are now available to them. It's important for cities to understand the impacts of the measures they are looking to implement.

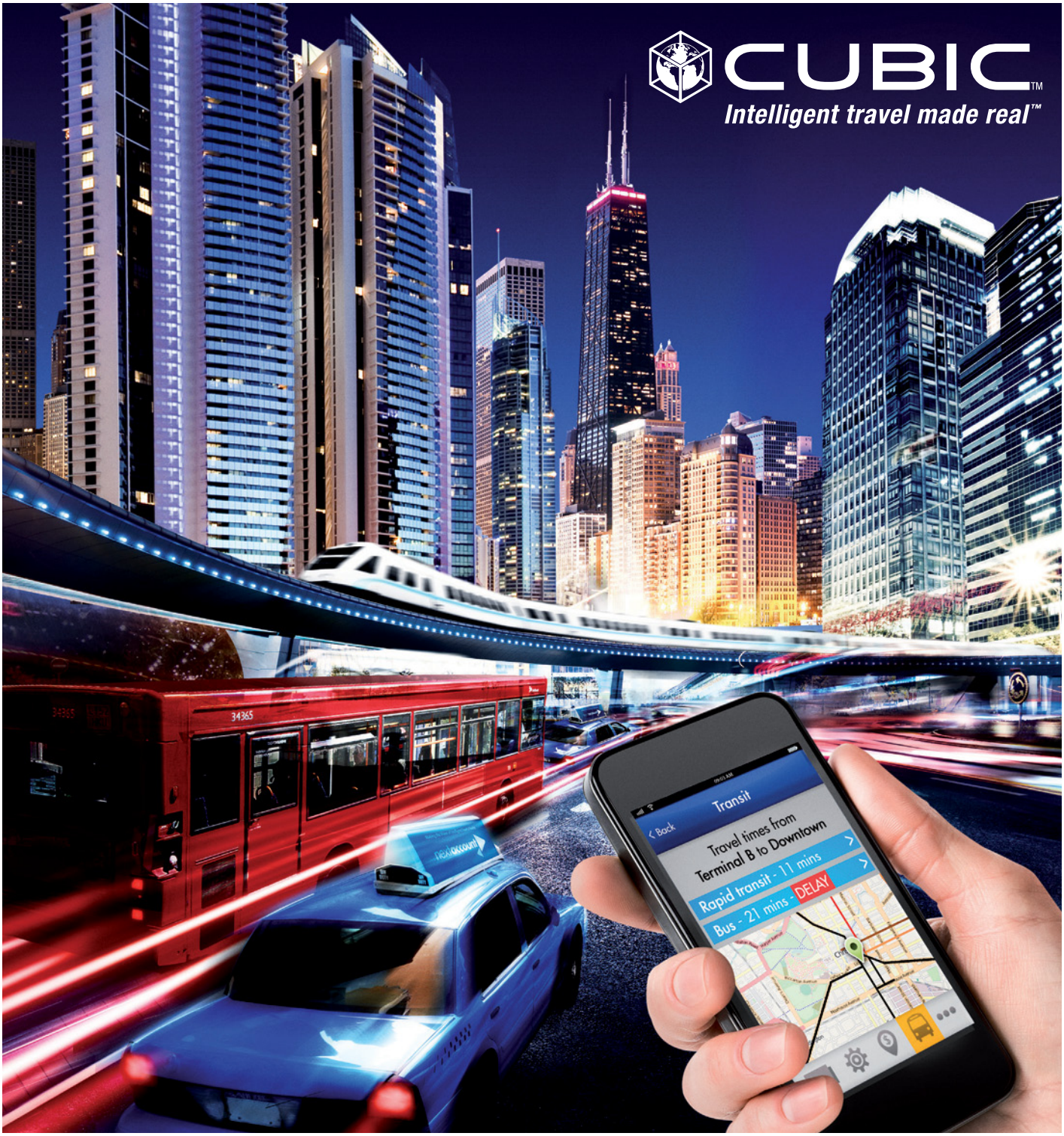
Electromobility is also about cooperation and all stakeholders have a role to play. The European level can set framework conditions to push the electric vehicle market to ensure that enough charging infrastructure is in place and the cities can also push the market by being "living labs" where innovation can take off by providing incentives to make sure that electromobility is becoming attractive to the end user. The interaction between the different players and the role of the cities to provide incentives in the initial phase will ensure that the electric vehicle is picked up by the end user and then it can play a role in making our cities more sustainable and ultimately more liveable.

CONTENTS

Volume 1 Issue 2 • October 2014

THINKING cities

A Thinking Highways publication published by H3B Media Ltd in association with Polis



Intelligent travel made real...

NextCity: Cubic's world-class integrated payment processing, customer service and financial management platforms for urban mobility.

Choose the specialist. Choose Cubic. cts.cubic.com

Editor-in-Chief
Kevin Borras (kevin@h3bm.com) +44 (0) 20 3463 9482

Executive Director, Polis
Karen Vancluysen (kvancluysen@polisnetwork.eu) +32 (0) 2 500 56 70

Art Editor
Barbara Stanley (barbara@h3bm.com)

Editorial Team
Kevin Borras, Karen Vancluysen, Dagmar Köhler

Contributors to this issue
Noel Alldritt, Patrik Anderson, Peter Paul Barbara, Eberhard Buhl, Matthew Cole, Rina Cutler, Michael Dinter, Paul Doherty, Greg Drach, Nathan Dwyer, Wolfgang Fleischer, Ian Foddering, Rod Halstead, Arno Klamminger, Sonja Koesling, Karsten Marhold, Crispin Möller, Margaret Pettit, Johannes Schleich, Albert Speer, Reha Tözün, Paul Vorster, Boris Wagner, Mark Walker, Bert Witkamp

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

Thinking Cities is published by H3B Media and Polis - ISSN 2054-9024

Thinking Cities is published by **H3B Media**, 15 Onslow Gardens, Wallington SM6 9QL, UK and **Polis**, rue du Trône 98, B-1050 Brussels, Belgium. This edition is distributed in Europe/RoW by Asendia and in the USA by Asendia USA, 17B S Middlesex Ave, Monroe NJ 08831. Periodicals postage paid New Brunswick, NJ and additional mailing offices. POSTMASTER: send address changes to Thinking Highways, 701C Ashland Ave, Folcroft PA 19032.

Printed in the UK by The Manson Group

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 thinkinghwys

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

Visit thinkinghighways.com for *Thinking Cities*' BPA Worldwide-audited sister titles, *Thinking Highways Europe/Rest of the World, Thinking Highways North America* and *Tolling Review*

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

- **Philadelphia, USA** – Deputy Mayor Rina Cutler is transforming her city into one of the smartest in North America, one step at a time

The City of Brotherly Love is getting smart in its old age

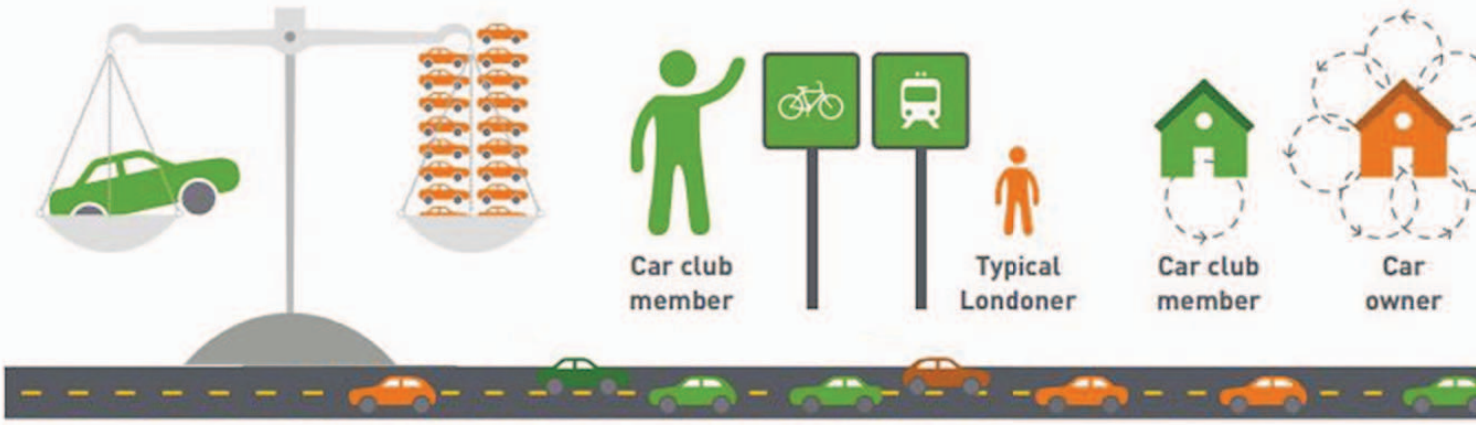
LONDON'S CAR CONUNDRUM

AIR QUALITY:
Road transport is a key producer of air pollution

REDUCED CARS OWNERSHIP:
Each car club car takes around
17 private cars off the road

TRAVEL SMARTER:
Members are nearly twice as likely to cycle or take the train
than other Londoners

GOOD FOR THE CITY:
Members drive less after joining
7 times fewer short trips than car owners



Car Lite London Video

2:30s

CONGESTION:
Congestion currently costs the London economy around
£4bn every year and is rising

PARKING PRESSURES:
On-street parked cars cover an area
the size of Southwark

INCREASING POPULATION:
London's population is set to grow by 14% in the next decade with the potential to add
350,000 more cars onto London's roads

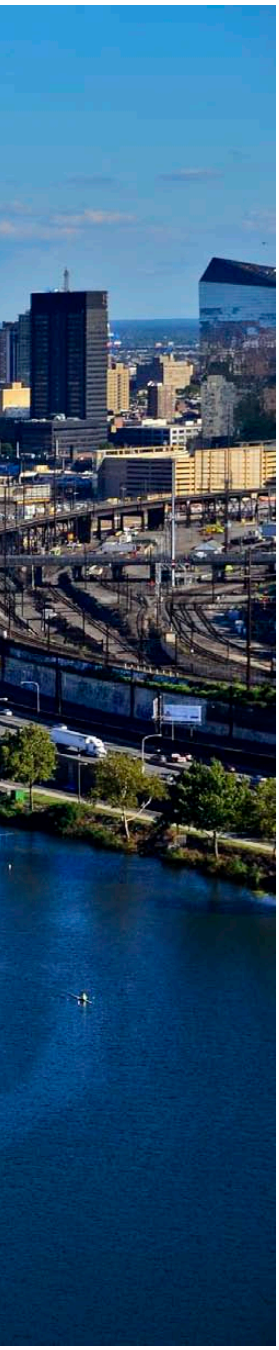
GOOD FOR CONSUMERS:
A typical car club member
saves £3,000 a year
compared to owning a car

GOOD FOR BUSINESS:
Croydon Council saved £500,000 by switching to Zipcar

CROYDON
www.croydon.gov.uk

Can we shift the modeshare and get drivers out of their cars and if so can we provide a viable alternative for multiple occupancy travel? How we can use technology to solve the capacity issue?

Rina Cutler



Rina Cutler's main two challenges as deputy mayor for Transportation in Philadelphia are funding and traffic congestion

Freedom to move

Sylvain Haon talks to **Rina Cutler**, Philadelphia's Deputy Mayor for Transportation, Energy and Utilities about the how the City of Brotherly Love is transforming itself into a smart city, step by step

Can you tell us a little about your role as Deputy Mayor for Transportation? What are you responsible for?

Philadelphia has a very unusual structure. The city has a deputy mayor in charge of transportation, energy, and utilities so underneath the umbrella of my responsibilities sits the airport, the water department and the streets department. I also sit on the board of the transit agency and the port authority and I get involved in a lot of the economic development activity in the city as they all have some impact on the transportation infrastructure system. The mayor created the deputy system as he wanted us to look at infrastructure in a very "global" way and it's why utilities and energy are kind of tucked into the transportation sector as well.

That's really interesting, as linking those potentially separate sectors is a very solid basis of a truly thinking city. So what are the main challenges in terms of transportation for a large US city? A lot of European cities would say congestion is their biggest challenge but is that the same for you in Philadelphia?

Actually, I would have congestion at number two. The first significant challenge we face, or I face, is funding. For some reason the United States, at both the Federal and State levels, decided that it doesn't have to pay for infrastructure. Somehow they believe that the taxes they pay should be sufficient to fund the infrastructure but it doesn't even come close. Funding is always going to be the primary issue and I think we are always trying to be creative in that respect. The State of Pennsylvania just passed its gas tax so that will supportive but it won't really get us to a place where we can implement great new projects and provide us with any significant new capacity.

In terms of congestion we're coming at it from the point of view that we just can't build ourselves out of it. There's not a lot of money to increase capacity, and while the driving public would probably love us to provide extra lanes to our highway and interstate system, the community is not that enamoured of that fact that most of our interstates come right through the city of Philadelphia so expanding them would mean taking out entire neighbourhoods as the community areas are right next to the road. There would be a huge number of homes and businesses that would need to be destroyed in order to make way for an expanded Interstate and this is just not going to be acceptable.

When we look at capacity issues in Philadelphia we look at two very distinct variables: can we shift the modeshare and get drivers out of their cars and if so can we provide a viable alternative for multiple occupancy travel; and the second is how we can use technology to solve the capacity issue. Both of those variables offer significant benefits but present significant challenges too.

You mention technology there. What kind of technology do you have in mind?

As you no doubt know, the research sector in the US is really looking at driverless cars. Twenty years ago this was nothing more than pie in the sky and nobody really believed it was going to happen and the idea of driverless cars just made everyone think of the Jetsons TV show where they drove around in these little personal spaceships. When it was first considered I think people thought that the technology was going to be in the ground, so that's where the R&D focus started. What would the sensors need to do in order to keep a safe distance between cars...now of course we know that the technology is going to be in the car and that's how it's proceeding. The technology will be built into new cars and there are many who are looking at automated vehicles as the way of the future. This is going to cause it's own set of issues.

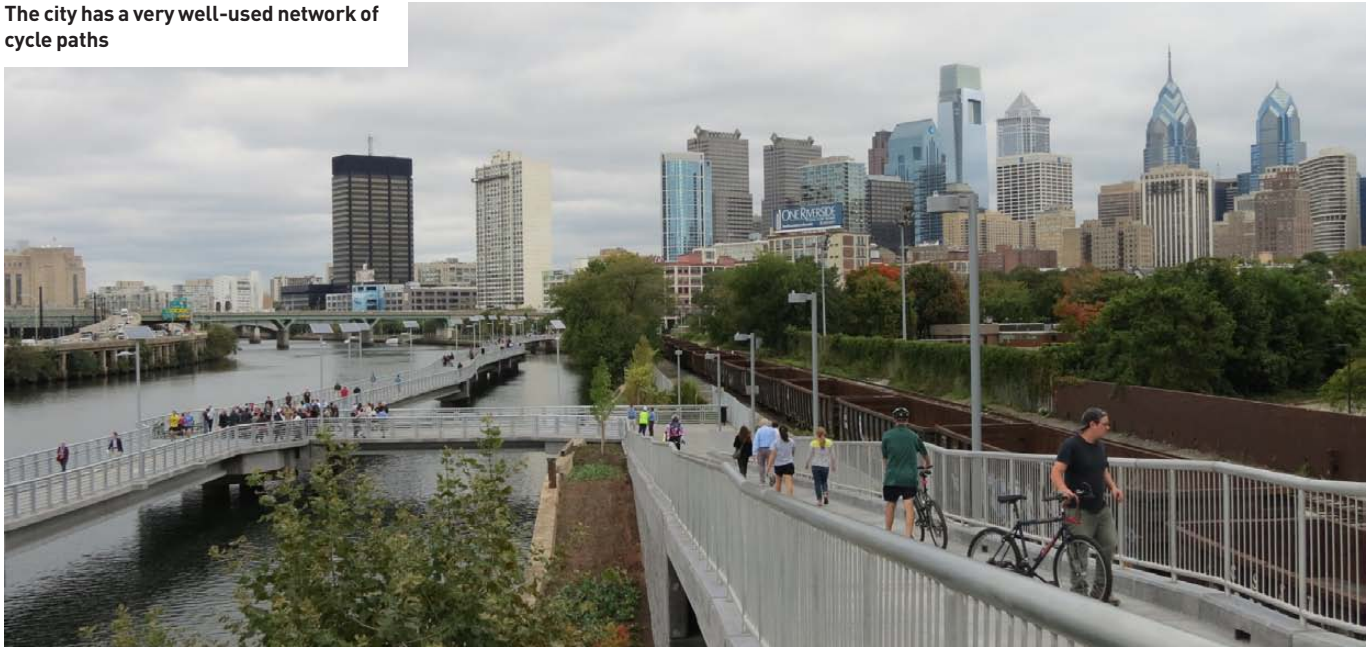
Do you think these developments could change your role as deputy mayor for transportation – and are you somewhat afraid of this?

Cities are far more likely to give thought to the issues of social justice, or injustice, than Federal Government. In terms of freight I think this kind of technological advancement can do amazing things in getting freight off the Interstate system

Well, no – I actually welcome anything that can help me manage traffic. I don't think I will be out of a job any time soon. For many decades people will be using regular automobiles so how it will work is that lanes that are currently for regular traffic or handle high occupancy vehicles (HOVs) will switch over to V2X lanes and the unmanaged lanes will still operate for what we can refer to as 'regular traffic'. It will take a long time for everyone to own a new-enough car in order to have access to this new technology. What is interesting is cost - I think this will create a social equity issue. Will this mean that only the rich will be able to afford an automated car and will the social justice question be answered? Cities are far more likely to give thought to the issues of social justice, or injustice, than Federal Government. In terms of freight I think this kind of technological advancement can do amazing things in getting freight off the Interstate system. The ability to coordinate freight with technology has huge promise. Of course we'd prefer a system where we can move trucks to their own managed lanes so it's all really interesting but will take several decades until we get to that point. Therefore what is most interesting is what interim solutions do we use in order to get to that point?

In Philadelphia we have just started a pilot project on a very dangerous road – it's curvy, it runs along the river, people drive far too fast on it and invariably end up in the river...it's not a great way for me to keep my job if people keep driving their cars into the water. If I have police officers out there doing enforcement then people will slow down but it's not the greatest use of that resource so we are trying a technology where we put sensors in the roadway and if you drive over those sensors at more than 10mph faster than the speed limit it turns the next traffic light red. We will stop you. And furthermore we decided to tell people it was there - we hoped that that way they wouldn't have to trigger the red light if they saw a sign and instinctively slowed down. The first thing we learned was that the technology couldn't be used in the morning or evening rush hours as people couldn't reach those speeds

The city has a very well-used network of cycle paths



"If you really want to drive into Philadelphia at 8am every weekday at least we have given you all the information you needed in order to make that choice"

even if they wanted to and it really messed up the synchronisation of the traffic signals so we pulled it off the rush hour and analysed a lot of data to show us where and at what time most violations occurred and where most accidents were happening. Funnily enough it was mainly in the overnight hours anyway so we've only been running the system around the middle of the day and at night and it's been interesting. Those kinds of easy, low-cost technology solutions to specific, localised problems are where cities' interests will ultimately lie.

Is automated driving really enough of a measure to address, if not solve, congestion though?
It's a solution but there needs to be many, many tools in the toolbox as we are just not ever going to have the capacity we need if everyone in Philadelphia decided that they were going to carry on using their car and more often than not drive by themselves during, in particular, our two rush hours. I have to admit that I'm pretty mobility-agnostic about how people move around – my concern is that they have options in order to do so. If you really do want to drive into Philadelphia at 8am on a weekday morning and you have been given all the information you need in order for you to know what's coming your way and that it's not really a good idea, then the best of luck to you. Truly. My job is to ensure if you do make that choice then you are going to be taking that choice while on the safest road possible but ostensibly it's about providing viable options to those people who are actually willing to leave their car at home and use other means of transportation in order to get to work or wherever it is they are going.

"It's about providing viable options to those people who are actually willing to leave their car at home and use other means of transportation in order to get to work or wherever it is they are going"

This means, in many cases, transit and rail and now I need to look at what I need to do in order to upgrade those systems. Some of the public transit options are of course sitting in the same traffic as the cars I just mentioned. For the traveller, or the commuter, it's the choice of do I drive in the privacy of my own car where I can make my own choices, listen to loud music if I want to, versus get on a bus and just sit in the same traffic. One of the options we are looking at is a transit priority system on high volume traffic corridors and we are doing a lot of pilot programs with the transit authority to figure out changes we can make in the system so we don't have four buses from different lines all showing up at the same stop at the same time so I can run an express service in certain corridors.

Also how can I shift people from one subway line to another if one is at full capacity and the other is at half…transit ridership figures have gone up every year for the past decade. If we deliver a great product we can shift more and more people towards the transit system without any requirement to actually do so. If we can move buses through the rush hour traffic a lot more quickly and efficiently than we can move cars, people will absolutely move over to taking public transit. I think there's a lot of focus on encouraging people to walk and cycle more and we have incentive strategies for that.

Do you see a good level of responsiveness from the people of Philadelphia towards taking public transit, walking and cycling?
Very much so actually, particularly on the bike commuting side. There has been a huge leap in the numbers of people cycling and this is before we set up the bikeshare program. Paris was the first city

to really implement that kind of scheme and we've looked at similar ones in most of the large and medium-sized cities in the world that run bikeshare programs to see the kind of things they do, what sort of scheme would work well for us as a large US city. Our bikeshare program goes live in the Spring of 2015 and we are now engaging with transit agencies to talk about "last mile" to get people to and from the transit stop by bike rather than driving. We are focused on making people think of their bicycle as a part of the transportation system and not a separate piece. The future looks really good in terms of the use of smart, connective technology to help us achieve our goals without having to build hugely expensive new infrastructure.

The bike scheme will invariably decrease transit numbers too, of course, but it's primarily targeted at people who will drive less than two or three miles on a daily basis. People tend to not realise that some of our bus and rail lines are at capacity so reducing that capacity is a very happy by-product of the bikeshare scheme. We start every conversation with the assumption that everyone is a pedestrian.

The concept of the smart city is very much about connecting different networks to provide greater efficiency, so does having such a varied portfolio of responsibilities as you have (transportation, energy, utilities) help you in your work? Or does it, in fact, not help at all?

No, it helps tremendously. There are people who work in their own silos who would have no idea that some of those connections even exist. As an example, the transit system has a traffic operations center and the city is building a traffic operations center and yet it didn't occur to either of them that they really needed to be able to communicate with one another. In an emergency situation they know they can talk to each other but on a day-to-day basis they didn't think to say "I need to see what you are looking at on your cameras and you need to see what I am looking at on mine." We are taking steps to ensure that every agency in the city who operates cameras, be it the police department who uses cameras to detect crime or the street department that uses cameras for traffic purposes or agencies who use cameras for transit applications, everyone can see what everyone else is looking at.

Those communications networks need to be able to come together. Another example is that the water department is conducting a groundbreaking program on green streets and storm water management so we are developing a new design guide for green

The Phlash is one example of Philadelphia's well-used public bus system

Intelligent Solutions for Traffic Surveillance

- **PoliScan*speed***
  Fixed and mobile LIDAR-based speed enforcement capturing up to 3 times as many incidents as conventional systems

- **PoliScan*seco***
  Next generation average speed enforcement

- **PoliScan*redlight***
  Red light enforcement without in-road equipment such as loops and sensors, can also be combined with speed enforcement

- **PoliScan*surveillance***
  Automated license plate recognition in flowing traffic

www.vitronic.com

VITRONIC
machine vision people

If we can move buses through the rush hour traffic a lot more quickly and efficiently than we can move cars, people will move over to taking public transit. There's a lot of focus on encouraging people to walk and cycle more and we have incentive strategies for that

Cars, buses, trucks, motorbikes and bicycles compete for roadspace with tourist trolleybuses

infrastructure so that brings in both my streets and parks departments as we are going to need to manage storm water every time we rebuild any of our infrastructure. The city owns most of the concrete! We need to manage the storm water with our own resources before it goes into the main waterways. When we build new playgrounds we will build them with porous concrete, and we've just built our first porous street which also helped a great deal with snow management and snow plow distribution as the moisture, in whatever form, gets pulled off the street far more quickly.

What about movement of goods in the city? This is where freight traffic interacts with local traffic – is this something you are working on too?

It is. We are trying to incentivise business to move their goods in during the early morning so they stay away from my rush hour! And we have created a lot of truck loading zones that take a good portion of car parking off the street and have created loading zones in certain time windows so we are trying to figure out what they need to do. If I can get you in and delivered then out again, I can get the next one in and delivered and out. Certain US cities, and New York City springs to mind, worked on programs where goods deliveries were restricted to certain time windows but it didn't prove to be entirely feasible, either politically or financially but it's an interesting question when you are looking at the connection between land use and transportation and you know in advance the kind of problems you are going to create for yourself. This is where having those responsibilities under one person is a really good thing. The transportation needs, the land use needs and the commercial needs are all pretty much tied in for me under my portfolio of responsibilities. I sit on the National Freight Committee for the Mayor and there is actually a lot of interest in both the infrastructure and funding sides as well as goods movement.

Cities such as ours, Chicago and New York that are at the nexus of several freight lines, are very focused on the smart movement of goods within their cities. We're finding that the freight and railroad sectors are coming to the table.

Basically though, it's all a question of balance. No one is going to get rid of cars and at least in my lifetime the bike population is not going to overtake the automobile population and everyone is a pedestrian at some point. My focus is getting everyone to move around Philadelphia safely and to get them home in one piece at the end of the day. To be a Thinking City you need the right combination of intelligent technology, the intelligent use of your existing technology and, crucially, the right leadership at the very top. The leadership needs the ability to look decades into the future and know what the city will need, from the State and Federal level, order to move in the right direction.

FYI

For more information about the city of Philadelphia and in particular the work of **Rina Cutler** and her Transoortation, Energy and Utilities department, visit **www.philadlphia.gov** and **www.discoverPHL.com**

email@philadelphia.gov

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

- **Sustainable transport** – does it have to be hydrogen versus electric?
- **Malta** – the impact of a National Electromobility Action Plan
- **Philadelphia, USA** – just how green can a city be?
- **Göteborg, Sweden** – the city that wants to get to know its cyclists

Malta has made the take-up of electric vehicles one of the key elements of its National Electromobility Action Plan

Conflict of interest

Bert Witkamp examines the pros and cons of hydrogen fuel cell vehicles and battery electric vehicles and wonders: are they foes or allies?

© Spongecake | Dreamstime.com

For the past few decades there has been something of a "war" between proponents of full cell electric vehicles and FCEV and battery electric vehicles (BEV).Both sides claim that they are the only option for the future and will be the "winner". Instead, both may become losers in this battle. For political decision makers, many of who will wait and see which technology will become the "winner" and this means that they are not committing themselves to any new technology. In this situation everyone is losing because it is clear that the transformation to electric driving will at worst not happen and at best be delayed without the political leadership and support from these self same decisionmakers.

We can argue that the first political drive to come to low or zero emission vehicles as a viable alternative for traditional combustion engine vehicles came from California about 20 years go. In 1990 the Low Emission Vehicle (LEV) was introduced in California with the aim to reduce emissions from mobile sources. The well-known Zero Emission Vehicle (ZEV) regulation was actually introduced as part of this LEV and went initially unnoticed.

ZEV required 2 per cent of vehicles sold to be zero emissions by 1998 and 10 per cent iby 2003. At the start, this could only mean electric vehicles as no other technology was available. Very strong lobbying from OEMs began when they realized California would not abandon the regulation and they started to understand the implications. They did not want to be forced to produce something for which there is no demand and wanted flexibility. In parallel, low emission targets were developed on the national level together with some OEMs like Hyundai, Ford and Honda, who wanted to participate but on the condition that in the zero emission vehicle mandate an extra option was introduced the over-compliance credits to compensate for the California EV requirements.

In terms of other zero emission alternatives, hydrogen is a special case, expectations were very mixed in the nineties and still are, with some policymakers from California Air Resource Board (CARB) going on record as saying that the promotion of hydrogen vehicles was a diversionary tactic whereas others believe in it as a long-term solution. Opinions at the academic level were somewhat mixed. If you want to change something you have to innovate yourselves but also get the environment to be enthusiastic and participating. The media played an important role in these tactics.

THAT WAS THEN...

This situation has actually not changed very much over the last 20 years. Hydrogen has not yet realized it's often "promised" zero emission

Within OEMs and suppliers the need to focus the often-scarce resources in one major issue that is impacting priorities

Is this really the start of a clean fuel war?

solution into reality for mobility, only dozens of demonstration hydrogen cars are on the roads. Battery operated vehicles have made nice inroads and we can now count them in the hundreds of thousands. But in reality of course, combustion engine vehicles using fossil fuels remains king and there are many forces at play trying to maintain the status quo.

So what next – a clean fuel war? In the press and other media, the next "war of clean fuels" is already being announced with some of the large OEMs supposedly have made final technology choices of battery electric versus hydrogen. Some like to divide the OEMs into three camps: hydrogen (Toyota, Honda, Hyundai); electric (BMW, Nissan, GM) or "not yet decided" (everyone else). However, the reality is a lot more complex and most OEMs are following all development closely and deciding on their strategic options per fuel, leading, following, partnerships or wait and see on a case-by-case basis.

So although one can observe that nothing has changed very much over the past two decades, the technology choice is still not being made, the costs are still too high and the infrastructure problem is still not solved. In reality, the status in 2014 has evolved dramatically.

Both hydrogen concept cars and battery electric cars have demonstrated that nice looking and fully functioning cars can be built - in other words, cars that people like to buy! Tesla is an excellent example of a car manufacturer that is showing that electric cars can be attractive, high performance and possessing a range that is more than enough to convince many people who were previously driving large BMWs, Audis and other prestige makes and models to make the switch to full electric. Tesla has proven wrong many critics who have been advocating that electric cars are maybe a solution for small, city vehicles but surely not to compete with "real" cars. The Model S is a very palatable answer to a potentially difficult question.

A PHONEY WAR?

So, will there be a war between hydrogen and electric cars? If we want to believe some of the media the war has already started, however the real question is whether a choice between the two technologies really has to be made. What are the potential reasons for a war? Competing for public resources and subsidies to do research and development into building charging infrastructures is one reason. Within OEMs and suppliers the need to focus the often-scarce resources in another issue impacting priorities. A more sinister reason is that lobbyists trying to maintain the dominance of the combustion engine as power source proclaim that as the technology choices are not yet being

made it is not wise to make any decision about which one to support. In other words, it is best not to do anything yet, maintain the status quo and wait and see how the technologies develop.

That OEMs and other private stakeholders have specific interests in one technology or another, or even wanting to maintain the status quo is of course a very understandable and part of our market economy. However, from a societal point of view clear choices have been made in many countries and regions that we want to move to a different society. Part of this is the shift towards clean fuels for transport.

And what about the costs? As discussed earlier, alternative fuel cars have already shown that they can be high performing and attractive for consumers, in Norway for example it is now evident that on an equal cost basis, consumers are moving towards electric cars that now have a market share of more than 20 per cent for new car sales. There is now a very wide consensus among experts and industry that around 2030 all technologies for cars will converge and be in the same ballpark; therefore in terms of direct costs for the consumer clean fuel cars will become a cost neutral option. But already today, taking into account incentives and individual situations electric cars can already be cost competitive.

CLEAN GETAWAY

Clean fuel has now become a driver in many countries (in the US in California in particular as a drive for cleaner air and in the EU as a drive for a low CO_2 society) seeking benefits in several areas at the same time. Yes, it reduces CO_2 emissions and it does make our air clean from fine particles, NO_x, CO_2 and many other components for which evidence is growing that the actual impact on our health and wellbeing is much greater

Is it really this simple? A straight choice between Hydrogen, fossil fuel and electricity?

PTV GROUP

the mind of movement

HOW MUCH DETAIL DOES A GREAT PLAN NEED TO KNOW?

The city of the future will create sustainable mobility. Here you feel the pulse of daily life – and traffic. The products of the PTV Vision Traffic Suite enable you to plan traffic and transport seamlessly – from entire networks to individual intersections.

Stay up-to-date with PTV Vision Traffic News: ptv.to/visionnews

PTV Vision Traffic Suite consists of the products:

- PTV Visum for transport planning
- PTV Vistro for traffic engineering
- PTV Vissim for traffic simulation
- PTV Viswalk for pedestrian simulation

vision-traffic.ptvgroup.com

than thought initially and which is costing society hundreds of billions of euros per year. But clean fuel is also providing many developed and developing countries an important means towards independence from fossil fuel imports. The EU alone is importing €1 billion per day of fossil fuels, money which is not staying in the local economy providing a source of investments and jobs. In addition, it also threatens political independence and democratic values as we now see in the Ukrainian crisis.

From a high level point of view, the political will to make the change towards clean fuel-driven transport is there but uncertainty about technologies, conflicting views on what to support or to choose are actually delaying the transition. As such the "fuel cell versus batteries war" is mainly serving interests who do not want to see changes happen.

What are the differences between hydrogen and battery electric cars? Let us first look at what are actually the common elements of the two technologies. From a technology point of view, both technologies have an electric drive train with high efficiency and silent electric motors. Both have a battery on board to provide the electricity to power the motor and to capture braking energy. Both emit zero harmful components, hydrogen cars emitting water (vapour) and BEVs no emission at all. Interestingly, the lightweight ultra-strong material carbon fibre is of high interest both for hydrogen storage tanks as well as BEVs, for which light weight is essential to reduce the battery size. The structural difference is limited to the question of where the electricity comes from to drive the car. Hydrogen cars carry compressed hydrogen in a carbon fibre tank and oxygen from the ambient air which is converted into electricity and water in a fuel cell. The main advantages being promoted are the range of the car and the rapid fuelling time, with the major drawbacks being the hydrogen currently being made out of fossil fuels. BEVs have stored electricity in the large battery that needs to be charged through the grid. The main advantages are the high-energy efficiency, while the main drawback is the limited range and longer charging times. As mentioned before, costs for both technologies is not yet at a competitive level and the infrastructure is not yet at an adequate level.

The EU alone is importing €1 billion per day of fossil fuels, money which is not staying in the local economy providing a source of investments and jobs

THE HYDROGEN ECONOMY

A discussion is often held in the context of looking at competing clean fuel car technologies as if this is an isolated environment that can be optimised as such. On the contrary, it becomes now evident that both from a cost point of view as well as a technology point of view we have to take a much more holistic approach in order to compare apples with apples. Firstly most technology comparisons exclude externalized costs related to: health and environment caused by car emissions; climate change; the economic and political costs related to the fossil fuel dependence; and the current societal costs related to the fossil fuel infrastructure. Next, cars are only part of our transport structure and we need to look at other forms of transport as well as heavy duty trucks and buses which are responsible for a large part of the problems and generated societal costs.

The hydrogen economy has often been hailed as the solution of all our energy problems, but this has not materialised. However, it may very well be that hydrogen can play an important role in the future. Utilities that are at this moment building wind and solar energy are now starting to think: "how can we balance this?" This is where hydrogen could come in as storage medium.

Urgency begins to build up. Within the European Commission they have organised a Strategic Energy Technology Plan (SET-Plan) with several different initiatives (wind, solar, nuclear, fuel cells, carbon capture and storage, smart grids, smart cities). These were initially independent initiatives but now they are starting to consider how should all these separate elements work together as it does not make sense to keep these independent initiatives. In this context, the Joint Research Undertaking Hydrogen (JRUH) in the EU aims for much more than "simply" putting hydrogen vehicles on the road. JRUH is a public private partnership supporting research, technological development and demonstration activities in fuel cell and hydrogen energy technologies in Europe. The three members of the FCH JU are the European Commission, fuel cell and hydrogen industries represented by the NEW Industry Grouping (New-IG) and the research community represented by Research Grouping N.ERGHY.Hydrogen.

Renewable energy (REN) is becoming mainstream, 56 per cent of new installed power capacity globally was

It's not just electric private cars that are seeing a notable upswing in uptake

Photo: Kevin Borras

renewable energy in 2013, and in the EU this was 73 per cent (source: UNEP). REN is now providing 20 per cent of global power needs of which half from modern technologies. In Germany in the first quarter of 2014, 27 per cent of the electricity produced was from REN and a record peak production of 74 per cent was recorded on 11 May. Although REN generation provides possibilities to manage demand and supply changes, it is clear that storage of REN is needed in the future as more REN is produced. Storage to manage grid fluctuations and short term may be provided by batteries but for longer periods and seasonal effects energy carriers will be needed.

This is exactly one of the main objectives of the EU Joint Hydrogen Undertaking project and pilot projects to prove the feasibility of power-to-gas at MW scale are ongoing making Europe the leader in this area. For HFEV to become a long term success, clean hydrogen is a must. This in combination with the role hydrogen might play in providing an energy carrier for REN power generation a win-win situation might develop. Of course hydrogen fuel cells may also provide other stationary power solutions in the future.

HYDROGEN, FUEL CELLS AND BATTERIES FOR TRANSPORT

As discussed earlier, the transfer to a sustainable zero emission solution for cars is, from a technological point of view, a transition to electric driving as no other technological solutions are available at this point in time, nor is anything foreseen to be developed in the near future.

The focus of the article has been on the developments for cars, but heavy-duty freight vehicles, buses and other (off-road) vehicles are almost as big in terms of fuel need and emissions. Of course shipping and aviation are consuming significant amounts of fuel and emitting substantial amounts of harmful substances as well. Therefore, a transition to a real sustainable and zero emission solution is needed for these forms of transport as well.

With consensus building up that electrification of road transport will be at least a major part of the solution towards sustainable transport it is key to support the different technological solutions to get there. Although currently the contribution of both BEV and FCEV in reducing fossil fuel consumption is virtually zero, we are now entering a phase whereby the technologies are getting mature for BEV's and in commercialisation phase for FCEV. With the zero emission technologies becoming more mature, cars that are acceptable for consumers start appearing on the road and while this will take

A transition to a real sustainable and zero emission solution is needed for shipping and aviation as well as these sectors are consuming significant amounts of fuel and emitting substantial amounts of harmful substances

several car generations to really materialize, the development from supply and demand point of view is set in motion and in this phase the role of our political decision makers is crucial in providing the incentives to overcome the problems in terms of deployment including the realisation of new charging and fuelling infrastructures.

For BEV, charging can take place at different speeds, at home typically a standard (overnight) charging is sufficient and no or only small adaptations are required. In practice for BEVs most charging takes place at home or at the workplace and a fast charging network is installed in order to assure that BEVs do not get stranded somewhere and can cover large distances. The installation of fast chargers at for instance at 10 per cent of all 200,000 EU gasoline stations would cover virtually all roads in Europe at an estimated cost in the region of €300m–500m. In time we will probably see this changing into a wireless charging infrastructure offering an easier charging option. Tesla is not even waiting and has put up its own supercharging infrastructure in the US and certain parts of the EU and is now starting in Asia. In April 2014 Tesla opened its 100th supercharging station.

In the EU, the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) proposes for transport to realize large scale hydrogen for fuel pilot in one country by installing 100 stations by 2015 and 1000 by 2020 while putting 500,000 FCEVs on the road.

While the costs for filling stations is estimated at around €1m per station, this would be a €100m cost for the first phase, a limited amount looking at what is at stake. California is already implementing a hydrogen filling station network so perhaps we can state that the infrastructure issue is an issue which is no longer the major hurdle it was thought to be before.

Nobody can foresee which technology will ultimately be most successful in which area but most likely both BEVs and FCEVs will find areas where they can each contribute substantially to the realization of zero emission and silent transport. Although I personally believe that for road transport of people battery-powered vehicles will become the mainstream solution, I also believe that truly clean hydrogen can become an important building block towards the zero-emission transport and energy world for example in storage of energy and providing a solution for heavy duty freight transport on roads or perhaps water and air as well. Regulators and politicians should be challenged to make the mind-set change that it is the combination and synergy of the battery and hydrogen (fuel cell) technologies will reinforce each other when well exploited. Looking at road transport, BEVs and FCEV's have far more points from a technology point of view but also both providing a zero emission, low noise in city environment and potentially fossil fuel-free transport solution which we need urgently.

It becomes now evident that both from a cost point of view as well as a technology point of view we have to take a much more holistic approach in order to compare apples with apples

FYI

Bert Witkamp is Secretary General of AVERE, the European Association for Battery, Hybrid and Fuell Cell Electric Vehicles. AVERE is Thinking Cities' partner on the topic of electromobility.

info@avere.org
bert.witkamp2@gmail.com

WINNER OF THE
ERTICO 2014 HALL OF FAME AWARD
IN THE CATEGORY “INDUSTRY“

swarco

THINKING ABOUT SUSTAINABLE TRAFFIC MANAGEMENT AND ROAD SAFETY SOLUTIONS?

TALK TO US FIRST …

… if you need a competent partner for environmentally sound products, systems and solutions to keep traffic in motion in a connected transport world.

SEE US AT TRANSPOQUIP 2014
28-30 OCT 2014
EXPO CENTER NORTE
SÃO PAULO, BRAZIL
BOOTH #1431

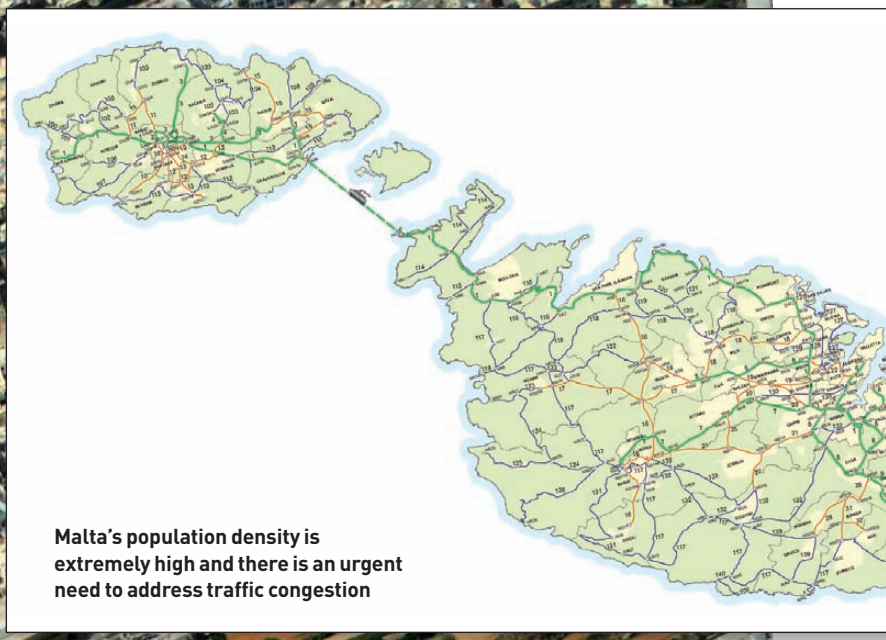
TRUST IN SWARCO …

- with its almost five decades of experience in the industry;
- with its worldwide production sites and sales network;
- with its competence centres for I.T.S., software development, and road marking technology;
- with its energy-saving LED-based products and systems in signalling and lighting;
- with its friendly and service-minded staff.

SWARCO I First in Traffic Solutions.

IRF PROUD MEMBER

SWARCO AG, Blattenwaldweg 8, A-6112 Wattens, Austria, T. +43-5224-58770, F. +43-5224-56070, E. office.ag@swarco.com, www.swarco.com



Malta's population density is extremely high and there is an urgent need to address traffic congestion

Electric island

Peter Paul Barbara examines why Malta's far-reaching National Electromobility Action Plan has created so much interest

Malta's National ITS Coordinator Peter Paul Barbara

Being such a small island, we are convinced that due to the short distances travelled in Malta, electric propulsion gives us the right solution to address most the environmental targets that need to be achieved

Malta has recently published an extremely comprehensive and highly detailed National Electromobility Action Plan. The formulation of the 76-page report was driven by a number of contributary factors. Among these factors are, notably:

- To address the need to improve national air quality levels;
- To address Malta's national Climate Change and Energy 2020 targets;
- To prepare Malta for the new propulsion technologies being introduced on the market;
- To lay down the necessary infrastructure and support that such technologies entail to make them successful;
- To make people aware of the new technology on the market;
- To assist in the market entry of the new technology;
- To try and achieve carbon neutral transportation;
- To address traffic-generated noise pollution;
- To start an education campaign and change in driving behaviour and journey planning.

Being such a small island, we are convinced that due to the short distances travelled in Malta, electric propulsion gives us the right solution to address most of Malta's environmental targets that need to be achieved both in the short and medium term. It is to be noted that the Maltese archipelago consists of two main islands, Malta and the smaller island of Gozo whose economy is predominantly agriculture-based. Both islands have their own economic branding, Smart Malta and ECO-Gozo. The Smart Malta brands come from the high level of Internet connectivity and extensive e-government services, (one of the highest in Europe) and from the fact that Malta is hosting a smart city based on the models of the Dubai Internet City and the Dubai Media City. On the other hand the ECO-Gozo Brand comes from Government Policy to conserve the unique characteristics of Gozo and sees it as an opportunity to make it an Ecologically Smart Island.

THE LAY OF THE LAND

The size of Malta, and the short distances between its major conurbations, Valletta, Sliema and Rabat mean that battery "range anxiety", often cited as a major sticking point in the take-up of electric vehicles across Europe, is entirely eliminated from the equation so the only hurdle remaining is the high price that one needs to fork out to purchase an electric vehicle.

With the current financial and economic situation as it is, the high cost of the vehicle will not help much in this regard. The Maltese Government is trying to address this issue by providing financial grants (which are available on first-come first served basis) for the purchase of Battery Electric Vehicles as well as Battery Electric Quadricycles which can go up to €5000.

Besides the number of grants available for the purchase of Electric Vehicles, there are other incentives available including a very low annual circulation tax of €10 per year which is negligible when one compares it to the hefty ICE propelled vehicles Annual Circulation tax which at times can even go up to over €1000 on certain vehicle models. In addition, even the registration tax of a Battery Electric Vehicle is considerably lower

Government is in the process of forming partnerships with the private sector to assist in market penetration for EVs

when compared to ICE vehicles. The Maltese registration tax, which is applicable for registering new and second hand vehicles put on Maltese roads is made up of a number of factors such as vehicle age, carbon emissions and length, the latter regarded as the congestion element. It is the latter segment of the tax that is only applied for Electric Vehicles. In addition for the short term, the Government is also considering other means of how to incentivise the purchase of electric vehicles in Malta.

Besides these measures, the Ministry for Transport and Infrastructure together with Transport Malta have started the implementation of a very ambitious programme for the deployment of Malta's National Electric Vehicle Charging Infrastructure which is being installed in a phased manner over a period of six years until a total of 500 charging units are installed nationwide. The composition of the national network will be made of both very fast charging stations as well as medium charging stations. This is part of the Malta National Electromobility Action Plan (MNEAP) that was published by Government in December 2013.

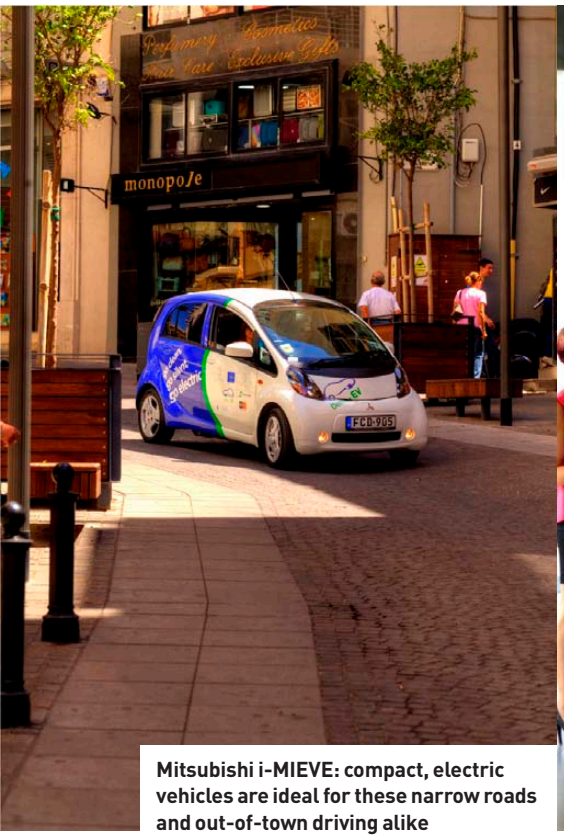
To implement this ambitious programme, the Ministry for Transport and Infrastructure together with Transport Malta has set up the Malta National Electromobility Platform (MNEP) of which I am its National Coordinator. The MNEP is chaired by the Minister for Transport, Hon Joe Mizzi himself, a strong signal by Government to show its commitment towards Electromobility in Malta. The main stakeholders of the platform are the Ministry and the Transport Authority being represented by the Permanent Secretary of the Ministry, Mr Joseph Callus and the Executive Chairman of the Transport Authority, Mr James Piscopo.

The MNEP is the largest stakeholder transport forum to be set up on the island, where each possible stakeholder is represented in the Stakeholder forum, forming part of the National Platform. These range from other Government Ministries such as the Ministry for Energy and the Ministry for the Environment, Sustainable Development and Climate Change, Public Authorities, Energy Service Providers and Transport Operators, Car Importers, Social Partners as well as Research and Vocational Institutions.

ISLAND STATE OF THE ART

The main scope of the MNEP however remains the implementation of the MNEAP that is made up of more than 22 concrete projects to be implemented over the coming six years.

These projects include lighthouse and demonstration projects as well as the deployment of the latest



Mitsubishi i-MIEVE: compact, electric vehicles are ideal for these narrow roads and out-of-town driving alike

Part of the PORT PVEV Project: new BMWi3 at Muscat's showroom

technologies as they emerge on the market. In addition the MNEP is also promoting Malta as a test-bed for new technologies to be tested at the concept stage due to the fact that besides being regarded as a normal country, Malta also considers itself to be a city in some respects, with the difference that it is a country with a specific topography, climate and particular urban design not usually common in most cities.

Considering the very short distances travelled in Malta, the BEV charging infrastructure is being deployed mainly to provide electric car charging facilities for those owners who do not have their own garage or parking spaces at night, but would still want to avail themselves from the use of an electric vehicle as well as for emergency charging.

The car-charging infrastructure being referred to above will be deployed in a phased manner so as to enable us to have the very latest technology as it is available for the market. The phased deployment is also being done in this way to see how the Electric Vehicle market will develop and new in-vehicle technologies which would be put on the market.

Considering the fact that this drive for Electromobility is in its infancy, it is still an aggressive approach and the Government is also working to encourage the automotive industry to make the cars available in Malta as well. It is for this reason that Government is in the process of forming partnerships with the private sector to assist in market penetration for those companies who are willing to assist the Government in the implementation of its electromobility policy.

In addition the Government is also in the process of starting the deployment of a number of solar car charging stations or car ports, with the capability of energy storage in batteries, grid connection as well as charging capabilities. Hopefully this will contribute towards Malta renewable energy targets, especially the 10 per cent RES target for transport fuels by 2020.

Both Transport Malta and the Ministry for Transport and Infrastructure are currently implementing two important demonstration projects funded through EU funds, namely the DEMO-EV Project funded under the Life+ Action Programme and the PORT-PVEV project funded under the Italy-Malta Cross-Border Cooperation Programme.

INTEGRATING ITS AND ELECTROMOBILITY

The integration of ITS with Battery Electric Vehicles and its respective infrastructure is a priority as future vehicles and infrastructure will have the driver at the centre of the city ecosystem; the idea of the

CONNECTED CITY, with the difference that in Malta's case it would be a CONNECTED COUNTRY.

This is where we want to go and what we want to achieve. This has become a major priority for the Government and the Malta National Electromobility Platform in its work to fuse both ends of the equation.

We sought to include both areas under one platform because of the synergies that exists between Electromobility and Intelligent Transport Systems. This include the relationship between the car of tomorrow and ITS in general. It is evident where technology is heading.

The core relationship between the two, through the use of Information and Communication Technologies, software applications and in-car built-in sensors in-between the cars themselves and transport infrastructure is already with us and in the near future, this will continue to expand into complex ecosystems.

Future developments in core communications in these relationships as defined in ITS, that is direct communications V2V, V2I and I2V is set to take major leaps forward, as the car will become more dependent on ITS and more intertwined with the infrastructure. One must not forget to mention the human interface in this relationship, where the user, being a driver or a commuter, is in the centre of this complex ecosystem.

For the normal average user, a full charge covering 140km of road is more than enough while for a heavy user such coverage should be enough to cover a day's work. The latest BEVs put on the market such as the BMW i3 can also cover up to 190km on a single charge.

We intend to be the first country to have a fully fledged national car-charging network that would cater for consumer demand. Besides a planned phased deployment strategy, Government will also provide such infrastructure to meet future demands if this arises, in places and areas where there might not be enough car charging infrastructure coverage.

Charging infrastructure is being installed over a period of six years – 500 charging units will be installed nationwide

CONTRAST AND COMPARE

In my position as National Coordinator for Malta's National Electromobility Platform and Intelligent Transport Systems at Transport Malta, I was recently interviewed for an article in *Thinking Cities*' sister title *Thinking Highways* about out equally thorough ITS Implementation Plan. I was asked if there was any other island state that could benefit from Malta's level of enthusiasm towards electric vehicles and one of the suggested countries was Cyprus.

Being small islands, one may think that both Malta and Cyprus have similar challenges, which is not the case as Cyprus doesn't have the same land restrictions as Malta does, as Cyprus is far larger.

Similarly however, accessibility to both islands is via seaports and airports and hence one can argue that they have some restrictions especially with respect to accessibility to the European mainland and European markets. Similar challenges do exist with seasonal influx of tourism especially during the months of Summer where in Cyprus in the months of summer this exceeds 3m tourists while in Malta this exceeds 1m tourists per year.

Cyprus, like Malta, is working a lot to give ITS the necessary push and extend ITS beyond their main cities and urban cores such as Nicosia. I believe that due to their specific situations, both Malta and Cyprus would be rapidly taking up ITS in the near future, much more rapidly than at present once the necessary ITS building blocks are put in place in each respective country. With respect to Electromobility in Cyprus, I am not that informed as to how much the electric car charging infrastructure is beimng developed, however according to the Second National Energy Efficiency Action Plan of Cyprus, Electromobility features high on the agenda.

Malta may be a small country in terms of land mass, but there's no question that we think big.

FYI

Peter Paul Barbara is National Electromobility and ITS Coordinator, Transport Malta

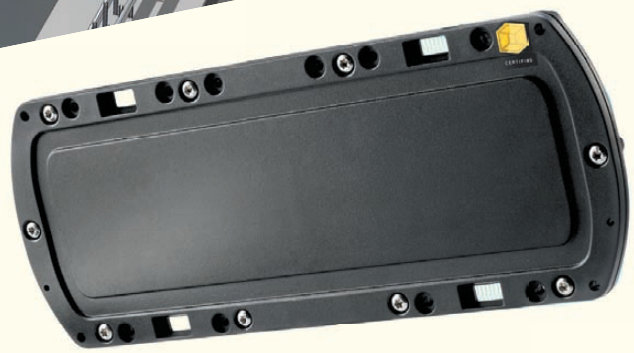
peter.p.barbara@transport.gov.mt

www.transport.gov.mt

AGD®

HIGHWAY MONITORING & INCIDENT DETECTION

AGD CERTIFIED
INTELLIGENT DETECTION SYSTEM



HIGHWAYS

RADAR TRAFFIC DETECTORS

AGD
INTELLIGENT DETECTION SYSTEMS

AGD CERTIFIED
INTELLIGENT DETECTION SYSTEM

ENFORCEMENT TRAFFIC CONTROL LIGHTING CONTROL STRATEGIC DETECTION

AGD Systems Limited
White Lion House, Gloucester Road
Staverton, Cheltenham
Gloucestershire, GL51 0TF, UK

T: +44 (0)1452 854212
E: sales@agd-systems.com
W: agd-systems.com

THE QUEEN'S AWARDS FOR ENTERPRISE: INNOVATION 2011

Philadelphia was the first US city to participate in an Urban Infrastructure Initiative project

Green and clean

The sustainable city is a key part of tomorrow's world – and if municipalities and companies join forces, the vision of the "green city" can become reality sooner rather than later. How this can be achieved is revealed by the Urban Infrastructure Initiative, a project group of the World Business Council for Sustainable Development in its current report on Philadelphia, as **Eberhard Buhl** explains

Policymakers of the world's major cities and metropolitan regions have been in agreement for some time that new solutions are needed: in just a few years two-thirds of the global population is expected to be living in urban settlements, as more and more migrants stream into the cities where they wish to work and live. Can the existing infrastructure be modified so that it is not only affordable but that it also benefits citizens, conserves resources and contributes to the city's sustainability?

The city has over 1.5 million residents and 680,000 jobs, and almost 40 per cent of these employees work in the city centre

This question is tackled by the Urban Infrastructure Initiative (UII) of the World Business Council for Sustainable Development (WBCSD), where experts from Siemens and 13 other leading high-tech companies from the fields of energy, construction, materials, transport, engineering, water, equipment and services work together. The UII experts support cities on their journey toward greater sustainability and work closely with the municipal decision makers and professionals to develop realistic, workable and affordable solutions.

IDEAL CONDITIONS FOR GREATER SUSTAINABILITY

The first North American city to participate in a UII project was Philadelphia. Companies and municipal representatives conducted numerous surveys and workshops to analyze the initial situation. Then, under the guidance of Siemens, the UII team developed a series of strategies and documented its recommendations in a comprehensive report. Philadelphia lies halfway between New York and Baltimore, and it is the largest city in the state of Pennsylvania. The city has over 1.5 million residents and 680,000 jobs, and almost 40 per cent of these employees work in the city centre.

Michael Anthony Nutter, who has been mayor of Philadelphia since 2008, is considered a leader in urban sustainability and has set the objective of making Philadelphia the "greenest city in America." Nutter aims to make this idea reality through his ambitious Greenworks Philadelphia action plan. Targets have been set in the areas of energy, environment, equity, economy and engagement, and projects have been initiated that will run into 2015. The first successes can already be seen: so far the residents have already reduced their car usage by 10 per cent; energy consumption has fallen steadily and alternative energy use has risen four years in a row to around 14 per cent. Yet there is still potential for further optimization, as the UII project clearly revealed.

The focus of the project is to help with urban sustainability, transport, mobility, financing and profitability

BUSINESSES AND URBAN DEVELOPMENT

It is not a new realization that the private sector can play an important role in urban development. On the one hand, companies require functioning infrastructure to operate successfully, and on the other hand they can develop innovative ideas and offer practical solutions. The municipal planners in Philadelphia also saw this as a benefit. In workshops and roundtables with decision makers and technical experts from the municipality, and in field studies and site visits, the UII team analyzed the requirements and possibilities and looked for innovative solutions. This resulted in a complex catalog of measures with a focus on urban sustainability, transport, mobility, financing and profitability with the aim of heightening the impact of existing sustainability projects in the city.

THE ECODISTRICT AS A MODEL

Philadelphia had already initiated Greenworks Philadelphia and similar

sustainability projects. The UII analysts therefore suggested creating a geographically limited EcoDistrict where projects for energy saving, sharing and financing models or sustainable mobility solutions could be showcased. Here the interlinking of municipal and entrepreneurial initiative, responsibility and financing takes place on a neighborhood scale – functional, clear and suitable as a model for other, larger projects.

MOBILITY: TECHNOLOGY APPLIED SYSTEMATICALLY

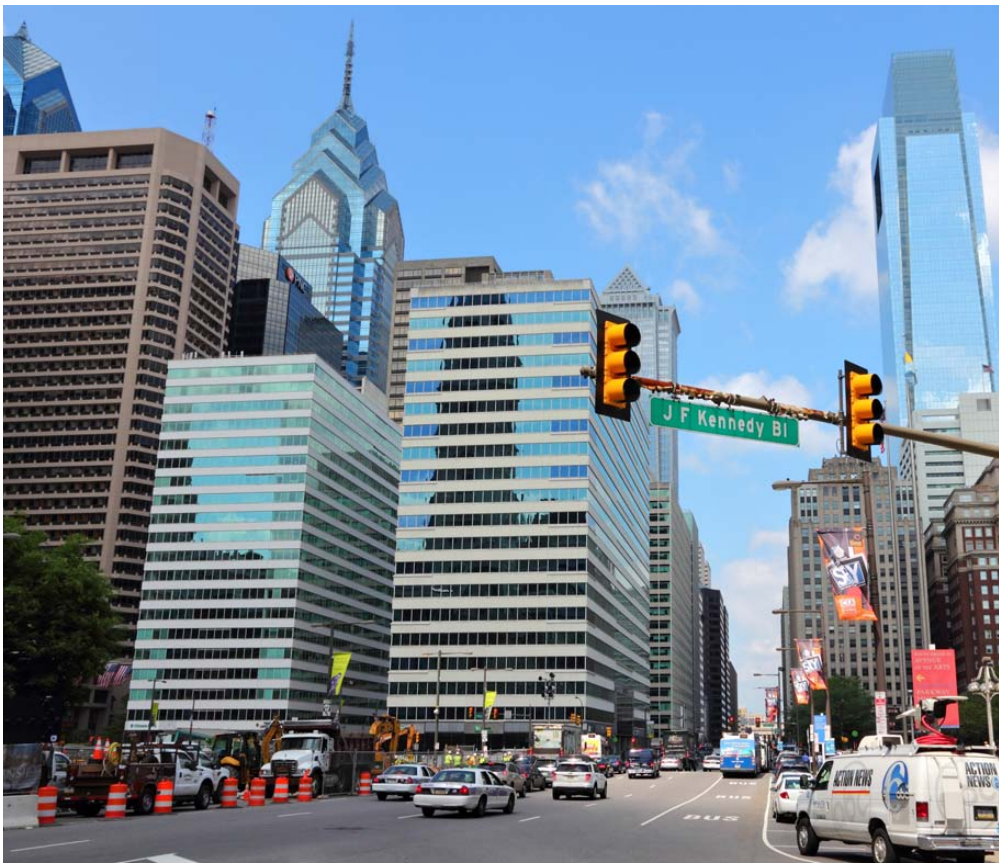
When it comes to mobility, Philadelphia is already in good shape. The public transport network operated by the Southeastern Pennsylvania Transportation Authority (SEPTA) includes subway, streetcar and trolleybus lines.

It is one of the largest public transport networks in the United States, with 9,000 employees and serving a region with almost four million residents. Nevertheless, the UII team anticipates that private vehicles will continue to play a crucial role in the mobility mix for the foreseeable future.

If Philadelphia wants to be prepared for the challenges of the 21st century, its transport systems have to be convenient, reliable, barrier-free and linked to one another. The goal is therefore to bring about integrated mobility systems with innovative technology and new business models: people should be able to travel smoothly around the city with buses and trains, car sharing, neighborhood cars, multimodal route planning and charging infrastructure for electric cars.

SMARTER ROUTING: INTELLIGENT TRAFFIC CONTROL SYSTEMS

To improve the performance of the existing transport infrastructure in a single step using intelligent traffic routing and control systems, the UII team developed the concept of



If Philadelphia wants to be prepared for the challenges of the 21st century, its transport systems have to be convenient, reliable, barrier-free and linked to one another

Integrated Corridor Management (ICM): whereas conventional traffic control systems change the traffic light phases depending on the time or the day of the week, in the ICM concept factors such as high traffic volume, accidents, events and weather conditions are analyzed in real time.

This data is incorporated in smarter control systems that can change green phases or show alternative routes at short notice, thus optimizing the flow of traffic within the city. The new operation control center is already under construction. It will control hundreds of smarter traffic signals on highly frequented traffic arteries in the city itself and the surrounding area to keep traffic moving steadily. On the particularly busy Roosevelt Boulevard, fast buses are to be allocated their own lane. Such Bus Rapid Transit (BRT) systems have proven themselves in many major cities worldwide that are growing rapidly and require a quick solution for low-cost, high-capacity mass transit.

Philadelphia needs its transport systems to be fully interoperable

Will the city achieve its ambitious goal of becoming the greenest in the US?

- The separate bus lanes can be deployed on existing roads – wherever they are required.
- BRT systems can be set up far more quickly than subways, for example, and can simply be adjusted when transport requirements change.
- The technology and equipment are more readily available and easier to maintain than complex metro systems which makes them highly economical to run. Partners for PPP financing models are also readily available.

Nevertheless, private cars continue to play a role. In most city centers around one-third of the traffic volume comes about through people looking for parking spaces, so it quickly becomes clear that this search needs to be made easier in the future. Technically these days it is no problem to combine intelligent parking space detection (infrastructure-to-vehicle communication) and user-friendly smartphone apps, ideally free of charge. Add to this dynamic parking fees, which alter according to their position and the traffic conditions, and you have a solution that could permanently alleviate Philadelphia's traffic situation.

ONE FOR ALL: INTEGRATED MOBILITY PLATFORM

A common information structure for all these measures can make getting around in Philadelphia a pleasurable experience. Using the Internet and smartphones, users can conveniently look up timetables, multimodal journeys and route recommendations, book bicycles for rent, reserve parking spaces for electric vehicles – and pay right away using a mobility ticket. The technology has proven itself over several years and, as numerous projects in Germany and the rest of Europe show, people are happy to use it. The municipal planners realized they had an excellent chance to improve sustainability by operating the city's vehicle fleet in a more environmentally friendly manner. At the time of the study the municipal fleet comprised over 6,000 vehicles of very different types: ambulances, police patrol cars, waste disposal and fire trucks, snowploughs, motorbikes and passenger cars. The UII team therefore looked for solutions that would simultaneously increase the performance, economic efficiency and sustainability of the fleet.

These criteria led them to a vehicle management software system that allows the city to keep an eye on all cost-relevant data such as mileage, consumption, insurance, repair costs and downtimes per vehicle. This data can be used in a life-cycle analysis, and it gives an indication of whether the fleet can be further reduced and how Philadelphia is performing in relation to other cities. An appropriate telematics solution is useful here: not only does it relay vehicle and location data, it also provides a basis for route optimization, driver training, more precise profitability studies and more. It is also clear that networking these various software applications can ensure the desired optimization effect.

The conclusion: if Philadelphia implements all the recommended measures, it will make a major step on the way to becoming "the greenest city in America." And although the UII study had very favorable conditions to work with in this case, the concept of municipal and private planners collaborating on solutions can certainly serve as a blueprint for other cities facing similar challenges.

FYI

This article first appeared in a different format in the May 2014 issue of Siemens Mobility Magazine, *COMO*. *Thinking Cities* version by kind permission of Siemens and edited by H3B Media.

Talking back

Göteborg, Sweden wants to get to know its cyclists better. **Noel Alldritt**, project manager for ITS at the city's Urban Transport Administration, explains to **Karsten Marhold** how his department is using its new Cykelstaden app to track cyclists' behaviour – and to develop a new and user-centric bicycle plan for the city

Göteburg's Cykelstaden app allows users to search for servicing points, pumps, sharing stations, etc

There's no denying the Urban Transport administration of Göteborg is trying to make life easier for the city's cyclists. The administration has deployed 17 bike pumps in the city centre near to convenience stores and petrol stations. They are free to use and work well with local cyclists: the first-ever pump deployed at Vasagatan has been used more than 350,000 times during its first year of existence. Göteborg also offers free bike servicing points at local bike shops with a basic toolset that can be used free of charge. These points are marked with a yellow bike symbol to make them easily discoverable. Another point in their favour is that they can be found using a smartphone as well.

Göteburg wants to become known as a cycling city

From 2011 to 2013, the city offered *Punkapp*, an iPhone app that allowed users to discover pumps and servicing points as well as the nearest station of the Göteborg bike sharing system Styr & Ställ. But the success of both the city's services to cyclists and the application called for a relaunch with a new and more all-around smartphone app for cyclists, explains Noel Alldritt, project manager for ITS at the city of Göteborg. "We needed an app that provided all the information for cyclists in Göteborg in one place," Alldritt says.

THE CYCLING CITY

What the city came up with is *Cykelstaden*, an app whose name can be translated to "cycling city" – precisely what Göteborg wants to become. The app was launched in 2013 on both the iOS and Android platforms, and the city plans to extend it over time to provide as many bike-related services as possible. Basic features include searching for pumps, servicing points and bike sharing stations, as well as a database of all cycling lanes in the city including information about who is responsible for them.

The most important feature, however, is the possibility to enter into dialogue with cyclists, as Alldritt explains. "When developing Cykelstaden, we realized that in order to improve the cycling experience in our city, we must provide a means for cyclists to talk to us. All too often, city administrations only provide information and awareness-raising, but they do not listen too much to what cyclists themselves have to say."

As a first step, the city integrated an error-reporting feature into Cykelstaden that was available starting with the launch of the app. Using this option, a cyclist can directly report problems on the road to the city. Using his smartphone, the user provides a short description of the

> ***All too often, city administrations only provide information and awareness-raising, but they do not listen too much to what cyclists themselves have to say***

problem and is given the option to take a photo. The photo is then geo-tagged with the GPS coordinates sourced from the phone's location services and sent directly to the city's support desk. With both the photo and the coordinates it is much easier to locate and understand the nature of the problem.

PLANNING FOR THE FUTURE

Yet the city's ambitions for the app do not stop there. Noel explains, "We not only want to use the app to improve the maintenance of existing infrastructure, but as a tool for future planning. This is why we have integrated the *Min cykeltur* function in 2014." *Min cykeltur* is a feature of Cykelstaden that lets users track their journey and send it back to the city's servers in the form of an anonymized GPX file and after they have given permission to upload the data.

The city hopes the data generated this way can be used as a basis for the development of its new bicycle plan in late 2014. "One of the problems with data is of course what do you do with it and how to turn it into information," says Alldritt, cautiously. "Therefore we not only need the app, but also a tool to analyse the data generated by *Min cykeltur*."

This job was undertaken by Johanna Aalto and Johanna Nyström at Chalmers University of Technology in Göteborg as a part of a Masters' thesis. Under the supervision of Noel

"We not only want to use the app to improve the maintenance of existing infrastructure, but as a tool for future planning"

"Bikes are flexible and cyclists use paths and shortcuts that we may not know about"

A cyclist can directly report problems on the road to the city. Using his smartphone, the user provides a short description of the problem and is given the option to take a photograph

Alldritt, Aalto and Nyström developed a method for analysing the generated data using Excel and the free and open-source data visualization program QGIS.

"We wanted a way to analyse the data that can be done with standard and free applications, and that is what we achieved," Noel explains. As part of the research project, 72 tracks were analysed with a focus on Nya Allén, a main street in the city centre. The researchers concluded that *Min cykeltur* could indeed be a useful tool in order to develop a bicycle plan based on users' needs. However, as the function has only been launched in early 2014, not enough data is available yet to draw conclusions for the entire city.

PULLING OUT THE STOPS

Noel and his department are confident that *Min cykeltur* will allow them to get a greater insight into the behaviour of cyclists and ultimately build better cycle paths. "We need to know where and how cyclists are actually cycling and not the way the city thinks they do," he explains. "A simple fact that makes cycling hard is having to stop all the time. One of the objectives was to identify where cyclists stop and how often, so that we can use this information to reduce the number of stops and increase the flow. The GPX data allows us to see this."

Other useful insights the app provides is how fast people actually cycle, and whether they use shortcuts. "Bikes are flexible and cyclists use paths and shortcuts that we may not know about," Noel explains. "By tracking their paths we can see how they cycle and hopefully make it better. This should be a win-win for all involved."

FYI

Noel Alldritt is project manager for ITS at the city's Urban Transport Administration

noel.alldritt@goteborg.se

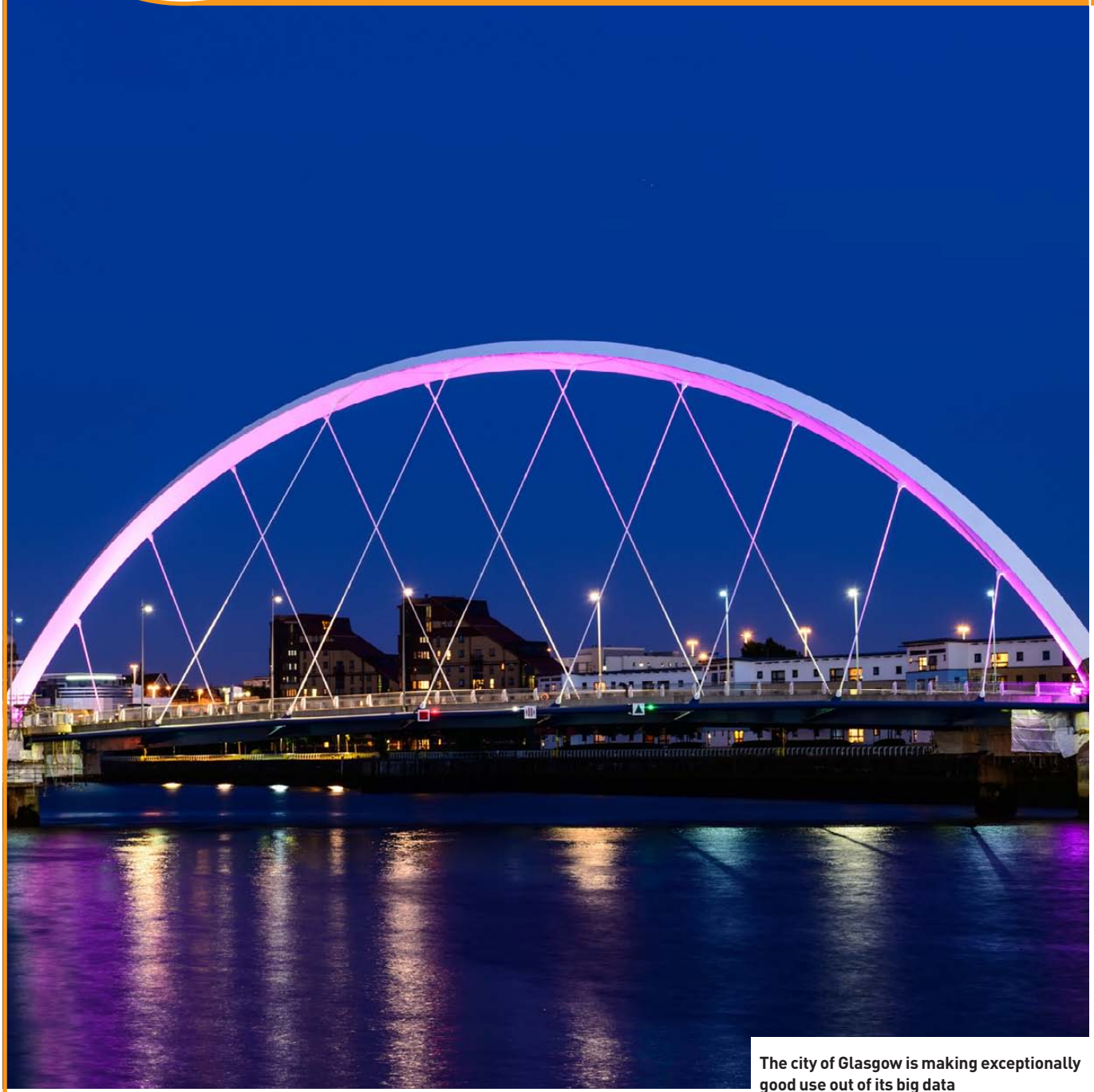
Karsten Marhold is project officer at Polis

kmarhold@polisnetwork.eu

www.goteborg.se

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



The city of Glasgow is making exceptionally good use out of its big data

© iStockphoto / johny007pan

Moving pictures

Traffic information: live! Romania adopts a real-time smart city solution, as **Sonja Koesling** highlights

While it is on the DN2A between HârĐova and Crucea the traffic usually flows but cars on Đoseaua Mihai Bravu in Bucharest, Romania's capital, are moving at a snail's pace this Saturday. Traffic info: live! TrafficGuide.ro is the name of the Internet portal that provides real-time information on traffic across Romania and allows those who need to see it what conditions are like on roads like the Đoseaua Mihai Bravu. The technology, which bundles the necessary data and assesses its validity before harmonising it, is called PTV Optima and is a tool that enables dynamic traffic forecasting.

Be it construction sites, roadblocks, traffic jams or accidents – on TrafficGuide.ro, road users can access information about both the current situation on the roads and the average speed at which traffic is moving. The information platform covers all national routes, motorways and Bucharest's main thoroughfares. The Romanian traffic information portal has been sponsored by the European Union and developed by ELSOL – Electronic Solutions, an engineering and consulting firm which specialises in ITS solutions and is working together with ITS Romania to implement intelligent traffic systems in Romania.

PTV OPTIMA AS A DATA HUB

"Our aim was to be able to map traffic information across Romania and to give network operators the ability to observe their road network and manage traffic events using a web-based interface", reports Sorin Dumitrescu, Managing Director at ELSOL. "The project covers 250,000 routes, monitoring a total of around 80,000 kilometres of road."

It was this scale that prompted the company to look for a solution that could obtain traffic data from

It was necessary that the solution should be able to broadcast traffic data automatically, with a minimum of effort, across a multitude of information channels, sorted according to geographical relevance

several different sources and in a variety of data formats and data protocols. Furthermore, it was necessary that the solution should be able to broadcast traffic data automatically, with a minimum of effort, across a multitude of information channels, sorted according to geographical relevance. PTV Optima fulfilled these requirements.

COMPILATION AND HARMONISATION

To map traffic information in real time, PTV Optima collects data using Floating Car Data (FCD), automatic number plate recognition (ANPR), detector information and reports of accidents and construction sites from the relevant sources. This data is then compared, validated, harmonised and merged. The data sources are dynamically weighted during the harmonisation process to facilitate adaptation to local circumstances.

Thanks to these solutions, PTV Optima can provide traffic managers with a comprehensive picture of speed, traffic densities and congestion across their traffic network. Vehicles equipped with RDS-TMC navigation and Location Tables (LT), developed by ELSOL, will receive the information within five minutes direct to the driver's cabin.

"Thanks to the open framework and the intensive training that PTV Group and its sister company Sistema provided, we are now able to independently connect new data sources and additional data suppliers to our system", says Dumitrescu. "It has lived up to our expectations in every respect."

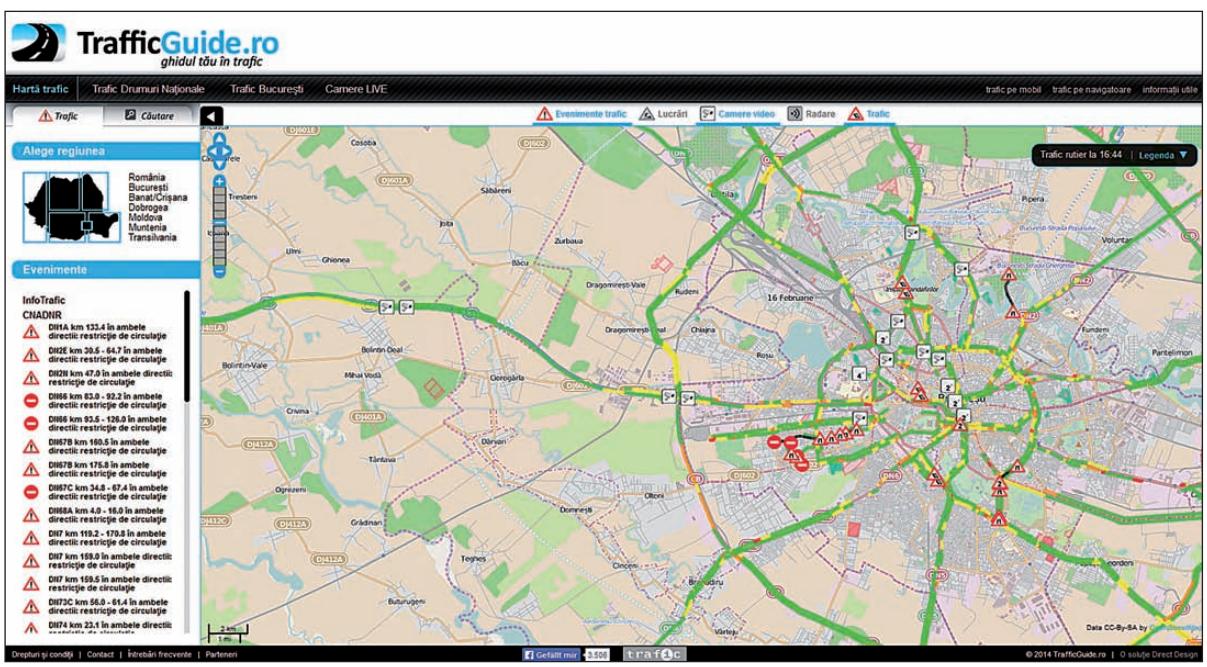
ELSOL also values the long-term opportunities to extend the system: "With PTV Optima, you can forecast traffic up to 60 minutes in advance", comments Dumitrescu. "At present, our plan to add this module as an extension to our system has not yet become a reality – but it's something we're extremely keen to do."

FYI

Sonja Koesling is head of corporate communications at PTV

sonja.koesling@ptvgroup.com

www.ptv.de



In the background of TrafficGuide.ro PTV Optima is collecting, validating, harmonizing and merging traffic data.

© TrafficGuide.ro

What's mine is yours

Is it even remotely possible for a city the size of London to ever be completely car-free? If not, could car clubs be the answer to getting at least some of the ever denser traffic off the roads? In the first of two articles, Zipcar's **Mark Walker** highlights some of the UK capital's boroughs that are doing their level best to make the seemingly unachievable achievable; while **Kevin Borras** talks to the company's general manager about the culture of sharing and how it's thinking electric

The London Borough of Hackney has recognised that car clubs can provide an excellent alternative to the private car and in 2013 Hackney launched its City Car Club. Car Club drivers on average generate less than half of the carbon dioxide emissions and local air pollutants compared with the average London household with at least one full car license holder. Therefore, increasing car club membership can assist Hackney Council in achieving its modal shift and its carbon dioxide and local air pollution targets.

Car ownership has continued to drop in Hackney, one of London's poorest boroughs, where the proportion of households that are car-free has risen to 64.6 per cent, up from 56 per cent in 2001, with just 170 motor vehicles per 1000 inhabitants. Despite the population of the

Increasing trips by car clubs can assist Hackney Council in achieving its modal shift and its carbon dioxide and local air pollution targets

borough increasing by 44,000 during this period the actual number of cars owned by Hackney residents has decreased by 3200. Hackney believes that this is partly as a direct result of the expansion of car clubs throughout the borough. Currently Zipcar, the world's largest car sharing club, operates from 95 locations with 147 vehicles and has had a growing presence in the borough for several years.

City Car Club now occupies 12 bays with 13 vehicles. Car club membership in the borough reached 8800 for Zipcar in May 2014, representing a 48 per cent growth in the last 2 years. There are a total of 160 vehicles in the borough with 80 per cent of residents now within a 3 minute walk of a bay and 90 per cent within a 5 minute walk of a bay.

Hackney's Mayor Jules Pipe made a political commitment in his 2010 Mayoral Manifesto that every resident should have easy access to a car club bay. As a direct result of this political commitment it meant that the Council's Transport Team saw car clubs as a key priority and ever since they have been proactively

Car clubs condensed

Currently, the UK has one of the highest car club memberships in the world with more than 160,000 members. The majority of these are in London, with the greatest density being in Inner London boroughs such as Westminster, Islington, Wandsworth, Lambeth and Hackney. Of the 33 London boroughs, 25 have car clubs, and many have incorporated them into their transport infrastructure in innovative ways.

London has the largest Zipcar network in the UK, with more than 1,500 cars across many of the London boroughs. Zipcar members benefit from: 60 miles of free fuel, insurance, maintenance, roadside assistance, road tax and the Congestion Charge when travelling in London. Car clubs are one of the most cost effective and simple measures that will help solve London's congestion, pollution and carbon challenges. They help with the drive for cleaner air and reduced carbon emissions, because they operate newer cars with the latest technologies and increasingly offer ultra low emission or electric vehicle options.

From local use to day trips, holidays and when your business needs requires some extra capacity

working with operators and ensuring coverage continues to expand.

BAYING FOR MORE

What Hackney has been doing to progress car clubs in the borough:

- New promotional signage – bi-directional signage has been installed, facing pedestrians on the footway at each bay in the borough. The sign is double-sided and positioned to face the footway, therefore viewable by pedestrians walking by the parking space. The promotional signage is placed at each existing bay operated by Zipcar and City Car Club to raise awareness of car sharing as an alternative to private car use, to encourage use by local residents.
- Installed cyclehoops on all bay signage to enable residents cycling to the bay to securely park their bicycles
- Waived parking permit fees to all operators that occupied new bays during the 2013/14 financial year
- Ensured that all new developments over a certain size secure contributions to new bays and membership for all residents.

CAR CLUBS IN ISLINGTON

The London Borough of Islington, to the north of the city, was one of the UK's car club pioneers, helping to establish the first permanent on-street car club bays as part of the London City Car Club in 2003. Growth was rapid, and Islington soon boasted one of the highest market shares of any car club city in the world. There are currently over 9,000 members using 169 Zipcars.

Islington's main impetus for establishing a car club was to reduce the negative impacts of car use, and to relieve the borough's parking pressures. Car clubs represent a positive parking story, which is rare in such a dense urban area. Elected members were strongly supportive from even before the launch, and have remained enthusiastic. The success of Islington's car club network has no doubt made a substantial contribution towards reducing car ownership in the borough – 65 per cent of households in Islington do not own a car (2010 figures), up from 48 per cent in 2001.

The popularity of Islington's car club undoubtedly owes much to its central location, making travel to work and leisure destinations easy. A high-quality public transport network

A brief history of car-sharing

Stakeholders from across London and the Car Club industry convened at London's City Hall earlier this year to discuss how London can continue to grow the number of car club members. The event built on the incredible growth of car clubs in the UK capital in recent years, with 86 per cent of the UK's 164,000 car club members now in London.

London is already the leading car-sharing city in Europe but now wants to lead the way in developing and promoting car clubs to set an example for all other global cities to follow. Encouraging further use of Car Clubs was a key recommendation from the Mayor's Roads Task Force, which was set up in July 2012, to help deliver a template for world-class streets and roads fit for the future.

London's roads are already under pressure, and maintaining a highly functioning road network is central to ensure it retains its position as a world-renowned economic capital. With the population forecast to grow by 14 per cent, potentially bringing thousands more cars on the road in the next decade, car clubs are a part of the solution to this challenge.

MAKING SPACE

Previous research carried out by CarPlus earlier this year showed that every car club car effectively removes around 17 privately owned cars from the streets. Car club members also tend not to commute by car or drive so much during rush hour, helping them save on average £3,000 (€3,600) per year. Therefore, by encouraging more boroughs to include Car Clubs into their transport planning, boroughs can help reduce the number of short car journeys, reducing congestion and vehicular emissions from their roads. To help expand the number of car clubs further across London, boroughs that already have successful car clubs have published new best practice guidance to help other London boroughs. The best practice guidance covers a range of ways in which boroughs can further encourage Car Club use, including:

- Using new build and refurbishments as an opportunity for installing more car club bays;
- Installing more bays that are in locations that are more visible and easily accessible to residents and local businesses;
- Promoting car clubs in their local boroughs in partnership with operators to enable greater take up.

Forecasts from the Car Club industry suggest that, with sustained investment by all stakeholders, including the Car Club industry, London could see up to 1 million car club members by 2020.

Transport Minister Baroness Kramer said: "Car clubs can help reduce congestion and carbon emissions through less private car ownership, whilst still giving people

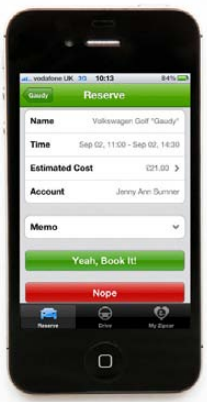
makes owning a car unnecessary for most people, and traffic congestion makes it usually faster to travel by public transport (or even by bicycle or on foot!) than by car for many journeys. But occasional access to a car is useful for many, and the car club has provided a more convenient and more affordable alternative.

Another part of this success has come from strong transport and planning policies at both the local and regional levels. In the early days, financial support from Transport for London allowed Islington not only to establish a basic borough-wide network of bays, but also to implement a number of innovative marketing activities such as the production of booklets to promote the car club to residents and businesses. This basic network made it possible for Islington to require Section 106[1] contributions from developers to pay for additional car club bays and subsidised membership for new residents of car-free housing, who would be ineligible for on-street residential parking permits. Section 106 contributions have formed an ongoing funding stream Islington has used to expand the initial spattering of bays to the current comprehensive network where every Islington resident has a car club vehicle within a five-minute walk of their home.

Over the years, Islington has fine-tuned its car club parking management to reduce the costs of expanding the network and to assist the operator in providing a high-quality service for its members. Initiatives include:

- Car club information boards to draw attention to car club bays and reduce illegal parking;

From finding the nearest vehicle...



...reserving it there and then...

...and unlocking the car at the roadside – all from your mobile phone

the freedom and flexibility to use a car when they need it. The success of car clubs in London has shown how these clubs can offer people more choice about how they travel."

MAYORAL APPROVAL

Mayor of London, Boris Johnson, is also fully behind the concept: "London has one of the biggest Car Club markets in the world and the potential for further growth is huge. Our Roads Task Force is fully supportive of this forward-thinking industry, one which offers massive benefits in terms of reducing congestion, improving air quality and reducing competition in the battle for kerbside parking. We know that just one car club vehicle can reduce up to 17 privately owned cars, and that car club users tend to make smarter travel choices such as cycling, walking and public transport. This is a really exciting time for the Car Clubs industry in London and I urge all London boroughs to get on board and support its development."

Leon Daniels, Managing Director of Surface Transport at TfL, has first-hand experience of the benefits of car sharing: "The use of Car Clubs in London has grown massively in recent years and we continue to support car clubs across London as a way to help reduce congestion. I am a regular user and welcome this positive action to further encourage use across the capital."

Nick Lester, Corporate Director of Services for London Councils, concludes: "The success of car clubs in many London boroughs shows how effectively they can meet Londoners' transport needs, and reflects the partnership work of councils and car club operators. We hope boroughs will be inspired by the best practice framework launched today to position car clubs as an integral part of their transport infrastructure for the future."

NOTE

1 Under S106 of the Town and Country Planning Act 1990, as amended, contributions can be sought from developers towards the costs of providing community and social infrastructure, the need for which has arisen as a result of a new development taking place.

- Allowing car club vehicles to park in residential bays within the parking zone where they are based;
- Avoiding objections by knowing where proposed bays are likely to be most suitable;
- Short-term offer of 'Vouchers for Permits', where residents could swap their parking permit for £200 (€252) worth of car club membership and use (or towards a bicycle).

The final important success factor has been Islington's partnership with Zipcar as the borough's exclusive operator of dedicated on-street car club bays since 2006 (when the company was called Streetcar). Working together as partners, the two have not only managed to overcome challenges, but have also proactively pursued innovations to improve the service and increase membership. This work led to London Transport Awards for Partnership of the Year (2008 with Streetcar) and Innovation (2010 – Vouchers for Permits), as well as a 'Highly commended' at the National Transport Awards (2010 – Vouchers for Permits) and a Gold Award at the Green Apple Awards 2010.

From April 2015, Islington will need to commence a new car club contract after the current exclusive contract with Zipcar has expired. Islington is currently considering whether the borough can sustain multiple car club networks, and it is hoped that electric vehicles will be made available to Islington car club users.

CAR CLUBS IN SOUTHWARK

In 2010, with cross party support, Southwark Council launched an ambitious programme to roll out a car club network within the borough. There are currently 120 Zipcar vehicles in Southwark that provide a more sustainable alternative to private car ownership for an increasing number of members. Southwark has seen a 40 per cent increase in membership in the past two years and, currently, there are over 7,700 members in the borough.

For maximum positive impact on making London more liveable, car club use needs to be mainstream

The reasons for the network are obvious to Southwark:

- Reduced vehicle emissions from cleaner vehicles and fewer car trips mean improved air quality leading to streets that are more attractive for walking and cycling;
- Reduced congestion and parking pressure as a result of fewer cars and trips equates to liveable streets for residents, businesses and visitors;
- Less pressure upon space means greater opportunity to reallocate road space to the majority of households who don't have a car;
- They provide a highly economic alternative to owning a private car, therefore saving residents money.

With an increasing population and thousands of new homes planned to be built, Southwark recognises the opportunity to introduce existing and new residents to the benefits of car clubs when they move in. Most new planning consents, over a certain size, require developments to build a new car club bay that will also be available to the wider public.

Southwark is committed to exploring all new opportunities to expand the car club network through close working with operators and partners across the capital.

Zipcar has long seen the potential for car clubs in London and has played a major part in establishing the strong membership base that already exists today. For maximum positive impact on making London more liveable, car club use needs to be mainstream. To achieve this will require all the relevant bodies – the Mayor's office, TfL, all the Boroughs and the car club operators – to come together, to form and to execute a clear and bold strategy for car clubs – one that all Londoners can get behind. Zipcar is fully committed to working with the city and playing its part in this alliance to make London a recognised leader in smart urban mobility and ensuring the capital becomes an even better place in which to live and work.

FYI

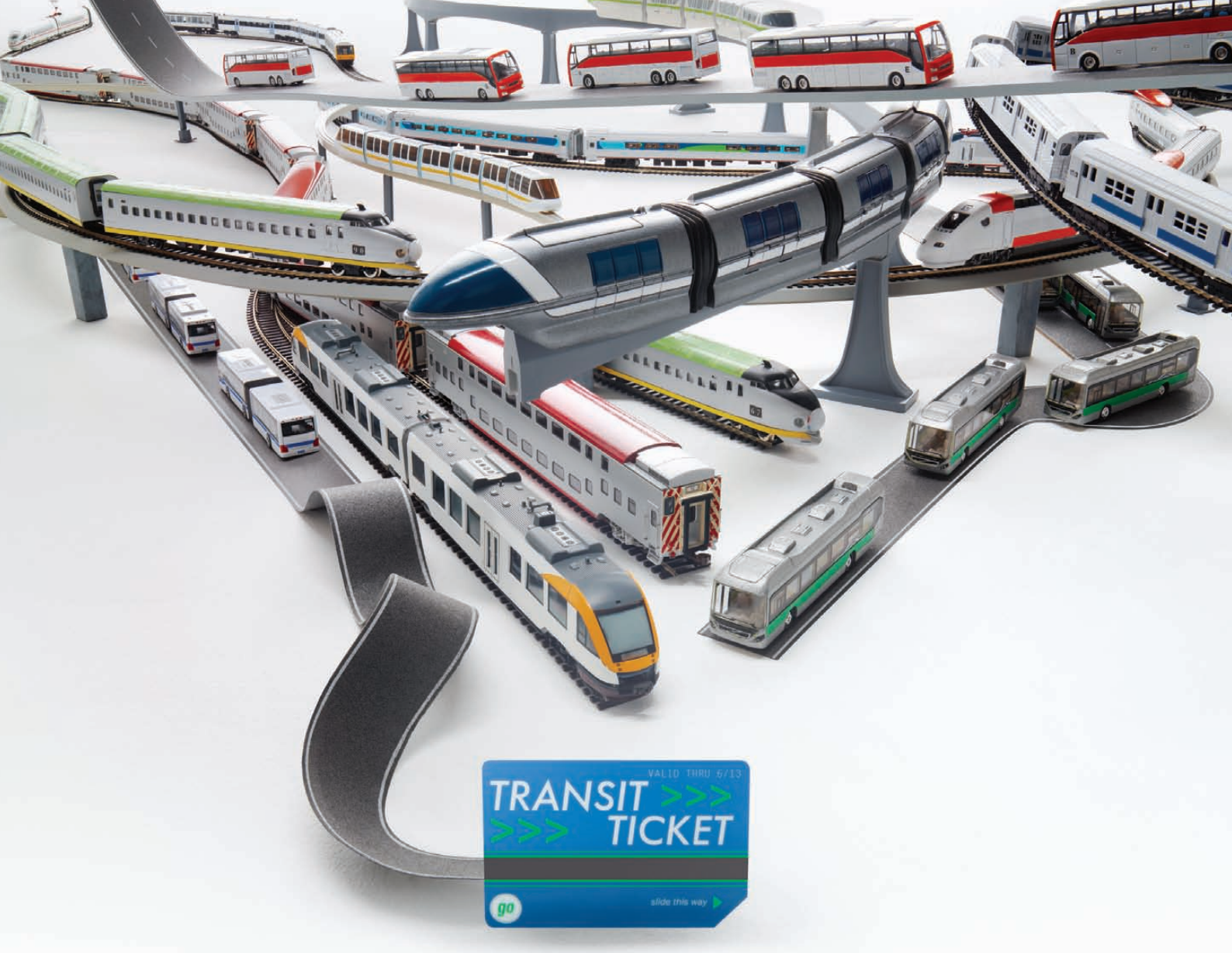
Mark Walker is general manager of Zipcar UK

mwalker@zipcar.co.uk

http://www.zipcar.co.uk

http://www.tfl.gov.uk/modes/driving/car-clubs

http://www.carlitelondon.org/



Collecting 37 billion public transit fares a year. Made simple by Xerox.

Today's Xerox is simplifying the way work gets done in surprising ways. Such as creating innovative, scalable and flexible fare collection solutions for public transit operators around the world. The results are not only an improved passenger experience and reduced operating costs, but with more people taking public transportation, fewer cars are on the road. It's one more way Xerox simplifies business, so you can focus on what really matters.

xerox.com/transportation

Ready For Real Business xerox

Hybrid theory

Mark Walker, general manager, Zipcar UK talks to **Kevin Borras**

How does the concept of car-sharing fit into the overall concept of the smart city?

Let's take the modern city that we know, first of all. As more and more people more to cities they become increasingly polluted and congested places which if we don't do the right thing and encourage people to make smart choices will make cities less desirable places to live. There's simply too much demand for spaces to park cars in so there's parking stress to deal with as well. What we now know about car club members is that their behaviour changes – the way they choose to get around the city changes. Whereas a car owner might use their car almost by default most of the time, after all they have paid for it and it's sat there outside their house, a car club member, who is paying to use that car only for the time they need it makes much more rational choices on a trip by trip basis as to which form of transport to use.

What that means is, and we have lots of data that proves this, is that their use of the car goes down, reducing congestion and relieving pollution and the use of all forms of public transport, walking and cycling increases. Car club members make seven times fewer short trips, under 5 miles, than car owners. This is really important in a city like London that is actively planning to reduce the space it gives to cars...what we are trying to do is broaden the general understanding of what car clubs can do and take the concept mainstream.

Could you talk about the correlation between car sharing and the upsurge in electric vehicles? What is the market like for EV sharing?

Electric vehicles are a really interesting area and people often think that car clubs and electric vehicles together almost intuitively as they are both seen as "good things," environmentally at least.

However, it's actually a rather complex issue. If you take the car club model we will have several people using the same car for a number of undefined trips every day. At the end of each trip the car has to be ready for use by the next member and that includes having enough 'fuel in the tank'. Some people may only want to go 5 miles to the nearest DIY store, other people may need to go to 200 miles to visit their aunt. With the kind of electric cars that have been available until very recently that has been something of on operational challenge for us and of course a member experience challenge as well. What is increasingly encouraging is that the electric cars that are coming onto the market,

"We think we have a real role to play in getting a lot of people to experience electric car driving for the first time"

particularly plug-in hybrids, are solving the range problem. That means short trips around town can run on the battery and longer trips out of town can use conventional fuels. If the electric engine doesn't have enough charge left you simply flick into the conventional engine.

We are constantly looking for ways to make it work but the economics have been a real challenge for us as electric cars have been so expensive, even with a little subsidy thrown in. We also have to consider the unknown residual value of electric cars as there isn't a second-hand market yet. So up until now it's been rather difficult but we are working hard with the manufacturers and the infrastructure providers for the charging posts and indeed with the cities to build the right kind of alliance to make it work.

We think we have a real role to play in getting a lot of people to experience electric car driving for the first time. The cars are good, so if we can get a good number of drivers experiencing them first hand we believe that they will be converted and they will talk positively about it to their friends and family and that will create a positive atmosphere around electric vehicles generally.

As the largest carsharing company in the UK, could Zipcar become something of a lobbyist for the electric vehicle sector, deliberately or otherwise?

I don't think we will solve the range anxiety part of the issue

but the car manufacturers themselves are doing everything they possibly can to increase their vehicles' range as it's in their interests to, but where we have an interesting role to play is more within the city itself where there are specific short trips that are still best suited to the car. It could be you are carrying a heavy load, taking lots of small children to an event or the trip you want to make is very difficult or complicated on public transport. In that case the car is the best option but wouldn't it be nice if you were able to make that trip in an electric car that has zero tailpipe emissions?

That's where we have a role to play. It is quite complex as you have multiple people using the cars in the course of a day who have to be mindful of the charge...where we have used electric cars in the past we've encountered problems where people just haven't plugged them in and logistically you start to divide up your fleet. You end up with some cars that you can only do short distances in, the remainder have total flexibility, but if you happen to live near to one of the electric cars but you want to take a longer trip you will have to go further to find a car that will allow you to do that. All these things play into how well the service is working for the members, so for us it's a step by step approach and I think this is where the plug-in hybrid may well come into its own, just in getting everyone over the line in understanding how good electric cars can be.

But what about charging points – there quite clearly aren't enough and this is going to have to change. I live in a quite densely populated South London suburb and I honestly couldn't tell you where the nearest EV charging station is. Perhaps more to the point, if you live in an apartment on the second floor, let alone the 10th, how do you charge your electric car?

I have done exactly that –I've had the cord running along the pavement and up through my living room window. In a city like London a lot of people live in terraced houses or flats and the only parking available is on-street so that's just not sustainable. That's how London works and that's how our service works so for us to roll out more electric cars we need charging points on pavements. To date there aren't very many and there are also different plug types for different vehicles and for whatever reason the charging posts can be quite temperamental.

More often than you would like you find they aren't working and you have to report a fault – up until now the charging infrastructure has been somewhat temperamental but I hope that now there will be more reliable infrastructure and of course much more of it.

One of the topics we address in *Thinking Cities* is smart logistics for the smart city. Some cities have tried adopting unconventional time-windows for deliveries but what can a company like Zipcar do to help this situation? You have Zipvan, so are there long-term plans for Ziptruck?

There's a real demand for vans by the hour and whereas most of the existing van and truck rental side of the market is set up for trade users, when it comes to domestic use where people need to take household rubbish or garden waste to the dump or pick up a large piece of furniture from a store, those people will only need that van for a short period of time and often just at the weekend. And yet, most of that market is set up for daily rentals and they close at lunchtime on Saturday! You are basically stitched into a two-day reservation for maybe a six-hour job. We know for sure that there's demand for an hourly rental business, and we know we want to trial an electric van. For a city like London the number of deliveries being made is incredible, especially with the advent of internet shopping so if we can get more of that demand into electric vans we would definitely like to capture that market.

We've talked about public membership of car clubs, but what does Zipcar offer to businesses?

Thousands of business use Zipcar in the UK today and they can be divided into a few different categories: one category we are very popular with is the small start-ups. Less than 10 employees, cash is very tight, and the last thing you want to do is get into a three-year car lease agreement so those business like the idea of paying for transport as and when they use it.

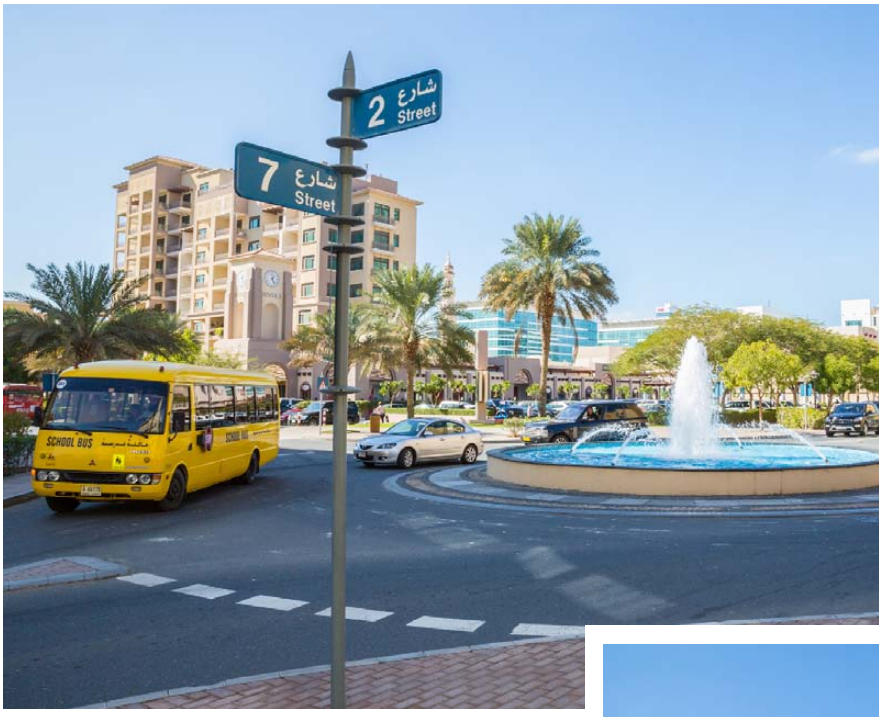
Zipcar for Business is ideal for them and we set up the account in the name of the business with registered drivers. It's a proper business account with a variable cost model and it suits start-ups perfectly. For businesses that are perhaps better established but still don't like the idea of purchasing car fleets or getting committed to a lease, we can offer them an exclusive use period. If they know that every Tuesday morning they go to the market to pick up goods and bring them back again we can guarantee that cars will be available in those slots.

At the bigger end where we can really have impact the case study we always cite is Croydon Council who switched from what we call a grey fleet where people used their own cars and received an allowance and claimed a mileage rate to a scheme where they brought in two dozen Zipcars for business travel purposes.

It's had an amazing effect – the number of employees driving for business has gone down by 50 per cent and the emissions have gone down by 40 per cent, as has the number of business miles travelled. They save £500,000 (€630,000) a year on transport costs. What councils can do is integrate that with a lift share system for commuting to work. This means that you are also getting reduced commute miles into the council offices on top of the reduced council miles driven – they are huge and real savings and Croydon are looking to expand that scheme.

Connecting communities

Dubai's Smart City Vision is winning admirers from all over the world. How it fits into the Internet of Everything is at the same time fascinating and, ultimately, crucial



It's a widely held view that the principles of openness that have made the Internet a thriving ecosystem over the past 20 years can be applied to create and grow the networked platform for connecting people with products, services and information. This same network can also provide a means for cities to manage services, provide citywide information, learn more about how their citizens use managed services and provide business opportunities as well.

By drawing on their experience from current strategic partnerships in smart city initiatives such as those in Barcelona, Nice and Hamburg among many others, experts and analysts from Cisco collectively agree that Dubai's Smart City plans could create one of the world's most connected and sustainable urban centers.

Having secured Expo 2020, Dubai's rapidly accelerating Smart City bid comes at an opportune time. Frost & Sullivan estimate that the global market potential for smart cities - infrastructure development, technology integration, and e-government, energy and security services - could reach US$3.3 trillion by 2025.

"The way we will move around in and interact with the city of Dubai is being revolutionized, and companies like Cisco are working very closely with both government and businesses to guide and support this momentous change,' said Rabih Dabboussi, Managing Director for Cisco in the United Arab Emirates. "The era of inert buildings, unresponsive citizen services, and lack of logistical transparency is over, and Dubai has everything in place to become an exemplary smart city pioneer, not only throughout the region but also on a global scale. The global need for cities to adapt is intensifying. Research from the Massachusetts Institute of Technology (MIT) predicts that cities in the future will account for nearly 90 per cent of global population growth, 80 per cent of wealth creation, and 60 per cent of total energy consumption."

According to analysis by McKinsey, one billion people will enter the global "consuming class" by 2025 – a rise of 70 per cent from today. Cities will need to construct floor space equivalent to 85 per cent of all of today's urban building stock – an area the size of Austria.

SMART+CONNECTED COMMUNITIES™ – A REALITY TODAY

Cisco is currently involved in over 90 Smart+Connected Communities (S+CC) projects worldwide, all of which feature an open-architecture platform that enables Cisco, its partners and

The era of inert buildings, unresponsive citizen services, and lack of logistical transparency is over, and Dubai has everything in place to become an exemplary smart city pioneer

customers to create and deploy new smart services and applications. To learn about cutting-edge smart city technologies in action, a delegation of Dubai government representatives recently visited Barcelona, one of Cisco's most prominent S+CC engagements.

The city of Barcelona is currently showcasing a Cisco WiFi Mesh network in the Born District that provides connectivity to different metropolitan devices, such as sensors, cameras and actuators. The Wi-Fi Mesh network is also the foundation for infrastructure-based management services. For example, environmental smart sensors report in real-time on temperature, noise, humidity, gas and dust-particle concentration, for example. The data gathered helps to paint a picture of the city's overall livability, while serving as "watchdogs" capable of detecting levels outside of set thresholds and triggering alerts back to the city situation room.

Dubai needed a carefully considered, robust plan structured to benefit residents, businesses and visitors – emblematic of its receptivity to cutting-edge technology

Smart parking sensors, for instance, help citizens find open parking spaces via smartphone app. Smart waste sensors installed in waste containers signal when they become full or are emitting odours above a set threshold for optimized pickup routes. Smart street lighting sensors in smart light poles can detect moving objects, including people and animals, in the street and adjust light levels accordingly. Cisco's reputation is already well-established in the technologies, standards and experience in having supported the development and growth of the Internet. The Internet of Things – and its next incarnation, The Internet of Everything – take this revolutionary achievement to the next level. The Internet of Everything could connect 50 billion people, processes, data and things by 2020.

"We can deliver the intelligent network to make it happen – a network that listens, learns and responds – on a scale like never before," explains Dabboussi. "The rise of the smart city is intimately linked to Cisco's Internet of Everything (IoE) strategy, which Cisco estimates has a value of US$14.4 trillion."

CONNECTING EUROPE

Cisco also recently helped launch the "Connected Boulevard" in Nice, France, an ambitious proof-of-concept project built to demonstrate the benefits and value of the Internet of Everything for both residents and city leadership. The project includes four types of city services – smart circulation (traffic), smart lighting, smart waste management and environmental monitoring. The applications gather information from about 200 wireless devices and sensors deployed along the 800m-long Boulevard Victor Hugo. The shared network platform makes it possible to transform raw data from these sensors into the actionable intelligence that, when scaled, has the potential to transform Nice into a smart city.

In the city of Hamburg, Germany, Cisco is also using Smart+Connected City Wi-Fi to improve service delivery to mobile citizens, to boost the

A VISION FOR A SMARTER CITY

Thinking Cities **editor-in-chief Kevin Borras asks Rod Halstead, Managing Director, Public Sector and Ian Foddering, Chief Technology Officer, Cisco UK & Ireland, to explain their company's position in the smart city environment**

What is a smart city to Cisco?

Ian Foddering A smart city is one that has the ability to adapt to the way its citizens use it. We're seeing an increasing number of people moving to cities and that's giving the cities themselves, or rather the local authorities that run them, some real challenges. So the question as we see it is how can technology play a part to make it more efficient and an easier environment for the people that live there to get around, whether it's travelling or commuting from a personal or professional point of view. It's a number of different elements coming together in scalable, sustainable fashion.

If you look at the way that cities run today, transport is relatively isolated from the rest of the city. It has its own infrastructure, the roads themselves and the technology that supports those roads, but typically transport is separate to the broader system around it so to bring those together in a secure, cohesive manner is going to be critical going forward. The technical element is less of a challenge, it will be more a challenge of governance and culture.

How does Cisco play its part in following or even implementing those societal changes?

Rod Halstead Well, Cisco has a very interesting motto which is "helping people live, play and learn" and the smart city is pretty much at the hub of that. How do you help people living in a conurbation, be that a city or a community to live, play and learn – in other words how do you change their options? You ask about society – it's having more access to information, informing them more quickly about issues regarding travel, an emergency situation, or entertainment, or traffic conditions...the more informed we are becoming, largely through the advent of social media, the more integrated we become, the more efficient and concise we become in terms of our movement. This will of course mean an improvement in traffic flow but it also impacts positively on our work flow. It will enhance the way people cohabitate in cities.

In terms of your smart cities strategy, how do you ensure that people get information that is relevant to them?

RH The technology exists, depending on what smart devices they are using, for people to be get that feedback loop you are talking about and they can opt in or not. They can receive tailored information, specific to their needs if they are in a city, a community, a store or whatever, depending on to what level they have opted in to people knowing their preferences, their travel methods and patterns of movement. The feedback loop can tailored to fit their needs and expectations and things that are important to them.

local economy, and to provide smart parking via the Hamburg Port Authority. City Wi-Fi also provides the foundational platform for enabling Internet of Everything innovations such as traffic congestion management and automated water metering, resulting in greener and more efficient city infrastructure management. On the public safety and security front, the City Wi-Fi solution improves situational awareness by accelerating incident detection, and it can trigger a combination of automated response, real-time collaboration, and escalated decision support for optimal city operations and planning.

Amr Salem, Cisco's Dubai-based Managing Director for Global Smart+Connected Communities, notes that Dubai's strategy was "a carefully considered, robust plan structured to benefit residents, businesses and visitors – emblematic of Dubai's receptivity to cutting-edge technology." The fiber optic networks, high-speed wireless Internet and sensors set for deployment across the city will mean a continuous flow of improvements – in everything from education, healthcare, and transport to utilities and general security.

Salem goes on to explain that Cisco's approach to addressing these needs – the same ones challenging most cities today and into the future – is to leverage the network as the foundation for managed

In Hamburg, Germany, City Wi-Fi provides the foundational platform for traffic congestion management and automated water metering

IF A real world example of that is a project we have been working on with an organisation called Intu who run a number of shopping malls in the UK, the Trafford Centre in Manchester for example, and we provided some wireless infrastructure for them, via our Connected Mobile Experiences (CMX) that lets you tap into this connected lifestyle and provide relevant mobile content while gaining meaningful analytics. It allows Intu to gain some insight into how people use their malls and it does that by following customers' mobile phones as they walk around the real estate. Building on Rod's point, the customers get free Wi-Fi access but Into get information about customer footfall and dwell time so they can apply a high degree of intelligence around where they need more security, potentially charge more rent, target marketing campaigns and so on.

Where do you stand on the gamification and incentivisation of travel within the Thinking City?

IF Gamification is certainly an interesting one for us, but on a personal level I have one of these wearable technology devices from a health point of view and that certainly adds a degree of gamification to my life as I earn points and it works for me.

From a Cisco point of view we are a strictly B2B company, but what we can do is provide the connectivity to allow these types of applications to be run over them so if an organisation wants to do that through a traditional Wi-Fi infrastructure or mobile capability that's something that is definitely possible but it's not an area that we necessarily focus in on.

RH There is a recognition with our technology that where we can inform people, whether it's dynamic message signs or information as they move towards stations or airports or malls, or points of congestion, we can help them make informed decisions.

I use public transport a lot and I'm delighted with the information I get from Transport for London that explains to me what is happening on the network. It tells me not to take the Victoria Line today or not to get off at a certain stop. It's real-time information, they know what time I usually catch the Tube so they target their communications to me at that particular time.

I leave every day before 7am and I get a text in good enough time that informs me of which way I should go. The more we can facilitate that, through our underpinning technology or enhancements of that technology through devices, that will enhance how a city works and how people can more efficiently through it, using that city's infrastructure. The same applies to parking – smart parking apps can tell drivers of space availability, or lack of it, before they get anywhere near their intended environment within the city limits. Enabling smart decision-making in real time is a wonderful spin-off from this whole debate around communities and smart technology.

Cisco recently helped launch the "Connected Boulevard" in Nice, France

city and business services. "This foundation layer will then incorporate all manner of mobility, security, cloud computing, virtualization, collaboration and video – and other evolving technologies – and rely on and accommodate a diversity of cross-functional, open-architecture applications that package and distribute information and services."

FYI

For more information about Dubai's Smart City Vision contact **Nik Jefferies**, Good Relations Group at **Nik.jefferies@goodrelationsgroup.com**

http://www.cisco.com/web/about/ac79/innov/IoE.html

The brave new world of transportation

Matthew Cole on making the transition between simulating city planning issues and addressing them when (or rather before) they occur to real people in the real world

Anyone who has played SimCity will know the problems that city planners face. Getting your Sims a good education, a secure environment free from crime, plenty of green spaces to play, and good transport links are all part of the game.

If you are the Mayor of Townsville, you sure as heck want to get re-elected come polling day. Build a new football stadium in the outskirts of town and you will have hell to pay if you can't get your simulants to the game on time. And when that tornado whips through town and tears down your overhead power lines, then Townsville can suffer the consequences for years.

But whilst SimCity is only a game, it is a remarkably lifelike one when it comes to some of the practical problems that real cities can face. Cubic's recent launch of Urban Insights is a little like SimCity on a gigantic scale. Except now the simulants are now real people and the problems they face are not computer-generated. If transport planners mess this up, they can't simply hit the reset button and start the game again.

Cubic identified early on that moving people from A to B and back again is only half the problem. The key is in providing travellers with information that is timely and accurate enough to influence their behaviour when problems occur. By changing their habits, they can reduce transport bottlenecks, holdups and delays. In many ways, city planning is not just anticipating the here and now, but interpreting and influencing what can happen in the future.

This is the essence of Cubic's NextCity. City transport networks need to respond to the pressures of increased urbanisation and population growth. In addition, planners need to interpret problems in real-time and influence passengers and customers to change their behaviour when needed. It is about getting people to 'choose' the most effective method of transport suited to them.

THE BIRTH OF URBAN INSIGHTS

Every transport system generates its own level of data. So every time a sensor detects any type of transaction or movement – whether that is a fare or road toll being paid, a bus' whereabouts being logged, or a boarding being made – that input is recorded. Urban Insights analyses the relationships between all those inputs and builds a model of how the entire system is really working.

The transportation industry is one of the leading exponents of the Internet of Things (IoT), the phenomenon whereby virtually everything is connected and interacting with the web. The transport sector has a huge number of sensors and data collection points to feed into scheduling and asset management systems.

Traditional data management tools are not built to absorb such large volumes of data from so many different sources. In the past, operators have not been the best at mining or understanding the information they generate. For instance, ticket information is great at telling the story of an individual trip, but not of an entire journey. What happens when a passenger switches transport modes, from bus to rail, or from one operator to another?

But whilst SimCity is only a game, it is a remarkably lifelike one when it comes to some of the practical problems that real cities can face

San Diego had a particular problem standardising data from multiple sources that had been collected using different methods

Sitting on this information can cost companies money and customers. By understanding data in greater detail opens up a whole new world of possibilities in terms of creating resources that are the best fit for the needs and requirements of their network.

Our customers have asked for help to combine the data Cubic's management systems create with the many other data sets they collect. Cubic's team also have a huge amount of experience in running transport networks and interpreting the data they receive, as well as managing large BI and data warehouses. Armed with a view of the interplay of these systems we can derive insights to improve customers operations. This need was the genesis of Urban Insights.

AN INTERNATIONAL REACH

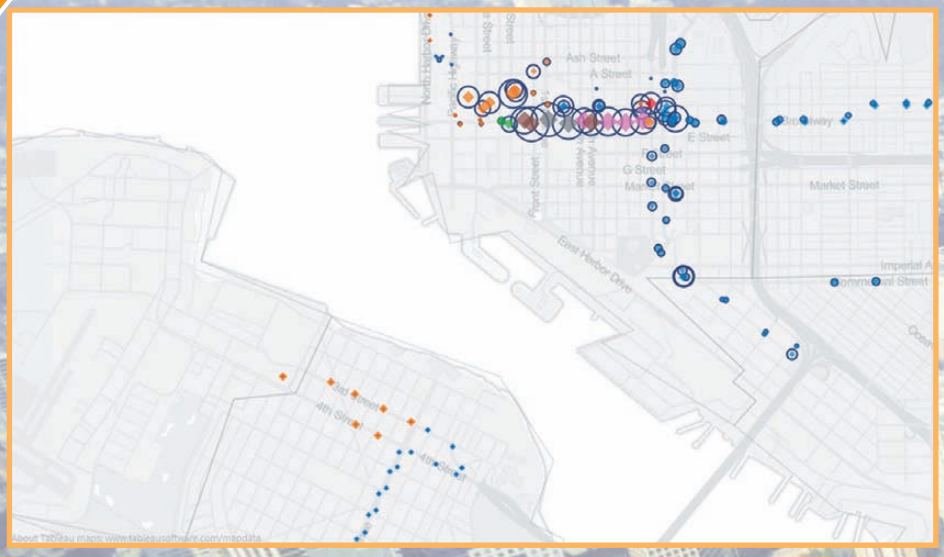
Based in Washington DC, USA, Urban Insights has a global reach and is able to operate in any of Cubic's international markets. A team of experts is already working on cutting edge projects for leading operators.

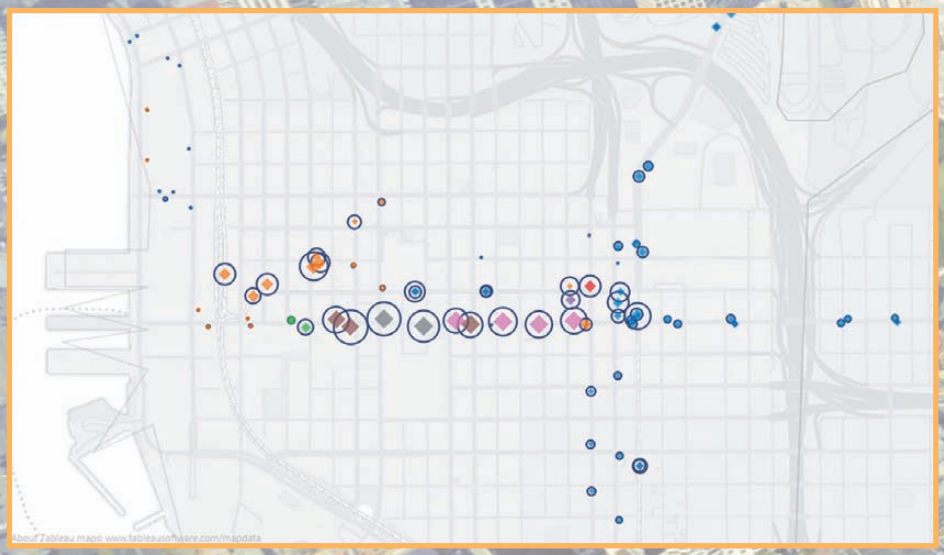
It was fitting however, that one of the first customers was on Cubic's home turf. The San Diego Metropolitan Transit System (MTS) wanted to gain an understanding of its customers' journey patterns, especially as they connect between bus and trolley services.

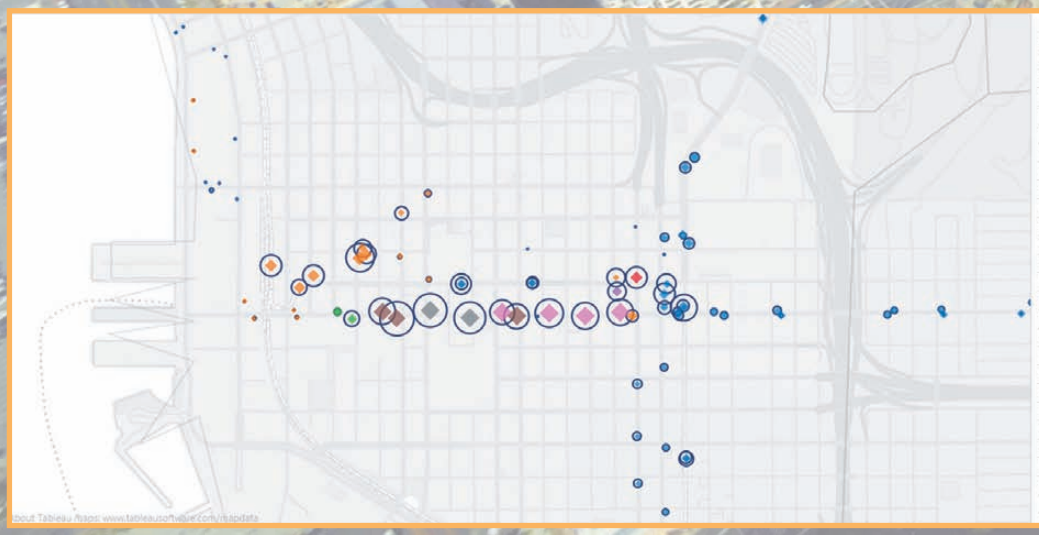
San Diego MTS had a particular problem with five independent data sources from light rail and bus services, produced by four distinct systems. Multiple technology partners created the data, some of which was collected manually, and none of which integrated with the others. Urban Insights' analytical model bridges the gap between these systems.

Urban Insights identifies service improvement targets for San Diego MTS. It pinpoints any mismatch between the scheduling and resourcing of services with the way that travellers actually want to use the system. Using its analytical models, Urban Insights provides answers to a number of MTS' issues, namely:

- MTS defines new connections if it discovers commuters are making unexpected travel choices or at unanticipated times
- New routes or transport connections are simulated to determine how much time these changes will save commuters
- These models educate travellers on the more convenient ways to use the network. In other words, if groups of travellers are taking longer bus routes or using more connections than needed, MTS informs the group of the most efficient journey to take
- Understanding usage patterns and the needs of travellers compared with the revenue collected and the cost metrics for each journey. Agencies can then predict and analyse the revenue generated against







Stop ID	Stop Name	Routes	Trips
10020	Voltaire St & ...	1	28
10024	Voltaire St & ...	1	28
10027	Voltaire St & ...	1	28
10031	Nimitz Bl & Ro...	1	28
10052	Clairemont M...	1	23
10053	Clairemont M...	1	23
10075	N Harbor Dr &...	1	28
10086	Broadway & S...	3	116
10090	Broadway & F...	6	340
10094	Broadway & 3...	8	393
10099	Broadway & 6...	1	12
10102	Broadway & 8...	7	381
10364	Voltaire St & ...	1	28
10366	Voltaire St & ...	1	28
10369	Voltaire St & F...	1	28
10371	Voltaire St & ...	1	28
10381	Voltaire St & L...	1	28
10382	Macaulay St &...	1	28
10415	Clairemont M...	1	23
10419	Clairemont Dr ...	1	23
10426	Clairemont M...	1	23
10454	Broadway & K...	2	40
10776	Chatsworth Bl...	1	28
10779	Chatsworth Bl...	1	28
10840	Broadway & 1...	8	394
10841	Broadway & 4...	7	382
10845	Broadway & 6...	7	382

These images depict the number of transfers taking place in the San Diego downtown area with the size of the rings indicating the quantity of transfers made at that location. This is information overlays the services offered at that same location, depicted as a diamond, with size and color indicating different features of the services offered there. The purpose of this visualization is to facilitate the identification of transit locations where the number of transfers taking place is inconsistent with the services offered at that same location.

> ***Having access to such rich data streams enables transport operators not just to react to the present, but also look to the future***

the cost of delivering services for each segment (distance between stops) of a route or rail line.

All of these factors are something that San Diego MTS hadn't been able to do up to now. It provides the level of granularity that enables operators to better balance demand, supply and budgetary constraints

TURNING TRIPS INTO JOURNEYS

Another early project for Urban Insights involved an operator who needed to understand traveller's journeys, from origin to destination. This was distinct from their 'travel segments' or use on multiple modes of transport such as rail, ferry, metro or bus. Transit agencies normally work and report in unlinked trips, rather than journeys. Understanding the entire 'origin to destination' experience provides much more powerful data.

In this instance, Urban Insights calculated the impact that service changes had on travellers' journeys. Assessments for route closures, service alterations or alternative transport options measured the impact across the entire network.

Urban Insights identified the next best alternative for each traveller impacted by the proposed changes. By measuring any additional walking distances, connection times, and overall journey time, it assessed whether their journey improved or deteriorated under the new conditions. In doing so, the transport authority predicted and quantified the impact of the proposed service changes before they were implemented.

They also examined how the changes impacted different traveller types, by location and time of day. It resulted in changes with a much richer context of how people would be affected, allowing service planning and changes to be much more responsive to user experience.

Those big data warehouses that most transport companies possess are incredible strategic assets when viewed through the lens of predictive analytics. They can provide unprecedented insights into planning and managing intermodal transportation networks.

HOW DOES URBAN INSIGHTS WORK?

Urban Insights is the glue that holds the real-world SimCity together. In the game, the player is essentially the planner making decisions about scarce resources and making their town work to its maximum efficiency. Urban Insights does the same thing in reality, allowing administrators to juggle their resources to keep traffic and people flowing at the optimum level.

We help transport planners and administrators make better decisions about employing scarce resources. Our analysis improves services and infrastructure loads, balances demand within the limits of capacity, and advances mobility and service quality for travellers.

The core of Urban Insights' offering is its consulting and service team that offers a unique combination of expertise. This includes:

- A deep knowledge of how transit agencies work and the problems, concerns and constraints they face; lessons learned as a leader in intelligent transportation solutions and services
- The technical know-how required to gather and fuse large, disparate data sets; apply predictive analytics and emerging data science techniques to expose insights and comprehend the information that's unlocked in an actionable form
- Established, transportation data-science processes that deliver the insights needed to achieve the desired outcomes

Urban Insights' consulting service is based on domain experience and a proven data science methodology. It is backed up with ApacheTM HadoopR, a distributed data processing platform that uses open software to process large data sets across clusters of servers. It is designed to scale up from a single server to thousands with a very high degree of fault tolerance.

But any data analysis relies heavily on the expertise of the Urban Insights' team. At the high level we define our consulting services and solutions offering in three key steps, namely, Gather; Comprehend; Act.

Gather: Urban Insights extracts and collects data 'as is' – in any format from whatever it lives. This is at odds from creating a data warehouse, using a complication extract/transform/load processes to convert and load data into pre-defined schemas.

Comprehend: During this stage, we analyse and present the results, meaning that we fuse the data from one domain into others, and perform tests and experiments to reveal

Urban Insights Outcomes

Urban Insights delivers data-driven insights that help shape the urban transportation networks of the future. Its analytic tools enable greater mobility and make cities' transport networks run more smoothly. Urban Insights provides the know-how, resources and next-generation tools to deliver on the promises of big data to yield greater insights. These will:

- Drive the efficient use of scarce resources
- Facilitate the balancing of travel demand with provisioned services and resources
- Help deliver optimal levels of service to the right locations at the right times
- Anticipate traveller response to service changes by predicting the impact on journeys
- Identify trends that warrant further investigation
- Identify stress points in transport networks and propose remedies
- Support frictionless travel across multiple modes of transport
- Advance service quality for riders with an understanding of their needs
- Enhance journey planning tools with customisations and real-time updates
- Facilitate the restructuring of transport networks to achieve strategic and operational objectives
- Comprehend travel demand in the form of journeys, rather than transactions, to improve the quality of transport networks
- Provide a greater understanding of and visibility into drivers of performance
- Anticipate future travel demands, demand elasticity, and the factors that influence them

insights. We then present these results in a meaningful way and in the same manner as those who need to understand the results. It is designed to answer any of the original questions and inform decision-making (in a way that non-technical domain experts can understand).

Act: Urban Insights uses the information to act on the data insights; by implementing repeatable processes, we can measure performance to help achieve desired outcomes. We also look forward and back to identify what else needs to be gathered, comprehended, and acted upon to reinforce this improvement cycle.

A RICHER MINE OF DATA

Big data now permeates all aspects of society. It is used to model how we live and interact. This includes traffic management, street lighting systems, water and air quality processes, pollution level controls, understanding demographics and everything in between.

That means in the future our tools and models will work in concert with data sources produced by operational systems as well as non-transit sources. These can include traffic and ITS data, weather feeds, economic and retail figures etc. All of these sources can improve transport management and planning activities.

Whilst transport authorities have information and advanced planning tools today that serve a specific purpose, by combining this information with additional data sources, Urban Insights delivers a much more dynamic picture. It can contribute to the effectiveness of a network, and consequently the satisfaction experienced by travellers.

Urban Insights' techniques let us combine fare data with other types of information in order to link travel segments into journeys. These are much more useful for planning purposes.

An additional factor that presented a challenge in the case of the San Diego Metropolitan Transit System is because its light rail network is 'open', so passengers don't need to pass through turnstiles before boarding. This configuration, whilst quite common, results in incomplete data. It demands the use of 'fuzzy logic' in order to account for these activities when fusing the data to present a more complete picture.

Urban Insights takes this approach much further by combining fare data and ticketing data with other sources, such as passenger counters, timetables, measures of on-time performance, and real-time vehicle location data. It makes the results much more complete and 'rich'. The fused data is advanced to comprehensive demand models that reveal the trends resulting from new developments. It includes the impact of service disruptions, usage patterns resulting from special events, and many other factors driving demand that cannot solely be determined by looking at fare collection data.

The result greatly enhances the visibility, completeness and accuracy of planning and simulation models. Perhaps most importantly it allows very specific customer questions to be addressed and answered.

PREDICTING THE FUTURE

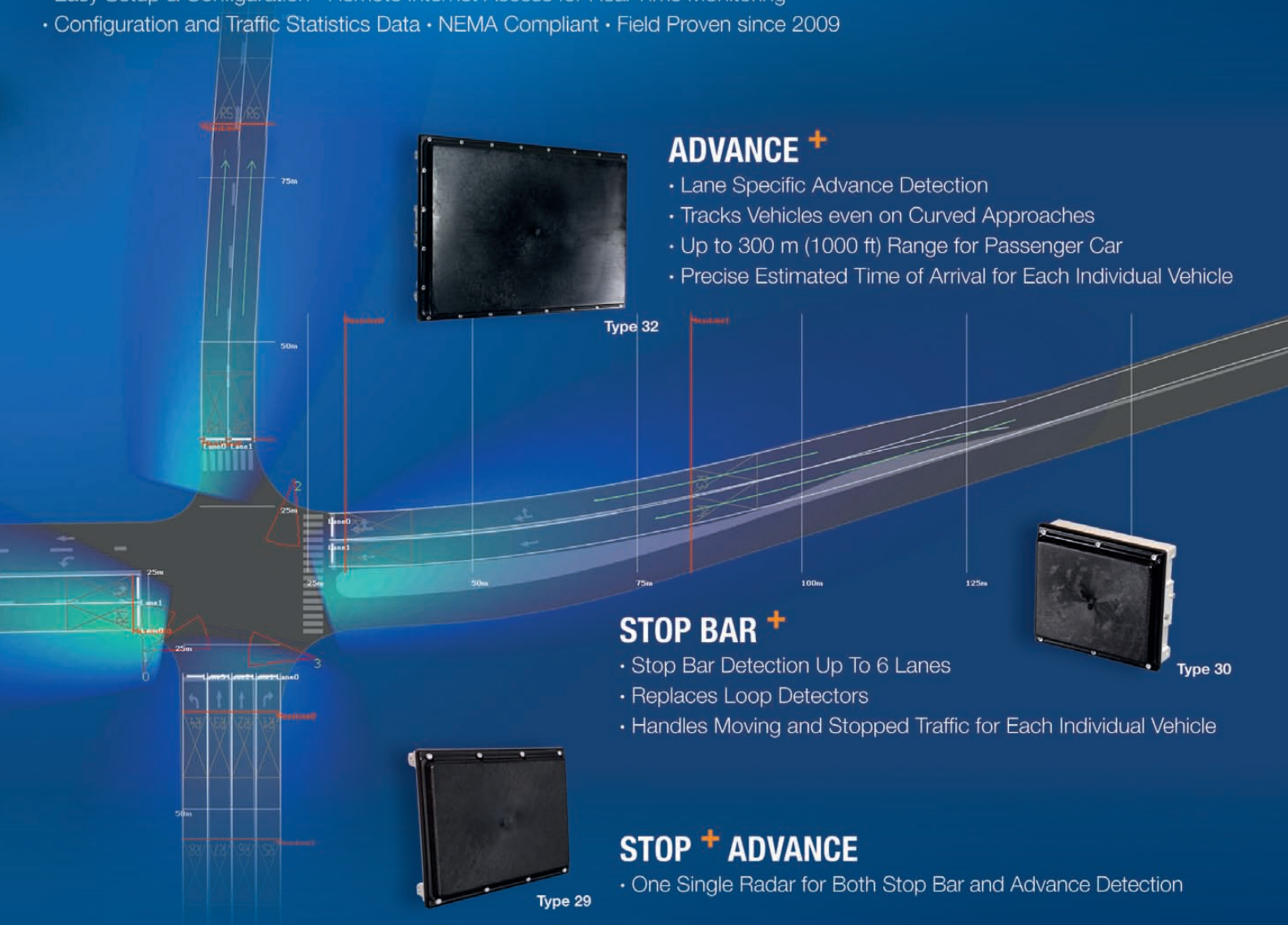
Having access to such rich data streams enables transport operators not just to react to the present, but also look to the future. Predictive analysis enables us to see how planned roadworks (such as lane closures) or transit maintenance projects (such as a subway line closure) impacts travel patterns.

Going back to the SimCity analogy, it is easy to visualise the effect of road closures or travel changes on a computer model. That level of detail is so much more sophisticated when you have real travel data patterns to rely on. The results can be interpreted to recommend the optimum

smartmicro
SMART MICROWAVE SENSORS GMBH

UMRR |
INTERSECTION MANAGEMENT RADAR

- Multi-Lane Object Tracking Radar • Installs on Road Side or Overhead
- Easy Setup & Configuration • Remote Internet Access for Real Time Monitoring
- Configuration and Traffic Statistics Data • NEMA Compliant • Field Proven since 2009



Type 32

ADVANCE +

- Lane Specific Advance Detection
- Tracks Vehicles even on Curved Approaches
- Up to 300 m (1000 ft) Range for Passenger Car
- Precise Estimated Time of Arrival for Each Individual Vehicle

Type 30

STOP BAR +

- Stop Bar Detection Up To 6 Lanes
- Replaces Loop Detectors
- Handles Moving and Stopped Traffic for Each Individual Vehicle

Type 29

STOP + ADVANCE

- One Single Radar for Both Stop Bar and Advance Detection

Smartmicro GmbH | In den Waashainen 1 | 38108 Braunschweig | Germany | www.smartmicrogroup.com | info@smartmicro.de

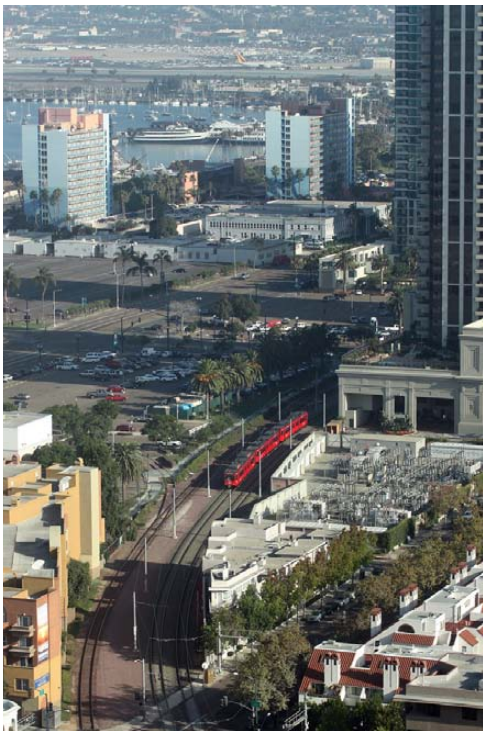
> ***Travel operators are already working with ways of incentivising people to use different travel routes by rewarding them with a discount on a coffee or an offer on an e-book***

change in transit schedules and communication strategy to deal with the impact. Using this information, planners can predict the impact of major unplanned events or interruptions on the transport network and beyond. They can also communicate alternative travel information to help individuals or groups navigate away from congestion hotspots and plan alternative routes.

Data analysis can minimise the economic impact of everyday events in the transport infrastructure that could otherwise lead to delays and frustration. These can include impact mapping of traffic incidents or vehicle breakdowns. Even everyday events, such as late bus despatch or breakdown, signal outage etc, can be given an economic impact assessment with recommended ways to eliminate or minimise the impact. On a bigger scale, Urban Insights can model and predict the impact of urban development projects and assist in their selection to achieve sustainability objectives.

On the same score, Urban Insights also provides the tools to deliver real-time in-journey information for the benefit of individual travellers. In understands individual journeys so can inform passengers of any delays or changes to their normal schedules. The ubiquity of mobile phones and instant internet-enabled communications means there is a two-way flow of information.

Passengers can log on to real-time information boards in a passive interaction with the network. Instead, transport operators can take a much more proactive approach and contact passengers who they know use certain routes. It means travellers can be alerted in advance of any changes or route alterations, heavily influencing their 'choice' of route.



San Diego's open light rail network means that fuzzy logic must be used in order to account for passenger data

It means with a bit of careful planning, potential bottlenecks or overcrowding can be avoided. Travel operators are already working with ways of incentivising people to use different travel routes by rewarding them with a discount on a coffee or an offer on an e-book. Once their journey choice is validated, passengers receive tokens which can be redeemed via their mobile phone, and is just one way that data can be used to influence traveller choice.

On a macro scale, analytical models can be used to model and predict the impact of planned expansion of transport networks with a clear understanding of the patterns of usage, the impact of land use, special events, holidays, employment etc. In the same way, if town planners want to build a major new sports stadium, or hold a major event, then impact assessments can determine when or where services should be adjusted, or how the public will react to geospatial factors, such as the number of nearby restaurants or taxi services, or how additional number of visitors can be accommodated.

In many ways therefore, The Sim City experience has been brought to life. It has the ability to make a major impact on the way towns and cities are developed, or transport networks evolve. The project with San Diego MTS is just the start of Urban Insights' global ambitions.

There are few cities across the world that will escape the increasing urbanisation and demand for finite resources. Only by working harder and smarter will we be able to cope with the increasing demand on city resources in the years and decades to come.

FYI

Matthew Cole is executive vice president and deputy for strategy, business development and diversification at Cubic Transportation Systems

info@urban-insights.com

The mind-shift for Smart Cities

Thinking Cities editor Kevin Borras asks **Dr Paul Vorster**, CEO of ITS South Africa, for his views on trends and prospects for ITS in South Africa. Below is a summary of his take on developments that will shape the future of a Smarter South Africa

It is quite funny that even when dealing with cutting-edge and even future technology and innovation how much we can learn from plain old-fashioned wisdom. One such example is Confucius who is quoted as saying that *"The most difficult thing is the decision to act, the rest is merely tenacity"*, says Paul Vorster, CEO of ITS South Africa.

VALUE OF WISDOM

These words of Confucius help the ITS Industry to highlight the "Rubicon" we have to cross to develop Smart Cities and elevate transport to the truly "smart level". The moment we – and our colleagues responsible for managing modern and mega cities – realise that the central spoke around which everything revolves is the ability to make appropriate and timeous decisions, the quicker we will make our cities and our transport systems truly "smart."

Says Vorster: We often discuss the so-called 'drivers' that will help to grow the ITS industry. We identify "drivers" such as increasing operational efficiency, the imperative to reduce the carbon footprint, the highly priority to reduce road fatalities. Perhaps we should identify the "need to take appropriate decisions" as the ultimate driver for the future of ITS.

"As industry we need to elevate our value to a policy and decision-making level by demonstrating our contribution to better strategic decision-making, in addition to the technical and operational benefits we introduce into the transport system."

When we as an industry achieve the positioning of ITS as a contributor to strategic decision-making and as a partner in migrating our metropolitan areas to become "smart cities", we will move from a line-item on the expense side to being rated as "invaluable" on the resource side, says Vorster.

"As the ITS industry we need to understand that Big Data in the Smart City context is essentially about appropriate decision-making on a strategic level. If not, we'll collect more and more data without converting it through the process to wisdom."

GLOBALISATION

In 1950, there were 83 cities of a million people or more. Today, there are 476. And demands on the world's transportation infrastructure are expected to exceed the rate of population growth manifold. Cities – both in industrialised nations and expanding economies such as South Africa – are in a battle to cope with an increase in demand and the systemic inability to build sufficient infrastructure to cope. For example, in the US as population grew nearly 20 per cent between 1982 and 2001, traffic

High-speed Gautrain, Gauteng, South Africa

Big Data in the Smart City context is essentially about appropriate decision-making on a strategic level

Johannesburg, with the Central Business District in the background, is South Africa's biggest city and one of three that make up the Gauteng Global City Region

Rea Vaya BRT bus at station, showing the level entrance from the station directly into the bus

jumped 236 per cent according to figures by IBM.

Globalisation, population growth and rampant urbanization, combine to overwhelm transportation systems in all parts the world, many of which were built to accommodate a fraction of their current load. This trend, linked to an aging infrastructure and often declining financial resources, have collective brought cities to the "tipping point" where the decision to act can no longer be ignored or postponed.

The negative effects of these overburdened systems in mature markets are not hard to quantify:

- Traffic congestion costs the European Union more than one percent of gross domestic product (GDP) — or over €100 billion per year;
- Twenty per cent of CO emissions are the by-product of transportation;
- US drivers wasted 4.2 billion hours, 2.8 billion gallons of fuel and US$87.2 billion due to traffic congestion in 2007.

These trends are inefficient and unsustainable. They're also incredibly expensive. They jeopardize the growth of businesses, cities, countries and entire regions, constricting economies and wasting money.

That's why operators around the world are gearing up for major infrastructure projects to break the logjams. It is estimated that in the next 20 years up to US$30 trillion will be spent on transportation infrastructure. And emerging economies are heavily

> ***We are on the verge of a transformative change for the world's transportation systems. We can measure, monitor and manage operations in real time***

investing in transportation to serve the needs of their swelling populations and to support economic development.

But we're going to need far more than just new infrastructure to solve these problems, because the cost of maintaining our existing roads, rails, equipment and terminals is already straining government budgets and corporate balance sheets.

Municipal leaders who run the complex network of diverse people, expected services and aging infrastructure are on a constant search for more efficient ways to analyse data, anticipate problems and coordinate resources in their cities. Fortunately, we are on the verge of a transformative change for the world's transportation systems. For the first time, we can measure, monitor and manage transportation operations in real time.

Today, urban dwellers are demanding a more interconnected approach to city planning in which major amenities such as traffic management, power and water interact with each other.

As governments infuse the basic systems of our planet with intelligence to stimulate economies and benefit citizens, we start to ask: Can the operations of government itself become smarter?

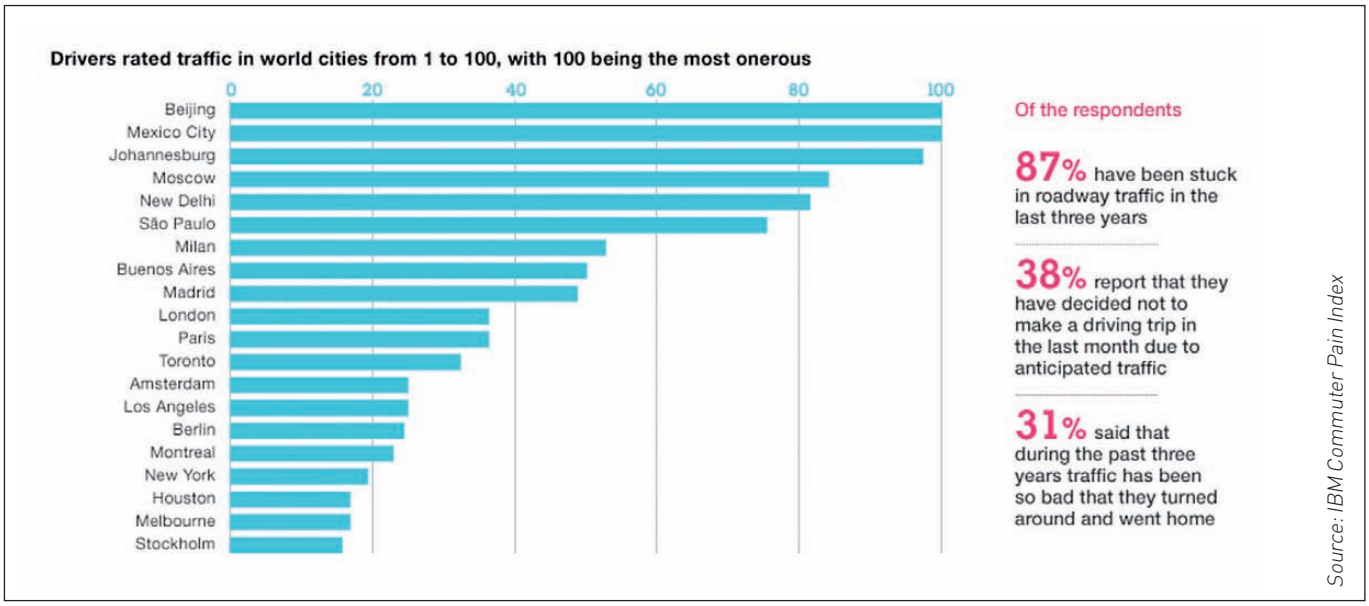
Our rapidly urbanizing planet depends on getting people and things from here to there. Our cars keep getting smarter. So how about our roads?

Transportation systems are the lifeblood of a functioning modern society. Despite this, infrastructures such as roads and railways are frequently inefficient and cost us valuable hours of productive time.

IBM COMMUTER PAIN INDEX

IBM compiled the results of the survey into an Index that ranks the emotional and economic toll of commuting in each city on a scale of one to 100 – with 100 being the most onerous. The Index reveals a tremendous disparity in the pain of the daily commute from city to city (see figure below). For example, the commute in Beijing is four times more painful than the commute in Los Angeles or New York, and seven times more painful than the commute in Stockholm, according to the Index. In South Africa, Johannesburg is rated as having the third worst commuter pain.

Johannesburg – the commercial centre of South Africa – is located in the central Gauteng Province and a very first decision point in addressing this mega city's challenges is to view it in its geographic context, just as



TOYOTA

SMART MOBILITY SOCIETY, Already Started

COMFORT
Next-generation telematics

ECOLOGY
Energy management

SAFETY
Cooperative ITS

CONVENIENCE
New urban transportation system

Dr Paul Vorster serves of the IRF ITS Policy Committee and is a past Senior Vice Chair of IBEC (International Benefit, Evaluation and Cost Working Group for ITS) and has recently been appointed to a panel off advisors to the newly-established Gauteng Transport Commission

the Greater London is more than the sum of its parts, says Vorster.

This holistic approach has resulted in defining the three metropolitan municipalities Johannesburg, Pretoria and Ekurhuleni) and the surrounding provincial area as the Gauteng Global City Region. For example, origin-destination studies show the uninhibited movement of people and goods across the municipal boundaries treating it as a whole (Global City Region) rather than as individual parts (Metropolitan and Regional Municipalities).

The principles and procedures required to create "smart cities" will equally apply to the Gauteng City Region. One recent policy decision – as one of the many building blocks required for the Gauteng Global City region – to become the anticipated "smart city (region)" has been the establishment of the Gauteng Transport Commission by Dr Ismail Vadi, Gauteng Minister of Roads and Transport.

Signatories to the Gauteng Transport Commission Agreement are the Gauteng Department of Roads and Transport, the three metropolitan municipalities of Johannesburg, Tshwane (Pretoria) and Ekurhuleni, as well as the seven local municipalities of Emfuleni, Lesedi, Midvaal, Randfontein, Westonaria, Merafong and Mogale.

The Transport Commission would act as a "transitional phase" on the road to establishing a fully-fledged transport authority. An advisory panel of transport specialists had been established and will support the Transport Commission.

The Transport Commission will also focus on the promotion, coordination and support of standardised intelligent transport systems, such as systems in support of integrated ticketing and fare management.

The City of Cape Town has been pioneers in paving the way towards smart city/smart transport by reconfiguring its transport department into a transport commission named "Transport for Cape Town".

INTEGRATED TRANSPORT MASTER PLAN

The Gauteng Transport Commission is part of a long-term strategic initiative, broadly termed the 25-year Integrated Transport Master Plan (ITMP25) commissioned the Provincial Minister for Transport, Dr Ismail Vadi.

At its core the ITMP25 is more than a transport plan. It sets out a plan to improve the lives of all Gauteng residents and to position our province as a great place in which to live and work, to be an attractive destination for foreign investment and tourism.

It presents a paradigm shift in spatial and transport planning. It serves as a point of departure from apartheid spatial planning; land use and mobility; and ushers in an integrated and equitable transport value chain, where public transport has the highest priority.

A detailed assessment was done of the current state of transport planning and implementation in Gauteng. The vision and objectives were consolidated from existing policy and planning documents such as the National Development Plan, the Gauteng Vision 2055 and integrated transport planning done by the various local authorities. The first output, based on an assessment of the status quo, was the 5-Year Gauteng Transport Implementation Plan (GTIP5). Its recommendations have been approved by the Executive Council (Provincial Cabinet) and are being implemented by the Department of Roads and Transport.

Comprehensive transport demand model was developed for the 25-year plan, in parallel to the development of the GTIP5. The key inputs and the main drivers of this model were:

- Demographic and economic forecasts;
- Spatial development and land use changes – looking at how the Gauteng Global City Region developed in recent years and how is it likely to change in future;
- Functional transport network plans for rail, public transport, freight and roads; and
- Interventions with a focus on land use, public transport, non-motorised transport (NMT) and freight.

The ITMP25 gives positive recognition to the value-adding role of ITS. The policy document includes aviation and cross-cutting transport system elements such as Intelligent Transport Systems (ITS), Geographic Information System (GIS) and sustainable ("green") transport.

Vorster tells *Thinking Cities* that as part of the strategic initiative the migrate towards an optimal transport system, ITS South Africa will host a Smart Cities/Smart Transport workshop in October 2014 and in May 2015 the biennial International i-Transport Conference and Exhibition will provide an exciting networking platform for local and international ITS role-players.

FYI

Dr Paul Vorster is CEO of ITS South Africa

paul@itssa.org

For more information about ITS in South Africa, visit www.itssa.org

ISOM
Business School
International School of Management
Educating Global Leaders

Global Executive MBA

Concentration in Transportation & Energy Infrastructures

Official Partner

THINKING Highways

A unique programme in close cooperation with the industry

Start of classes: January 30th, 2015
Pre-admissions open until December 19th, 2014

This Programme is designed to answer the executive education needs of two industries of growing importance at the global level. With a hands-on approach, the GEMBA-TREN covers the academic contents of a Global Executive MBA, and in addition provides a strong insight into case studies and real-life business situations of relevance to the transportation and energy industries.

Academicians and business executives with a broad international experience share their knowledge with the Programme's students through a combination of online learning sessions and in-class residential periods in London (United Kingdom). This learning approach allows a high degree of flexibility and time optimisation to high-level professionals with limited time availability.

The GEMBA-TREN targets primarily at experienced professionals active in the transportation and energy industries holding a University degree and a good command of the English language. However, up to 25% of the seats are available to recent graduates with a brilliant academic record.

For more information: www.isombs.org

Platform alteration

Reha Tözün raises an important question: do cities put enough effort into fulfilling their potential role as computing-platforms-cum-ecosystems for the applications, data and services that facilitate and assist their citizens' everyday lives?

Platform, in the context of ICT domain, is one of those flexibly used terms that moves about freely and seems to mean different things in different contexts. Very broadly put, a platform can be defined as a specific computing environment of hardware or software or a combination of both that enables software applications or ICT-based services to exist and operate on. It is a usual practice to refer to desktop or mobile operating systems (eg, iOS, Windows or Android), certain web-browsers (eg, Chrome), hardware architectures or even social networking sites like Facebook and Twitter, as platforms.

Independent of what type of platform is considered, a general agreement is that their "owners" wield considerable control over what happens on and through these platforms, not only in the technical sense, but also in the business sense.

As for the term ecosystem, we will adopt Jansen et al's definition of software ecosystems for this article: "a set of businesses functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts." Hence, when we talk about ecosystems in the following paragraphs, we talk about software-based business relations, services and added-value rather than software applications in bits and bytes alone.

Many cities use ICT systems very intensively and there are seriously respectable efforts in liberalizing the use of data by open data practices for the common good of all (and not free circulation of personal data). These efforts have even been interlinked in Europe across cities to unleash more creativity and added value for citizens. There are also quite a number of software firms out there that are happy to offer "software platforms" to manage the public services of a city.

It can be argued that the cities can start to think beyond data politics and ICT tools and contemplate a conscious decision to restructure how they approach, create and use ICT-technologies and solutions. On a similar note, it is high time that the citizens begin to see their city's data and ICT infrastructures as part of the public realm, not different than a downtown street or a park, - in other words they can, in fact should, see them as their "own" property.

CUSTOMER SATISFACTION

Today cities appear to be more like consumers of ICT products and services, like most of us individual citizens. Yet, there is serious leverage potential and power to gain for the cities, if they choose to develop themselves into computing platforms with attached ecosystems. Building on and going beyond their existing efforts with ICT tools and open data, cities can take the conscious decision

Today cities appear to be more like consumers of ICT products and services, yet there is serious leverage potential and power to gain if they choose to develop themselves into computing platforms with attached ecosystems

to go deeper, wider and higher and thereby co-define the ICT and business architectures anew.

As importantly as stimulating new arrays of solutions and services, this decision may bring us all one step closer to the democratization of the management of personal data. If city administrations assume a more active role of collecting, harnessing and protecting the data of their cities – among them the personal data, the citizens would gain a more direct influence over the decisions on the use of it. This, in return, would reduce the severity of the trade-offs that we have to make, when we allow the use of our data against the eventual benefits we receive. As more people buy in to the idea, we would have higher quality data, which help our cities to be more efficient and be better places to live.

ONE STEP FURTHER

Parallel to this, developing living and creating ecosystems around this new architecture is essential. Again here, we have seen innumerable IT clusters and networks and the like, which have served an enormous role as business networking platforms, but we can still go one step further. Our cities can create and feed these ecosystems, which can be the actual meeting and co-development forums for the stakeholders that create the actual ICT solutions.

The role of the ecosystem would be far from a static, centralized ICT-bureaucracy: technologies and customer behaviors shift constantly and

the cities need a dynamic development process that can keep up with them. This can hardly be done alone by city administrations. It is much more likely to happen with a living and breathing ecosystem of firms and other stakeholders that buy into the overall idea, push the development further and build healthy business cases. Having a technologically identifiable platform before them would provide IT-firms with an inviting entry point. Many of these, often young firms are used to operating in ecosystem-like environments, so the organizational form would not provide a challenge. IT businesses want for more than merely being able to survive. Their success would in return create jobs and added value that would make those cities more attractive places to live.

Another question relates to the identity of the stakeholders to be involved to co-develop such a construct. The research institutes, universities, networking stakeholders like chambers of commerce and IT firms of different sizes are bound to be part of this, but how can and should we involve the citizens from the outset? How can we create space for them to be active members of the ecosystem? Is there enough room here for the proverbial "teenage hacker in his/her bedroom"?

Yet another logical step would be to seek synergies in the creation of basic building blocks right from the beginning by linking European cities on meta-platforms. Not only for the obvious scale, efficiency and penetration effects, but also for the necessary infusion of a real European character, should this be considered seriously.

So this brings us back to the initial question: are cities doing enough to fulfill their potential role as software-platforms-cum-ecosystems for the applications, data and services that facilitate and assist their citizens' everyday lives? The short and admittedly subjective answer is no, not enough, not yet. There is, however, a whole lot of effort that goes into making our cities smarter. This article hopes to be the starting point for a discussion to re-think the essence of what makes a city smart.

FYI

Reha Tözün, PhD, is Senior Consultant T BridgingIT GmbH, based in Stuttgart, Germany

reha.toezuen@bridging-it.de

The author would like to thank Bart Kamp for his valuable comments and suggestions

The bigger the better

Cubic's **Dr Kevin Moat** sets off down the Big Data highway alongside *Thinking Cities'* **Nathan Dwyer**

As city populations grow, transport infrastructure has to cope with new demands and increased pressure on existing resources. Mining 'Big Data' makes cities smarter and helps predict future transport trends that can bring real benefits to transportation networks by making Big Data real.

"Cubic Transportation Systems recognises that cities are waking up to the power of data – data that is already being captured and stored – but not used," explains Cubic (ITMS) Project Manager Dr Kevin Moat. "With more than half the world's population now living in urban areas, we need to work to make cities better places in which to live and work. It is an important milestone – for the first time in human history more people live in cities than outside them. It is a trend that will continue with predictions that by 2050 more than two-thirds of the world's population will be city dwellers."[1]

With a finite level of resource, it is imperative that transport planners make better use of existing infrastructure. We can't widen the roads, or make train platforms longer, or bridges bigger, without massive investment. That isn't going to happen overnight. So, faced with an increased demand on our existing assets, our cities have to become smarter. Cubic's NextCity vision provides both operators and travellers with real-time, dynamic information that will make journeys faster and more reliable.

Says Moat: "Glasgow is an example of how it is making Big Data work. The city recently won funding in a contest run by the Technology Strategy Board, the UK Government's innovation agency, to demonstrate how technology makes life and transport in the city smarter, safer and more sustainable. Cubic has been at the heart of many of the transport improvements in Glasgow, as part of its Future Cities Programme, most notably the newly opened Glasgow Operations Centre. The high-tech facility brings teams together from the Community Safety Glasgow's (CSG) CCTV operation and Traffcom, the council team responsible for managing the flow of traffic in the city."

With the facilities now pooled, CSG and Traffcom have joint access to the city's entire network of live and recorded CCTV footage. The centre will also oversee the installation of advanced digital cameras across the city.

"Smart cities are no longer the next coming thing; they are here today and Glasgow is leading the way. It has become the 'Future Cities Demonstrator' to showcase how integrating its service can enhance the local economy and the quality of life for all. With health, transport, energy and public safety at the heart of its strategy, it is a test-bed for UK businesses to export their solutions around the globe. Driving all that is Big Data and Cubic is central in deploying the solutions to achieve transformational results."

SHAPE OF THINGS TO COME

Big Data may be a hackneyed phrase but it is here to stay. With the Internet of Things (IoT), information sensing devices such as mobile phones, microphones, cameras and RFID readers have given us greater insight into everything from transit trends to healthcare needs. The convergence of social, mobile, cloud and information, referred to by Gartner as the 'Nexus of Forces'[2], can be leveraged

REFERENCES

1. From the Technology Strategy Board, www.innovateuk.org
2. Gartner: Transform Your Business With the Nexus of Forces, 2014

> ***Large enterprises are often met with the challenge of determining who should own Big Data initiatives that***

Glasgow is a prime example of a city making Big Data work to its advantage

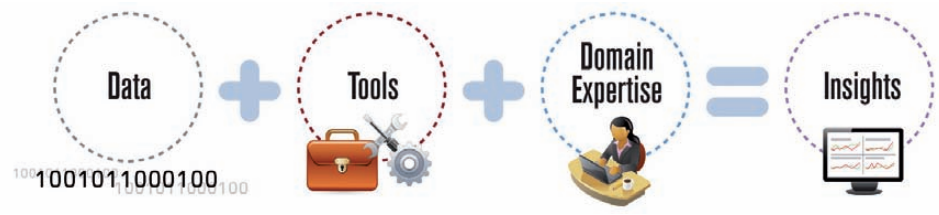
to make life easier for us all. Mined intelligently, data insights can lead to improvements that are immediately felt, from ensuring people's journey's go as smoothly as possible to making sure a hospital has enough medicine in stock to cope with an epidemic.

For transport solutions this can result in a reduction in travelling time, reduced fuel consumption, operational efficiency improvements and improved revenue management. Travellers can also benefit from more responsive transportation systems providing them with the information they need to make their journey more satisfying.

However, NextCity recognises that data is only one part of the equation: making best use of transport assets against a backdrop of burgeoning urban populations will require some behavioural change by the travelling public. Given that human beings can be notoriously resistant to change, psychology is a key component of NextCity. Using data to gain an understanding of what will motivate each individual to make small changes that collectively make a big difference enables operators to offer meaningful personalised incentives.

"All these benefits are only reaped if the challenges of Big Data – and there are many – are handled correctly," insists Moat. "There may be more devices collecting intelligence than there are people on the planet, but considering its current popularity, its curation, storage, analysis and visualisation are far from easy. To be interpreted correctly, Big Data needs personnel with the domain expertise to mine the information effectively. The data and the tools on their own don't do much unless they are in the hands of experienced personnel with deep industry knowledge."

Large enterprises are often met with the challenge of determining who should own Big Data initiatives that encompass the entire company. If this is hard enough for a multinational providing IT services, imagine what it is like for transport authorities in major cities with millions of citizens. They would benefit hugely from Big Data principles being applied to their transport needs, but



multiple privatised operators and fare policies make this difficult.

PREDICTIVE PATTERNS OF BEHAVIOUR

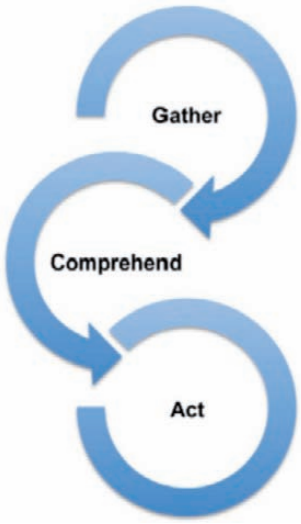
As Big Data begins to come to transportation, road planners can now combine volumes of transportation fare and vehicle information with even larger sets of information from other sources. They can apply a new generation of analytics and visualisation tools to get insights into what the massive amount of information is telling them.

The upshot is they will actually be able to predict what is likely to happen under different scenarios, making them far more effective at restructuring their transportation networks than they are today, as Dr Kevin Moat explains.

"NextCity is Cubic's vision of a fully integrated, whole-of-transport journey and payments management system that will enable operators to regulate demand by setting fees across all modes within a region, as well as empowering their customers to manage how they travel. By incentivising users to make minor adjustments to their travel patterns, at a macro level they can help spread demand to gain much-needed additional capacity at peak times.

"Cubic has a number of tools that can interpret and configure Big Data and provide dynamic, integrated, configurable and real-time information in all journeys occurring within each city. We not only prescribe the reporting and data warehouse functions for information, but can apply data science and predictive analysis to the information. By creating a holistic view of a city's transport journeys, we can remove the information silos that currently exist within the different operators, agencies and regulators. It also empowers these transport stakeholders to understand the demand for, and use of, the existing transport infrastructure to best determine where excess capacity exists, and where new capacity is required."

From an analytic point of view, Cubic has the power to gather information, comprehend its meaning, and act on the information presented. The data, combined with the tools and domain experience, provides us with the insights transport planners need. This information can be used to anticipate travellers' response to service changes by predicting the impact on journeys or identify the stress points in a transportation network and propose the potential remedies.



"Imagine, for instance, receiving a phone call or text message first thing in the morning. It is from your local transport agency," elicits Moat. "They know today is a workday and you are due to set off on your drive to work at 7.30am, a journey that usually takes 45 minutes. But today there has been an accident and a critical junction on your route is closed. The message informs you that you need to set off 15 minutes earlier and provides an alternative route so that you can get to work on time. This is an example of predictive travel information. Because the user has chosen to let the transport agency know their travel patterns, and understand their regular movements, they can apply that knowledge to an intelligent response to the users' situation. The fact is that everyone who uses that route can receive personalised messages geared to them and their routine, or used to influence their travel behaviour to make sure the network runs at its optimum efficiency."

This is the essence of Big Data in being able to interpret, predict and respond to situations in real-time. Big Data can also be used in other ways; if there is a transport delay and travellers have to wait for their next ride, operators can lessen the impact by providing incentives for other services, such as discount vouchers to buy a morning coffee or a local offer at a book store – dependent upon their previously stated choices. It is about understanding and interpreting customers as individuals.

THE TECHNOLOGY SHIFT

Over the past 10 years, there have been two great shifts in the use of technology that has enabled authorities to track passenger movements much more accurately. The first is the ubiquity of web-enabled mobile handsets, which has put an input (and output) device into the hands of most travellers and operators. Allied to this is the emergence of reliable high-speed networks and Cloud technology, which has allowed an almost instant two-way flow of information.

Dr Moat says: "Connecting the in-vehicle Controller Area Network (CAN) bus with smart phone technology has enabled sensor information, such as vehicle position, speed, air temperature and rain detection (via automatic wipers) to be collected and presented as Big Data. Cubic has the vision, knowledge and experience to capture this data and aggregate it into meaningful intelligence that can be exploited by traffic authorities and other interested parties and

> *Over the past 10 years, there have been two great shifts in the use of technology that has enabled authorities to track passenger movements much more accurately*

Just as Glasgow has started to use data to improve the city's service provision, other cities will follow suit

delivered back directly to motorists. This dramatically reduces the cost of sensor and drive technology needed at the road side; but it does call for a change in practice in how the user can support the supply and receipt of Big Data information."

For the road user, this will help them avoid delays, increase access to the transport networks and a wider range of journey choices and deliver capacity to carry more people. In the future, we should start to look at viable alternatives to the use of personal automobiles, such as car sharing schemes, in order to free up more space on the roads.

In the same way that we need to understand who travels where and when to improve travel times, we can also use the data in other ways. A better understanding of who is travelling and when and where they are doing it provides invaluable opportunities for targeted advertisements. Location based advertising can identify when a potential customer is in the vicinity and send a personalised sat-nav message, SMS or banner ad, for instance. It provides a potential new revenue stream for both travel operators and retail partners.

This kind of transformational thinking means governments and operators need to analyse their existing infrastructure, current events, and market demand in radically new ways. It will require a highly flexible information management technology solution.

BIG DATA IS BIG

To do so will require a completely different mind-set in the way companies handle data. This 'new' data needs to be augmented with existing data, such as highway traffic loads, the weather, special events, CRM, demographics, real-time positioning, etc. to give a fully rounded view of travelling conditions. All the advantages that derive from the use of Big Data come at a cost and the volume of data must be managed accordingly.

Data is also not a one way traffic flow. Travellers can provide information from mobile devices, web sites, social media posts, or from real-time traffic sensors. These data sets often provide an accurate read on the transport network and infrastructure status. The ability to manage and integrate these and other types of unstructured data is the way to differentiate a truly great future city service.

"In the past we have focused our attention towards objective data received via sensor technology," Moat points out. "But as our youth of today transitions towards a heuristic control of information (for example, crowdsourcing), we need to develop cleverer means of managing conflicting information and to exploit the benefits of techniques used in other business environments such as the gaming industry. Encouragement will be provided by receiving a useful service in return for the supply of information and through the receipt of virtual benefits, for example a score against your own profile like in online games. These capabilities allow transit agencies to refine the way they serve passengers, perform

planning, support operators and help other stakeholders, such as advertisers."

Discovering insights that will drive transport agencies to change the way they do business will require using data much more intelligently and apply next-generation technologies that have been successfully applied by companies such as Google, Facebook and Yahoo to perform sophisticated analytic routines against very large data sets.

THE MARKET CONCEPT

Transport operators across all modes face one distinct challenge: it's very difficult to improve what we can't see or can't measure. The transport sector often throws up complicated cross-functional challenges and decisions are frequently based on intuition, rather than cold hard facts. When operators do have access to information, it is difficult to collate or takes too long with which to do anything meaningful. The need to provide better passenger information often takes second place to the drive for cost efficiencies and overhead reductions.

Data helps to cut through the information fog. It enables operators to see all the transactions made and creatively analyse what has happened during the course of the journey. Over time, and through predictive analysis, it turns this into an increasingly reliable forecast of what will happen in the future. It also provides system-wide visibility, insight and decision support to a business' back office.

"Data analytics accurately record transport activities, transactions and journey movements," Moat explains. "From here, Cubic's data analytic abilities allows transport authorities and agencies to better understand operational drivers, and make more well-informed decisions. Predictive models can be implemented to support process improvement within a business or transport model and feeds directly into Cubic's NextCity vision, where travellers use one integrated account for use across all modes of transport in a city, whether road, buses, trams, cabs, car share or rail."

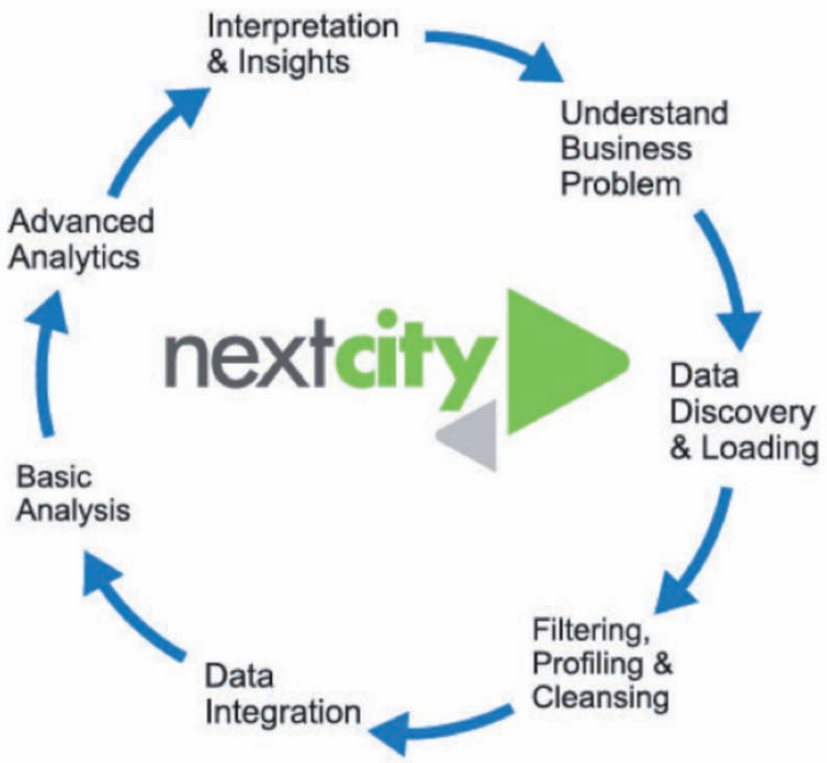


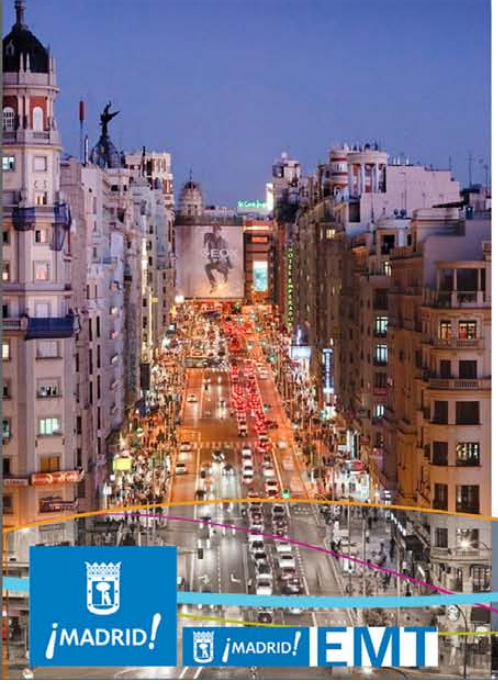
Fig 1.1

1. **Understand the business problem**
2. **Data discovery and loading**
3. **Filtering, profiling and cleansing**
4. **Data integration**
5. **Basic analytics**
6. **Advanced analytics**
7. **Interpretation & Insights**

Data can be used for a variety of predictive planning. On the macro level, it can record passenger density levels for routes across the city, or the flow of passengers into and out of transport hubs. This information is vital for effective city planning measures. Below ground, on the Metro network, data can be used to capture and record passenger movements using travel card information; this in turn can model the demand and compare that to the supply of services. An understanding of travel patterns across the network also leads to a prediction of the response to change.

Data visualisation is vital in interpreting these patterns. Through the application of innovative state-of-the-art visualisation techniques, analysts and planners are better able to get actionable insights from massive data sets. They can also model different scenarios and then more effectively and rapidly communicate the conclusions to other stakeholders, making them far more effective at measuring citywide transportation networks than they are today.

Dr Kevin Moat takes up the story: "Armed with broader perspectives and deeper insights, planners can more effectively balance demand against capacity when restructuring services. For example, knowing the



2014 ANNUAL POLIS CONFERENCE
27-28 November 2014 in Madrid
Innovation in Transport for Sustainable Cities and Regions

2014 Annual POLIS Conference 27-28 November 2014, Madrid

The 2014 Polis Conference is a major platform for cities, metropolitan areas and regions to exchange on their transport challenges. High-level plenary sessions are complemented by technical sessions showing innovation in policy and practice across the transport spectrum.

Programme, side events, registration and exhibition possibilities:

http://www.polisnetwork.eu/2014conference

The Polis conference features the latest innovative transport solutions and policies implemented in cities and regions across Europe, including:

- Rotterdam's sustainable mobility agenda,
- how Örebro encourages active travel, and
- Reading's use of cloud solutions for traffic management.

HIGH LEVEL SPEAKERS INCLUDE:

- **Magda Kopczynska** (Director, European Commission DG MOVE),
- **Francesca Racioppi** (Senior Policy and Programme Adviser WHO Europe),
- **Pierre Serne** (Vice-President Ile de France Region),
- **Gerrit Riemer** (Director of Future mobility, General Motors),
- **José Viegas** (Secretary General International Transport Forum),
- **Marcia Pincus** (US Department of Transport),
- **Pascal Smet** (Minister for Transport, Brussels Capital Region),
- **Sir Albert Bore** (Leader of Birmingham City Council and member of the Committee of Regions),
- **Christine Revault D'Allonnes Bonnefoy** (Member European Parliament Transport Committee), and
- **Ana María Pastor Julián** (Minister of Public Works and Transport, Spain).

SUPPORTED BY THINKING cities

origins and destinations of passengers' journeys lets planners determine not just how many people will be impacted by a schedule change, but what their re-route possibilities are. It can determine the actual time impacts on their journey, letting planners assess the real customer travel implications of the changes they make. It also helps regulatory reporting, where an agency or regulatory authority can present information in a way that supports larger national planning initiatives and directs funding to where it can serve the higher purpose."

On a micro level, an understanding of people as individuals will give transport agencies an edge at providing the personalised information people need to make their lives easier. It is what will lead to the early morning warning call about transport delays, or influence individual travel behaviour by offering personalised incentives for choosing a particular mode of travel – by offering a discount at a coffee store for travelling on a certain road rather than a 'normal' route for instance. It is what makes travel individual and personalised for every single user on the network.

GAME-CHANGING DATA

A conventional database is quite inflexible to change. However, Cubic's solution, says Moat, keeps pace with the rapidly changing requirements, size and granularity of data. Whereas other suppliers house data outside of mode or specific 'silos' that are not integrated, Cubic's solution stores and manages data in a single, central database. This enables raw data to be synthesised to provide meaningful insights across a whole city or region, regardless of the multiple operators.

"In particular, our solution applies predictive analysis to reveal the subtle factors that impact cost, revenue and customer satisfaction. Combined with historic trends, predictive analytics leverages new insights into what is likely to happen in the future under different scenarios, helping planners achieve the optimal allocation of resources."

It must also be able to handle the sheer number of disparate sources of data that need to be accommodated in a typical transport network. The analytic model (fig 1.1) shows how a transport operator will typically go through each of these stages to maximise the benefits derived from the data they capture and use.

The way data is used transforms the way transport operators use and think about data. It has a game changing capability to influence the ability of transit agencies to become more customer focused, raise additional revenues and realise a central core of Cubic's NextCity vision.

"Just as Glasgow has started to use data to improve the city's service provision, other cities will follow suit. Cubic has been instrumental in providing the technology in the new Glasgow Operations Centre, which acts as a platform to collect, validate and analyse data in order to make real-time decisions on the city's infrastructure network," Moat proudly points out.

The information feeds into Glasgow's city dashboards, a shared operational management platform accessed via mobile phone. It alerts users to traffic incidents, live rail updates, corridor travel times, emission alerts and energy consumption levels across the city on a real-time basis.

The accompanying 'My Glasgow' app monitors street lighting conditions, A&E waiting times, water levels, people movements and crime risk spots across the city, all of which is customised to the needs of the user.

The public can also access an interactive map portal to explore and contribute to spatial datasets based on various themes, such as Active Travel, food growing networks and public safety. The map portal empowers communities to provide additional feedback with access to reporting tools. Open portals, such as OpenStreetMap, and GIS software allow environmental, social and economic information to be updated by Glasgow's citizens.

"Glasgow has become a pioneer of Future Cities, providing a two-way flow of information to keep people moving," concludes Moat. "Its use will be closely monitored by many other cities over the next few years as a potential road-map for how to effectively manage resources now and in the future. Glasgow is just a snapshot into the power and potential of data – as systems develop and evolve around the world, the sophistication and capability of information has the power to transform the way we live and enhance the quality of life for everyone in a city environment."

FYI
Dr Kevin Moat is ITMS Project Manager at Cubic Transportation Systems
kevin.moat@cts.cubic.com
www.cts.cubic.com

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 for everyone; the financing of public transport and transport projects generally; and regulation, planning and governance.

- **Middle East** – What's driving smart city culture
- **Public Transport** – Planning to provide the perfect service
- **Smart Finance** – Data transactions underpin any smart city
- **Funding** – 2014-2020 funding opportunities
- **Gamification** – More of us must travel sustainably more often
- **Frankfurt, Germany** – Improvement instead of reinvention

In terms of the thinking city, the Middle East is one of the most forward-thinking and innovative regions in the world

A new dynamic

Paul Doherty on how the combination of economic growth, societal needs and human aspiration is establishing a Smart Cities culture throughout many of the urban centres of the Middle East. Dynamic Middle Eastern cities – including Dubai, Abu Dhabi, Jeddah and Doha – are creating Smart City projects and programs, setting a rapid pace of development and implementation

> ***Four drivers are influencing governments in the Middle East to plan and implement Smart City projects and programs, not by choice, but out of necessity***

Smart Cities are designed and developed to provide citizens, workers and visitors with a safe, healthy and sustainable environment in which to live and work. With strong government policies and programs that have been developed over recent years to move cities away from a dependency on hydrocarbon energy and into clean technology energies like solar and wind, the cities of the Middle East are emerging as the global benchmark for alternative energy generation, transmission and consumption. These cities are using their move toward clean technology as the foundation to a larger Smart Cities strategy.

As a key part of their energy infrastructure development, Middle Eastern cities are developing smart grids to help better manage their energy needs. Smart grids will not only improve network resilience and reliability, but they will also result in better energy efficiencies and overall savings. In the context of Smart Cities, the use of smart grids enhances a city's quality of life, creating an environment for innovation. The Middle East can leverage emerging smart grid infrastructure as an opportunity to create a better educational experience, higher-level jobs, a more efficient transport system and improved healthcare in a cleaner environment.

Although the UAE has a national Smart Cities plan, Abu Dhabi and Dubai are planning and implementing two different approaches, explored here in detail, along with King Abdullah Economic City (KAEC and pronounced 'cake') and Kingdom City, two new Smart Cities on the West Coast of Saudi Arabia, each with its own strong identity and different Smart City needs. Finally, Qatar is examined in advance of the 2022 FIFA World Cup, which has been a catalyst for Qatar's capital of Doha to emerge as a Smart City.

Four drivers are influencing governments in the Middle East to plan and implement Smart City projects and programs, not by choice, but out of necessity. First, these cities want to move their collective economies from fossil fuels to alternative energy sources. The Arab Spring uprisings have forced all Middle Eastern countries to re-evaluate their governance, economic policies and communications with citizens, leading to fundamental changes in job creation, greater educational opportunities and the creation of more transparency in government program goals, processes and results.

Second, the populations of most Middle Eastern countries are very transient, prompting a move from nation-state to city-state countries. In Qatar, where migrant workers comprise a majority of the population, the government is making accommodations for guest workers by providing housing, healthcare, transportation and education. Qatar needs these migrant workers to stay to build massive infrastructure projects in time for the 2022 FIFA World Cup.

Third, regional security and religious conflict are always a risk in the Middle East, but through policy and action, the more secure and flourishing regions of the Middle East, such as the Gulf Cooperation Countries (GCC) of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates are emerging as examples of stability throughout the rest of the Middle East.

Finally, the Middle East's large youth population and the education and job creation necessary to accommodate these citizens is another primary concern that has found its way into the planning discussions of Smart Cities throughout the region. The young, educated and well-connected population of the Middle East is demanding change and they want it now.

The urban population of the Middle East averages 88 per cent of the entire population for all countries in the Middle East, and estimates show the population of the Middle East will double by 2050, with the urban population percentage rising even more. With the four drivers of influence growing at an unprecedented rate, the cities of the Middle East cannot afford to fail at their Smart City strategies, projects and programs.

United Arab Emirates

The United Arab Emirates (UAE) – made up of the emirates of Abu Dhabi, 'Ajman, Al Fujayrah, Ash Shariqah, Dubai, Umm al Qaywayn and Ra's al Khaymah – has an urban population comprising 84.4 per cent of its total population and enjoys stability in its society, economy and political system.

The UAE's per capita GDP is on a par with those of leading Western European nations. Its high oil revenue and moderate foreign policy stance have allowed the UAE to play a vital role in the affairs of the region. For more than three decades, oil and global finance drove the UAE's economy. However, in 2008-2009, the confluence of falling oil prices, collapsing real estate prices, and the international banking crisis hit the UAE especially hard.

The UAE has essentially avoided the Arab Spring unrest seen elsewhere in the Middle East, though in March 2011, political activists and intellectuals signed a petition calling for greater public participation in governance that was widely circulated on the Internet. In an effort to stem potential further unrest, the government announced a multi-year, US$1.6 billion infrastructure investment plan for the poorer northern emirates.

The UAE has an open economy with a high per-capita income and a sizable annual trade surplus. Successful efforts at economic diversification, a key component for Smart City development, have reduced the portion of GDP based on oil and gas output from 55 per cent to 25 per cent. Since the discovery of oil in the UAE more than 30 years ago, the country has undergone a profound transformation, from an impoverished region of small desert principalities to a modern state with a high standard of living. The government has increased spending on job creation and infrastructure expansion and is opening up utilities to greater private sector involvement.

The country's Free Trade Zones, offering 100 per cent foreign ownership and zero taxes, are helping to attract foreign investors.[1] Within this framework, two of the emirates of the UAE, Dubai and Abu Dhabi, are not just leading in transforming into Smart Cities but are emerging as global leaders in strategy, projects and programs of Smart Cities worldwide. Incentives for foreign direct investment, regional headquarters and tax free zones are attracting foreign companies to the UAE, creating a strong foundation for a sustainable economic future while creating a market need for Dubai and Abu Dhabi to introduce smarter ways of conducting business, servicing citizens and nurturing a society that thinks of its environment in a holistic manner.

Downtown Dubai: since the discovery of oil in the UAE more than 30 years ago, the country has undergone a profound transformation

CHALLENGES

The global financial crisis, tight international credit and deflated asset prices constricted the economy in 2009, creating a difficult environment for Smart City development. UAE authorities tried to blunt the crisis by increasing spending and boosting liquidity in the banking sector, but those measures were not enough.

The crisis hit Dubai hardest, as it was heavily exposed to depressed real estate prices. Dubai lacked sufficient cash to meet its debt obligations, prompting global concern about its solvency. To avoid this crisis, the UAE central bank and numerous Abu Dhabi-based banks bought the largest shares of Dubai's debt. In addition to this bailout, in December 2009, Dubai received an additional US$10 billion loan from the emirate of Abu Dhabi that has stabilized Dubai's finances and created the opportunity for Dubai to continue its growth.

Dependence on oil, a large expatriate workforce and growing inflation pressures are significant long-term challenges to Smart City development. The UAE's strategic plan for the next few years focuses on diversification and creating more opportunities for nationals through improved education and increased private sector employment.[2]

NOTE

1 US Central Intelligence Agency, The World Factbook https://www.cia.gov/library/publications/the-world-factbook/geos/ae.html

2 US Central Intelligence Agency, The World Factbook https://www.cia.gov/library/publications/the-world-factbook/geos/ae.html

The close relationship that has emerged between Abu Dhabi and Dubai in the wake of the financial crisis has also highlighted the differences between each city. Since the bailout, Dubai has been regarded as an open city that is more tolerant of foreign customs and behaviors, allowing its tourist industry to thrive in the region. However, Abu Dhabi has been seen as having more influence over social issues, and certain tightening of rules has been put into place, slowly, since 2010. Aside from this, the differences are noticeable since each city is acting as its own city-state in how it prioritizes urban issues and delivers Smart City solutions.

For Dubai, the awarding of the 2020 World Expo, is serving as a catalyst for many projects, including the new Dubai Airport and the expansion of the Port of Dubai and other programs that will further transform this former fishing and trading outpost into a world-class Smart City. Meanwhile, as the capital of the UAE, Abu Dhabi is transforming itself as a leading global example of sustainable design, construction and operations with projects such as the US$27 billion Saadiyat Island multiuse sustainable development and the US$18 billion Masdar City development, positioned to be the flagship global center for renewable energy.

Dubai Silicon Oasis

As the setting for the 2020 World Expo, Dubai aims to incorporate as many Smart City solutions as possible. In late 2013, Dubai's leader Sheikh Mohammed bin Rashid Al Maktoum announced an ambitious Smart City initiative that includes more than 100 projects in transportation, communications, infrastructure, electricity, economic services and urban planning. Some of these projects include a physical address system, an expansion of their urban rail system, a new airport and the development of Smart City real estate projects like Dubai Silicon Oasis. The strength of this program will help position Dubai to advance Smart City development. The emirate has also recently made a strong push in terms of citizen engagement by providing key services and smartphone apps. It is also building its partnership ecosystem by working closely with service providers, technology vendors, and Information and Communications Technology (ICT) leaders, such as SAP, Schneider Electric and Advanced Micro Devices (AMD), within the UAE and abroad.

Dubai aims to incorporate "smart" initiatives into six key pillars: the economy, the lifestyle of its population, transportation, governance, the environment and future generations (in terms of communication, integration and cooperation). The goal is to transform Dubai into the smartest city in the world between 2014 and 2017.

The Dubai Silicon Oasis Authority (DSOA), established in 2004, is one pilot project of the Smart City Dubai initiative. The DSOA is owned by the government of Dubai and is the only technology park in the region that provides an integrated living and working community. Silicon Oasis is a free zone authority that provides a full package of incentives and benefits to companies operating within the free zone.

DSOA opened the US$299 million Silicon Park, its first integrated Smart City project, in April 2014. The project comprises over 1 million square feet of office space, 270,000 square feet of retail space and approximately 215,000 square feet of residential space along with a 115-room hotel. The Smart City development will also include lifestyle amenities such as running tracks, cycling trails, prayer rooms and underground parking for 2,500 cars.

Electric-powered vehicles and smart rechargeable bikes will be the primary means of transportation throughout Silicon Park, with charging

Dubai's Silicon Oasis headquarters

stations widely available. Smart light poles are being equipped with digital signage that can be remotely controlled with apps, along with free Wi-Fi and charging stations for personal devices. Another example is the implementation of advanced technologies to control water consumption through recycling procedures in the home and at the office. These developments at Silicon Park are raising the bar on what it means to shape an intelligent environment that provides maximum comfort and well-being for its visitors, workers and residents. The goal of Silicon Park is to provide the best Smart City solutions and systems so it becomes the model for future Smart Cities throughout the Middle East North Africa (MENA) region and a benchmark worldwide.

Abu Dhabi

Abu Dhabi is the capital of the UAE and uses this leadership role to lead by example in areas such as economic development, job creation, security, safety, sustainability and Smart City solutions. Abu Dhabi has a growth framework called "Abu Dhabi 2030" that has its roots in *estidama*, an Arabic term meaning sustainability with a focus on energy and water efficiency. The Abu Dhabi municipality also understands the role it must play in improving energy efficiency and reducing carbon emissions while moving away from fossil fuels toward clean energy and a more diversified economy. Abu Dhabi 2030 is a coordinated citywide effort to address these issues in combination with focused Smart City strategies. The Abu Dhabi municipality has allocated US$4 billion to be used for Abu Dhabi 2030 with initial projects focused on technology that will make it easier to live, visit, navigate and do business in Abu Dhabi.

One major project that is being coordinated with the Department of Municipal Affairs is the modernization of its streets, in terms of addresses and signage. Abu Dhabi, along with most major Middle Eastern cities, does not have a system for street addresses in line with international best practices. To deliver mail, food, appliances or furniture, a resident must give the delivery person directions using landmarks. This often leads to errors and wasted time, money and resources. The safety and well-being of residents are increasingly at risk since emergency services also rely on landmarks to navigate around Abu Dhabi.

A Smart City initiative, currently being implemented, will digitally map addresses, rename (and geo-name) streets, and tie the system to a digital signage program. This municipal project, called *Onwani* (Arabic for "my address"), will provide tremendous value to Abu Dhabi by improving both emergency response times and utility services by accurately identifying defective water pipes and electric outages; it will also monitor neighborhood consumption. This can also boost the economy by increasing the likelihood of online shopping. The emergence of smarter solutions for delivery, distribution and navigation for residents and visitors is also expected to spur more tourism.

Francisco Anzola

The Abu Dhabi municipality has allocated US$4 billion to be used for Abu Dhabi 2030

Saudi Arabia

Since King Abdullah of Saudi Arabia ascended to the throne in 2005, he has worked to incrementally modernize the Kingdom of Saudi Arabia (KSA). This modernization has involved a series of social and economic initiatives that expand employment and social opportunities for women, attract foreign investment and increase the role of the private sector in the economy.

In early 2011, in response to unrest, King Abdullah announced a series of benefits to Saudi citizens, including funds to build affordable housing, salary increases for government workers and unemployment entitlements—the foundation of Saudi Arabia's Smart City programs.

The country remains a leading producer of oil and natural gas and holds about 17 per cent of the world's proven oil reserves. The government

The Kingdom of Saudi Arabia has undergone something of a modernisation since 2005

continues to promote foreign investment and pursue economic reform and diversification, particularly since Saudi Arabia's joined the World Trade Organization (WTO) in 2005.

Saudi Arabia's urban population is approximately 83 per cent of its total population, making its transformation into a Smart City a critical domestic challenge for future growth and social stability. Saudi Arabia has an oil-based economy with strong government controls over major economic activities. It possesses about 16 per cent of the world's proven petroleum reserves, ranks as the largest exporter of petroleum, and plays a leading role in the Organization of the Petroleum Exporting Countries (OPEC).

The petroleum sector accounts for roughly 80 per cent of the country's budget revenues, 45 per cent of GDP, and 90 per cent of export earnings. Saudi Arabia is encouraging growth of the private sector in order to diversify its economy and to employ more Saudi nationals. Diversification efforts are focusing on power generation, telecommunications, natural gas exploration, and petrochemical sectors.

Over 6 million foreign workers play an important role in the Saudi economy, particularly in the oil and service sectors, while Riyadh is struggling to reduce unemployment among its own nationals. Saudi officials are particularly focused on employing its large youth population, which generally lacks the education and technical skills the private sector needs. Riyadh has substantially boosted spending on job training and education, most recently with the opening of the King Abdullah University of Science

and Technology – Saudi Arabia's first co-educational university. As part of its effort to attract foreign investment, Saudi Arabia acceded to the WTO in 2005. The government has begun establishing six economic cities in different regions of the country to promote foreign investment and plans to spend US$373 billion between 2010 and 2014 on social development and infrastructure projects to advance Saudi Arabia's economic development.[3]

CHALLENGES

A burgeoning population, water aquifer depletion, and an economy largely dependent on petroleum output and petroleum prices are ongoing challenges in Saudi Arabia. Another challenge is the Arab Spring – a series of revolutionary protests and demonstrations that have been happening in the MENA region since 2011. In some cases, the overthrow of governments has occurred while in other cases civil unrest and wars have erupted. The driver for many of these protests and demonstrations is poor economic conditions for many young males living in MENA.

The Arab Spring is reverberating in Saudi Arabia, driving King Abdullah to make changes to maintain peace and control. The Kingdom of Saudi Arabia has more than 13 million citizens, half of whom are under 20 years old. King Abdullah has set goals to create more than a million new jobs and 4 million homes within the next 15 years. He has a vision to develop an economy less dependent on oil and run by a new class of professionals, including architects, doctors, engineers and businessmen who can thrive in a global marketplace.

If the Kingdom of Saudi Arabia does not achieve its goal of creating Smart Cities, there could be more intense clashes with militant forces that could ripple across the entire region, causing instability in the markets. Conversely, resistance from the country's conservative religious establishment to the government's Smart City projects could also slow down progress.

Two new Smart Cities under construction – Kingdom City/Kingdom Tower and King Abdullah Economic City – are in the area surrounding the port city of Jeddah on the Red Sea, a relatively stable area of Saudi Arabia near the Holy Cities of Mecca and Medina. The success of these projects will be the framework for future new cities throughout the region.

NOTE

3 US Central Intelligence Agency, The World Factbook https://www.cia.gov/library/publications/the-world-factbook/geos/sa.html

Kingdom City and Kingdom Tower

In the northern area of Jeddah, near the existing King Abdulaziz International Airport, construction of the iconic Kingdom Tower is now underway. When completed in 2017, the estimated US$1.23 billion tower will surpass the 827-metre high Burj Khalifa in Dubai as the tallest building in the world. It is part of a US$20 billion development by Kingdom Holding Company, a firm owned by Prince Al-Waleed bin Talal city. The tower will have 200 floors and require about 5.7 million square feet of concrete and 80,000 tons of steel. It will host mixed-use commercial, residential and resort facilities, including offices, residential units, a school, hotels and retail facilities. A bridge under construction across Obhur Creek links the site to the city center and airport. Both Kingdom City and Kingdom Tower can be viewed as two cities in one location; one is vertical, and the other is horizontal, but both are designed to be Smart Cities. The tower will be one of the first to be built as a vertical city, incorporating Smart City fundamentals into a Smart Building entity.

Smart City fundamentals that will be employed in development of Kingdom City and Kingdom Tower include:

- Maintaining/Enhancing Quality of Life
- Information and Communications Technology (ICT) Management
- Safety/Security
- Resource Management (Natural and Man-Made)
- Energy Management

When complete the Kingdom Tower, north of Jeddah, will be the world's tallest building

Reliable Free-Flow Tolling for Modern Cities

- **TollChecker**
- Multi-lane free-flow
- Video and DSRC tolling
- Exceptional performance rates
- Excellent cost-benefit ratio
- Modular and scalable design for all lane layouts and applications
- Simplified installation, service and maintenance

www.vitronic.com

VITRONIC
machine vision people

- Waste Management
- Air Quality
- Education
- Healthcare
- Economic Sustainability
- Internet of Things Management (People, Places & Things)

Within each of these Smart City categories, the Kingdom Tower is exploring the opportunity to integrate Smart City solutions as part of the construction of the building. Regarding ICT management, Kingdom Tower has critical decisions to make concerning connectivity. Traditional structured cabling is one option for a vertical asset like a skyscraper, but there are new types of ICT that move beyond traditional horizontal solutions (Wi-Fi, iBeacons and Personal Networks). Among them are Apple's operating system that iPhones and iPads employ; these choices are less expensive, more flexible and allow for multi-use.

How can ICT be used in the tower as a vertical solution? Communications, data, life safety, security, ecommerce, social media and a multitude of Kingdom Tower apps will all run on the tower's backbone, making the tower not just a city in the sky but a building that serves as a computer. Designed as a Vertical City, the Kingdom Tower will be used as holistic lifestyle environment, meaning that some people will not leave the building for days at a time, as they will work, live and play inside the Kingdom Tower. Taking this into account, the building needs to be more than a shelter or a machine; the building needs to become intelligent.

In the same way Siri has become a talking and responsive personal assistant for smartphones like the Apple iPhone, designers of the tower are exploring how the building can become a companion to its inhabitants. Tools like Siri are based on Pattern Recognition and Machine Learning (PRML), which has been in the market for many years, but now that the Internet of Things (IoT) has emerged, the value of PRML has become clear.

Universal Robotics, based in Nashville, Tennessee, has developed software called Neocortex – a form of artificial intelligence (AI) software that is independent of specific hardware and discovers patterns in chaotic environments relevant to an assigned task. It then analyzes those patterns to understand complexity and improve processes.

Neocortex can allow facility managers to measure optimization of space usage based on multi-dimensional variables; it can sense the number of people in a specific space and learn their movements during the day, optimize and anticipate their needs. It can know you need a conference room at 2pm and automatically reserve the proper conference room, then inform you that this task has been completed.

Neocortex has the ability to anticipate your behavior. It can learn your actions, role, responsibilities and resources, and then provide you with a personal assistant for many tasks, such as note-taking during meetings, making and receiving calls on your behalf, taking care of email/text/video messages, ordering lunch/coffee, and searching and delivering proper documents/data for meetings. By using Apple's iBeacon technology or Google's Nest networking equipment, Neocortex helps make Kingdom Tower Smart City-efficient.

While Kingdom Tower is a vertical Smart City, the traditional horizontal Smart City of Kingdom City is incorporating the same technologies as the Kingdom Tower with the benefit of pervasive computing. The estimated cost of Kingdom City is US$18 billion, with the majority of the money devoted to sustainable infrastructure and buildings.

For instance, Kingdom City will have:

- Buildings with the intelligence to perform preventive maintenance and repairs on themselves based on real-time measures like normal wear and tear over time, incident damage and sabotage.
- Constructors will have many potentially hazardous building systems built in the field by drones that seamlessly adapt to ever-changing field conditions based on immediate feedback from materials, people and environmental conditions.
- Nanotechnology that is built into building products that allow surfaces of a bathroom, for example, to "gang up" and begin to lobby to be cleaned as a social group, not according to a set schedule, but on a needs basis, saving time and money for facility managers.

Artist's impression of the Kingdom City masterplan

The implementation of these types of solutions is meeting a market need that until now resided in research and development silos. The unleashing of these solutions into high profile projects like the Kingdom City/Kingdom Tower urban system is a fascinating experience because for the first time, both vertical and horizontal cities are working as one entity, providing the environment for innovative solutions to thrive.

King Abdullah Economic City (KAEC)

The US$86 billion King Abdullah Economic City (KAEC) development is one of six special economic zone cities in Saudi Arabia designed after similar economic zone models in the People's Republic of China. KAEC has delivered approximately 15 per cent of its development thus far, including a working port, residences and community support projects like schools, hospitals, markets, commercial buildings and life safety. Planned as a port city, KAEC will cost approximately US$86 billion upon completion in 2020. When fully developed, KAEC will have a projected population of 2 million people, encompassing 66 square miles. Like Kingdom City, KAEC resides on the Red Sea but is 100 kilometers north of Jeddah.

The project is being built by the international arm of Dubai-based Emaar, the developer behind the Burj Khalifa and the surrounding downtown Dubai development, and is partnered with the Saudi Arabian General Investment Authority (SAGIA) as the prime investor.

Phase one development of KAEC, completed in the fall of 2013, has produced a modern shipping port meant to ease the pressure of the existing, old Jeddah shipping port and streamline logistics of transporting goods from North America and Europe to and from the Middle East.

In phase two, a high-speed rail link to Dubai from KAEC is planned for construction. The development will change the dynamics of shipping and logistics throughout the region, as KAEC becomes a major port and hub for sea, land and rail. Implementing "smart" transportation systems and solutions is the initial focus for KAEC's Smart City strategy. Pilot tests of shipping container sensors are underway as a method to gather a vast amount of data from numerous sources.

From the shipping palettes and containers to the trucks and trains that distribute the shipped

King Abdullah Economic City is one of six special economic zone cities in Saudi Arabia designed using similar economic zone models to developments in the People's Republic of China

goods, sensors are assisting KAEC with cost savings related to security, safety, quality assurance and efficiencies of knowing where assets are at all times. This Smart City implementation with a focus on transportation also has the potential for use throughout KAEC, employing sensors to assist in data gathering that can be used and reused to assist with traffic management, public transportation schedules, congestion pricing, and driverless car systems through the implementation of smartphone apps.

App creation for KAEC is in development, using a series of online app challenges run by KAEC. Independent software developers are developing their apps and competing for use in KAEC; this will drive innovation by leveraging use of captured sensor data as a primary requirement. One initial idea suggests using sensor data of street parking spaces to develop an app that allows a person searching for a spot to quickly see what is available in a specific area, saving an enormous amount of time, energy and effort to find a parking space in KAEC.

The King Abdullah Port (KAP) has allowed KAEC to emerge as a direct foreign investment destination, helping diversify Saudi Arabia's oil-based economy. As the next phases of KAEC become operational, the city will create up to 1 million jobs, relieving some of the pressure to employ the youthful population of Saudi Arabia.

Saudi Arabia also has the need to build 190,000 new homes a year, and KAEC's next phases will address this need with a 48-square-kilometer residential district. Unlike other cities in Saudi Arabia, the design of residential areas will include more open public spaces, such as waterfront promenades, parks, recreation areas and plazas meant to be part of a cultural diversity program that will require Smart City strategies and solutions to achieve success. In addition to the port and residential district, KAEC has planned an education district, a resort district fitted with luxury villas, an industrial park to host over 2,500 manufacturers and logistics companies, and a central business district of 13.5 square kilometers.

KAEC is also exploring the creation of its own social media system for the development that will allow interaction with government agencies and officials to take suggestions, complaints and ideas. Smart City social apps are under consideration, including an online video app for hosting town hall-style events that rely on interactive communication, coordination and collaboration. Another suggested energy-consumption app will encourage people to reduce their carbon footprint by asking users questions about their everyday life and offering suggestions for improvement.

Qatar

Qatar is embracing Smart City projects and programs in order to meet the delivery of the 2022 FIFA World Cup and leave a legacy after the event has ended, but its aspirations are challenged by autocratic bureaucracy, world crises and reliance on a workforce comprised primarily of expatriates.

As of 2007, oil and natural gas revenues enabled Qatar to attain the highest per capita income in the world with the lowest unemployment, paving the way to Smart City development. Qatar has not experienced domestic unrest or violence like that seen during the Arab Spring, due in part to its immense wealth. Since the outbreak of regional unrest, however, Doha, the capital of Qatar, has prided itself on its support for many of these popular revolutions, particularly in Libya and Syria. In mid-2013, Hamad transferred power to his 33-year-old son, Tamim bin Hamad, a peaceful abdication rare in the history of Arab Gulf states. Tamim has prioritized improving the domestic welfare of Qataris, including establishing advanced healthcare and education systems and expanding the country's infrastructure in anticipation of Doha hosting the 2022 FIFA World Cup.

Qatar's urban population is 98.8 per cent of its total population, one of the highest in the world, making Smart City initiatives essential. Throughout the financial crisis of 2008-2013, Qatari authorities sought to protect the local banking sector with direct investments in domestic banks. GDP is driven largely by changes in oil prices and by investment in the energy sector. Economic policy is focused

For the best ANPR-ready images, you need more than a camera

You need VISCAM 1000

JAI's new VISCAM 1000 is a complete imaging system for a wide range of ITS applications.

Its unmatched combination of 5-megapixel resolution, real-time through-the-lens light sensing, multi-slope high dynamic range, and advanced video triggering analyzes and reacts to the most challenging imaging conditions, giving you better read rates, more enforceable images, and lower back office costs.

VISCAM 1000 features multiple lighting options and it comes in a compact all-in-one configuration that's durable, easy to integrate, and more affordable than you may think.

If you're ready for better image quality, look for more than a camera.
Look for VISCAM 1000.

VISCAM 1000

- 5-megapixel CMOS global shutter technology
- Real-time adaptive light sensing
- Multi-slope HDR
- Advanced video triggering

Americas: +1 1800 445-5444
Europe & Middle East: +45 4457 8888
Asia Pacific: +81 45-440-0154

www.jai.com

See the possibilities

on developing Qatar's non-associated natural gas reserves and increasing private and foreign investment in non-energy sectors, but oil and gas still account for more than 50 per cent of GDP, roughly 85 per cent of export earnings, and 50 per cent of government revenues.

Proven oil reserves in excess of 25 billion barrels should enable continued output at current levels for about 57 years. Qatar's proven reserves of natural gas exceed 25 trillion cubic meters, about 13 per cent of the world's total, and the reserves are the third largest in the world. Qatar's successful 2022 FIFA World Cup bid is accelerating large-scale infrastructure projects, such as Qatar's metro system, a light rail system, the construction of a new port, roads, stadiums and related sporting infrastructure. The new Hamad International Airport is expected to open in mid-2014 with an annual passenger capacity of 24 million on initial opening and 50 million when complete[4].

CHALLENGES

Qatar understands its immediate and long-term challenges. In its "Qatar National Vision 2030" plan, Qatar identified five main areas of concern:

1. Modernization and preservation of traditions
2. The needs of this generation and future generations
3. Managed growth and uncontrolled expansion
4. The size and the quality of the expatriate labor force and the selected path of development
5. Economic growth, social development and environmental management.

Weaving through these issues are three priority challenges that the Qatar Foundation is addressing:

1. Renewable energy: raising the production of solar energy to 1GW by 2020
2. Fresh water: promoting scientific research in the area of water desalination
3. Cyber security: strengthening information security management .

In addition, the FIFA World Cup in 2022 will require social and legal reforms in Qatar, most notably around workers' rights and the construction of the soccer stadiums for the tournament and new Smart Cities where its large expatriate population will live, work and play. The biggest challenge with hosting the FIFA World Cup is how to achieve a balance in developing enough infrastructure to host the event but not so much that it becomes unsustainable after the event.

Skyline of new downtown Doha with the harbour in the foreground

With nine stadiums, tens of thousands of new hotel rooms and thousands of new restaurants are planned for Qatar, a country of 1.8 million people (280,000 citizens and the rest foreign nationals); the concept of sustainable infrastructure is a critical discipline to adopt and follow. Qatar is expecting approximately 500,000 visitors to attend the FIFA World Cup. A major challenge is determining what to do with the surplus of infrastructure once they leave. The Supreme Committee for Delivery and Legacy, the Qatar government authority in charge of the FIFA World Cup, is working on the following key areas based on sustainable infrastructure best practices:

- Tourism: Create a long-term appeal for tourists by creating the Qatar experience using online and in-person continuous marketing after the world sees a successful FIFA World Cup.
- Dual-use construction: Identify community needs and develop creative adaptive reuse of surplus facilities.
- Temporary and moveable facilities: Design and build removable facilities. The Supreme Committee has already booked ocean liners for the period of the FIFA World Cup for use as hotels to accommodate the visitors, limiting the amount of hotel construction needed. Another plan is to float some of the stadiums to poor countries in areas like Africa after the event has concluded.

Doha – Host City of the FIFA World Cup 2022

With the rare opportunity to reinvent itself by hosting the FIFA World Cup, Doha, the capital of Qatar, is embracing Smart City strategies and projects to meet the objectives of hosting the event and having a sustainable future after the event. Since the majority of the population lives in Doha (population: 1 million), it is a priority to improve the lives of its inhabitants and drive the economy beyond its wealth-producing Liquid Natural Gas (LNG) industry. Known for its high-quality institutional framework, stable macroeconomic conditions and efficient goods market, Qatar wishes to also achieve sustainable development that safeguards natural resources, including delivering a carbon-neutral FIFA World Cup. There are over US$120 billion worth of projects that lead up to the World Cup, with exponential growth in ICT, product innovation, smart grids for water and electricity, all having Smart City connections for Doha.

Education City, a new district on the outskirts of Doha, is projected to have a population of 66,000. It will have research labs, educational facilities, student housing, offices, athletic facilities and physical plant utilities, such as district cooling plants (DCP). In order to follow Smart City strategies, an optimization plan was adopted to utilize eight planned DCPs to connect into a ring network and provide cooling to connected customers. Under a traditional plan, DCPs would connect only to different primary substations. This subtle design shift of employing a ring network ensures that each customer is capable of receiving energy from one of two district cooling plants.

The DCP network is then managed by an Intelligent Operations Center (IOC) that monitors the DCP sensors indicating which customers are being served by which DCP. The IOC can also communicate what final energy sources are carrying the significant load based on real-time DCP loadings. The IOC also allows the physical plant manager to make informed decisions on which connected buildings can be served from which DCP to relieve energy usage on the primary substations during times of coincidental peak load. The IOC can also analyze the captured data and communicate results to a Smart City Green Energy Dashboard app, so a customer can see how they use energy throughout the day and potentially change their behavior.

This Smart City initiative will also avoid the need to build additional expensive energy substations as Education City grows. Under the plan, the physical plant manager will be able to move DCP loadings from one energy substation to another during peak times where energy usage in a particular area is impacting the operation of that energy substation, saving vast amounts of resources.

Stadium construction, Doha, Qatar

Lusail City

Lusail is a US$5.5 billion ambitious waterfront city development currently under construction. Located about 15 kilometers north of Doha, on the Qatari coast, it is 35 square kilometers (377 million square feet) in size and will have an approximate population of 260,000 when completed in 2019. Innovation is the key at Lusail for construction of marinas, island resorts, residential and commercial districts, luxury shopping, leisure facilities and an entertainment district. Lusail is also home to the new 90,000-seat Lusail Iconic Stadium, which will host the 2022 FIFA World Cup opening ceremonies and the finals. As the largest development in Qatar, Lusail is under development by the state-owned enterprise Qatari Diar Real Estate Investment Company. The investment firm is developing Lusail with the Smart City principle of a three-layer system:

1. Network Layer: OCT infrastructure that connects people, places and things. Also referred to as the Internet of Things (IoT).
2. Control Layer: Using an Intelligent Operations Center, a city can manage and maintain service delivery.
3. Service Layer: Human and machine interactions are conducted using Smart City apps to deliver services to residents and visitors.

Lusail has built-in environmentally responsive protection policies and a controlled development strategy that is meant to transform an existing raw tidal basin into a Smart City with sustainable features (such as building design) that use the building's mass and shade to reduce heat and the need for cooling mechanisms.

CONCLUSION

These Smart City innovations can only transpire with adequate investment. As more people migrate to cities, increased financial investment in Smart City technologies and initiatives is needed to ensure completion of these projects. This capital can come from a multitude of sources, whether the private or public sector, research grants, or sponsorships.

The world's population continues to grow, especially in the Middle East, and more and more people are relocating to urban areas, straining the infrastructure of the world's major cities. It is therefore vital that technology is utilized to create effective, innovative ways of making urban cities "smarter" to improve standards of living.

Urban populations in these Middle Eastern cities will only continue to grow, due to the encouraging factors of employment, a better lifestyle and social support. Citizens, visitors and migrant-worker guests need an urban experience that is safe, secure and improves the quality of life. The municipal governments of the Middle East are using the stimulus of hosting world events like the World Expo and the FIFA World Cup as delivery milestones that create legacy opportunities when implemented in a Smart Cities framework.

To create smart cities, it is necessary that city planners and governments have the vision to drive change, and a strong overarching vision is ultimately required. Technology can help create ways of making cities work better, and collaboration across the public and private sector can bring endless possibilities.

In order to assure this transformation, the cities of the Middle East will need to provide:

- More local digital knowledge content.
- Lower prices for connectivity.
- Business-to-business market structure, competition and governance.
- Higher mobile and fixed broadband penetration.

The Middle East is leading by example by aggressively implementing Smart City solutions in both its new and existing cities. A Smart City strategy of developing a Smart Grid using CleanTech energy sources is a fundamental first step in the Middle East. This sustainable foundation is creating the opportunity for urban environments throughout the Middle East to improve the lifestyle for its citizens, workers and visitors. The world has definitive benchmarks for Smart Grid planning and management in addition to learning from the best practices of the design, construction and sustainable maintenance of the world's tallest vertical cities.

There is much to learn from the Middle East as its biggest cities create leading sustainable environments. Given a growing demand for efficiency and resources, these cities must increase reliance on innovative measures and new technologies to meet the needs of a large and growing urban population. The Smart City initiatives discussed in this article will help these countries manage their resources more efficiently, improve the quality of the services provided to citizens, facilitate new approaches to driving efficiencies, promote innovation and improve transparency by providing information in real time. Perhaps most importantly, the initiatives will cut energy use and generate income – making the cities leading global competitors and role models for other smart city developments around the world.

The waterfront development of Lusail City is 15km north of Doha, Qatar

FYI

Paul Doherty, AIA, is a fully licensed architect and the president and CEO of the digit group, inc., a market-leading Cloud software incubator for Smart City products and co-founder of the critically acclaimed AEC Hackathon. He is an author, educator, analyst and advisor to Fortune 500 organizations, global government agencies, prominent institutions and architectural, engineering and contracting firms.

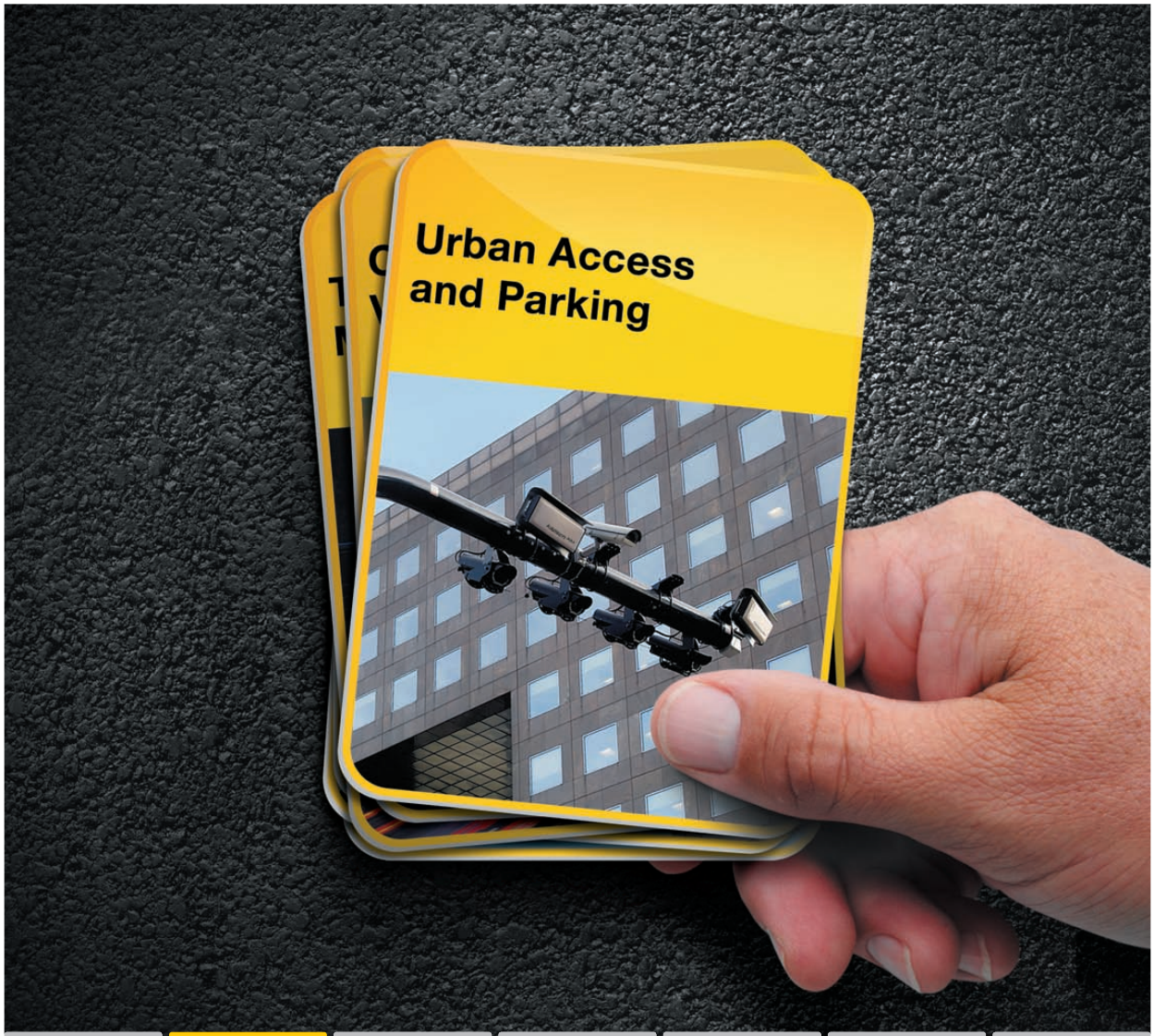
pdoherty@thedigitgroupinc.com

www.thedigitgroupinc.com

www.aehackathon.com

Kapsch TrafficCom

kapsch >>>



Road Safety Enforcement | **Urban Access and Parking** | Road User Charging | Commercial Vehicle Operations | Electronic Vehicle Registration | Traffic Management | V2X Cooperative Systems

Hundreds of Low Emission and Limited Access Zones in all sizes exist around the world. Well known examples are Singapore, London and Stockholm. Kapsch solutions are flexible and versatile. Cities may need to limit access to centers, establish charging schemes for use of certain corridors, zones, or areas and implement on-street dynamic parking using automatic fee collection. Our solutions support the full range of charging policies, based either on the time of the day, the length of stay, the pollution class of the vehicle or traffic volume.
www.kapsch.net

always one step ahead

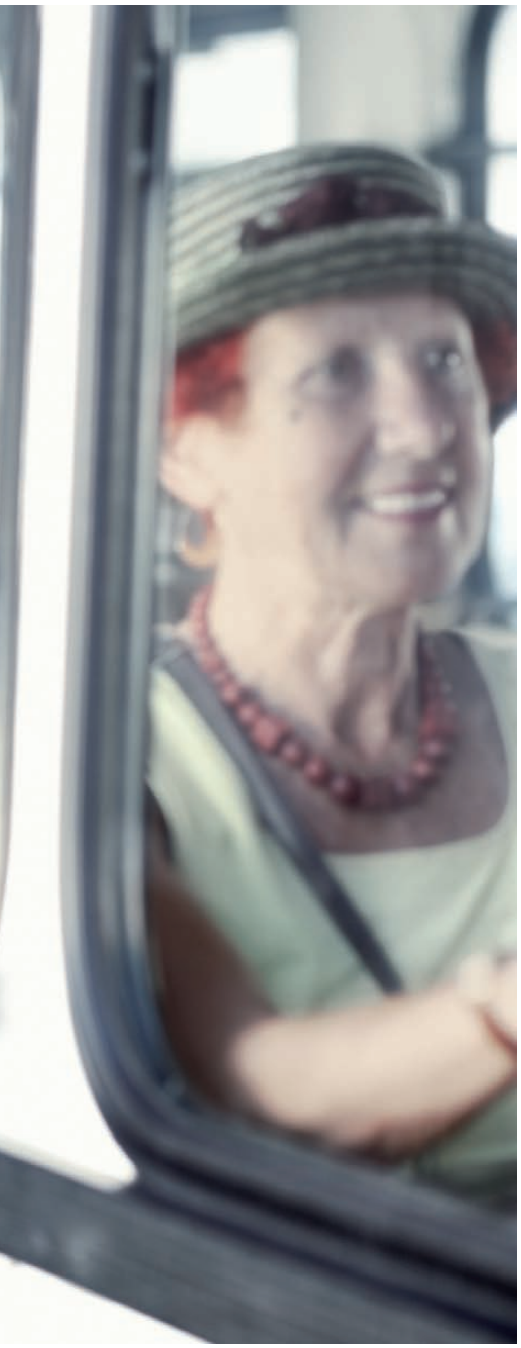
Line drawing

Public transport planning, says **Johannes Schlaich**, needs to provide perfect services all along the line

Today's society has high expectations regarding mobility: It should be powerful, secure, eco-friendly and inexpensive. Public transport has a key role to play in this ambivalent environment[3]. However, not only today's situation is demand, the Public Transport sector is facing major challenges in the future.

A recent survey[2] identified fewer resources and climate change and demographic change as the major drivers for Public Transport in the future:

Therefore, it is important to plan it in an anticipatory and market-oriented manner. However, the design, implementation and operation of public



> ***One of the classic tasks of network modelling is to provide passengers with an attractive line network that at the same time is efficient from an operative perspective***

transport systems are demanding tasks. Professional software tools such as PTV Visum assist planners in coping with these tasks. PTV Visum is a comprehensive planning tool that offers detailed planning and analysis functions, easy-to-interpret display options that cover all strategic and operational processes across public transport planning. Important to note is that it is always required to link the transport demand with the transport supply.

DEMAND-BASED PUBLIC TRANSPORT NETWORK AND SUPPLY PLANNING

One of the classic tasks of network modelling is to provide passengers with an attractive line network that at the same time is efficient from an operative perspective. In terms of spatial planning, this means to determine the line routes and transfer points in the network. Temporal planning, on the other hand, focuses on the optimum headway, the coordination of lines and connections between the stops and the analysis of supply in terms of line performance and output.

Users usually import timetable and network data from common systems and use it for modelling the current public transport supply. Network data is imported via interfaces to geographic information systems (GIS) and timetable information systems, such as Google Transit, HAFAS or railML. Moreover, it is possible to import data from different sources, including automatic passenger counting, vehicle tracking and ticketing systems or MS Office. All services can then be displayed and edited in the public transport network editor, in the tabular and graphic timetable.

In order to analyse the quality of public transport services from the passengers' point of view, planners can use transport planning software to combine public transport supply with statistical data of land use, number of jobs and residents. GIS functionalities shall enable the planner to identify how many residents can reach the next long-distance train station within a given travel time, for example. But users cannot only analyse travel times, there are also detailed parameter analyses to visualise transfer frequencies and waiting times for all connections across the entire network.

How attractive new lines, new connections or more frequent services actually are for all passengers and whether these changes will have the effects and impacts desired can best be judged by modelling demand by means of an origin-destination matrix. Such matrices can be created on the basis of public transport survey data or a multimodal demand model, such as the classic four-stage algorithm. The latter models all passenger choices in both private and public transport – from the choice of the destination to the transport mode and transport connection. This also allows planners to calculate the changes in modal split caused by improved public transport services.

ATTRACTIVENESS – A MEASURABLE BENCHMARK

One can differentiate between three assignment methods that identify possible connections of the passengers for each origin-destination pair

and then assign the demand matrix to these connections.

The simplest one is the transport system-based assignment, a quite pragmatic approach to conceptual public transport network planning. It does not include any timetable data and does not even require a line network, however it allows users to differentiate between road- and rail-bound transport. Based on demand matrices it models the desired network from the passengers' perspective. This so-called "what-if scenario" indicates which public transport options passengers would chose to travel from the origin to the destination, if they were not limited in their choices.

If there is a timetable, there are two additional assignment methods – the headway-based and timetable-based assignment. The timetable-based assignment is often used for timetables with high and regular frequency services. Moreover, it enables planners to create impact analyses of long-term planning scenarios, such as transport master plans which, due to efficiency reasons, do not require detailed timetables to be modelled for each scenario. However, precise information on transfers cannot be included in the assignment without timetable modelling. Nevertheless, users can assign pre-defined transfer times to specific transfers. This includes transfers between regional trains and buses, which can usually be scheduled quite precisely.

The timetable-based assignment offers the highest level of detail. It allows for fine-tuned planning and analyses including complex transfers and connections. This means planners can realistically model various effects, such as transfer waiting times and analyse measures for optimising individual stops.

Another important factor for connection choice may be the effects of capacity constraints in the assignment. As a result, overcrowded lines

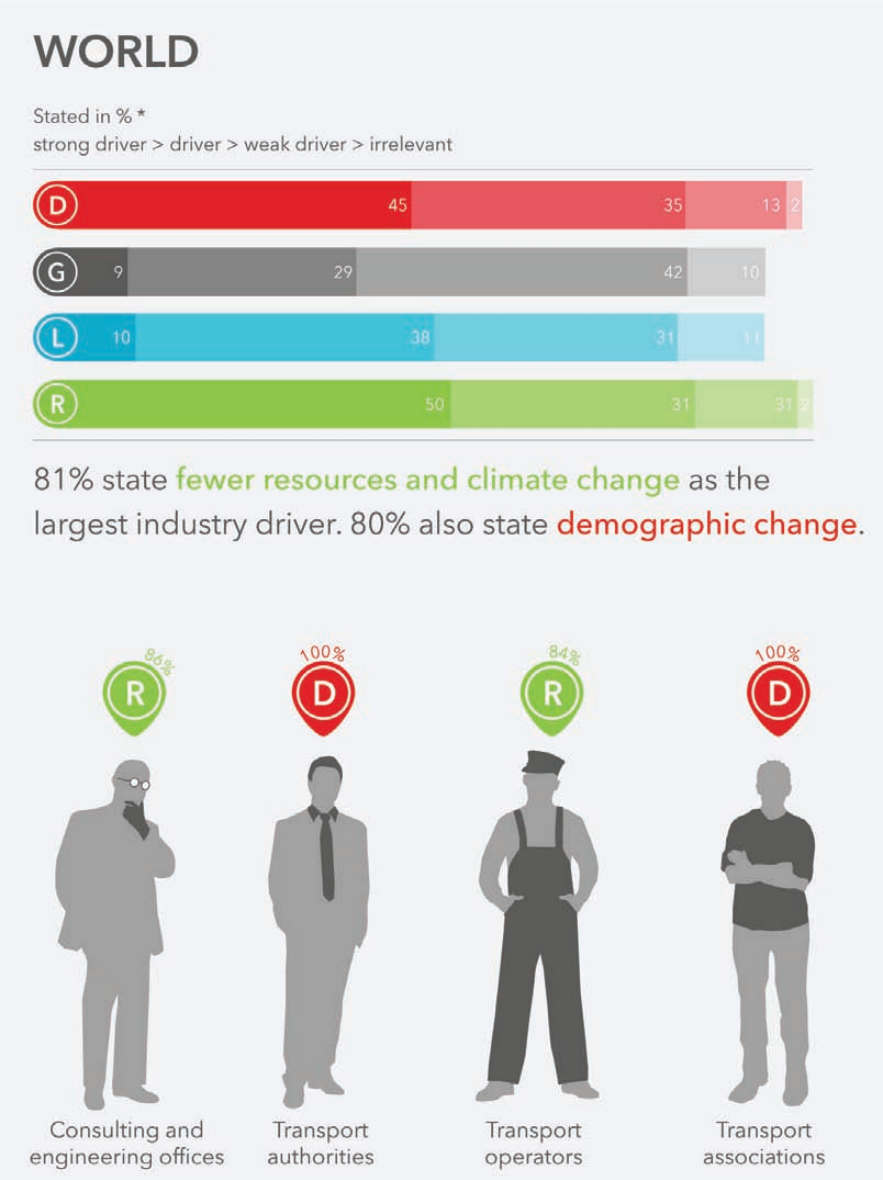


Figure 1: Drivers of future Public Transport planning [2]

REFERENCES

1 Friedrich, M., Schlaich, J., Schleupen, G. (2007), *Modell zur Ermittlung der Betriebsleistung und der Betriebskosten für Busverkehre, Tagungsband der 21.* Verkehrswissenschaftlichen Tage 2007, Dresden.

2 PTV Group (2013), Perspective - Public Transport: What moves the sector?, http://vision-traffic.ptvgroup.com/en-uk/lp/ptv-visum/white-paper/, accessed 26 June 2013.

3 Rauh, W. (2010), *Staukosten: Ein starkes Argument für den öffentlichen Verkehr*, *DER NAHVERKEHR*, Heft 7-8, S. 68ff.

4 Remy, M., Zappe, F., Mott, P (2012), *Komplexe Angebotsplanung beim Verkehrsverbund Rhein-Neckar*, *DER NAHVERKEHR*, Heft 9, S. 68ff.

5 Schlaich, J., Schleupen, G. (2006), *Benchmarking Subsidised Public Transport Services* (poster and abstract), Proceedings of 3rd International Symposium Networks for Mobility, Stuttgart, Germany.

You stopped to look because it's cute

You'll only keep coming back if it's got something to say

THINKING Highways™

Print • Digital • Broadcast

Magazines · Daily news updates · Online magazines · Dedicated online content · Extensive editorial archive
Podcasts · Searchable content · Industry directory · Webinars · White papers · Online events · Position papers

thinkinghighways.com

Another important factor for connection choice may be the effects of capacity constraints in the assignment. As a result, overcrowded lines become less attractive due to the large amount of passengers

become less attractive due to the large amount of passengers. Just like in reality, in the model, passengers switch to less crowded modes of transport. From a technical point of view, the capacity constraint is included in the impedance calculation of each connection, in addition to other attributes such as travel time and transfer frequency. This additional component can eg be a function of the assumed standing minutes on a bus or train. The seats are randomly allocated to the passengers for each stop section – a procedure which is quite similar to the popular children's game of musical chairs.

FARE MODELLING

Capacity utilisation of individual connections is not the only parameter that can be included in the impedance calculation during the assignment. In addition to the classic parameters, such as journey time, waiting time and transfer frequency, it is also the fare which may play a major role. As tariff structures are often complicated, a software tool shall allow users to model any type of fare and tariff model in all their facets including dependencies. This, for example, means multiply-counted zones for a city centre can be combined with short-distance tariffs or transitory tariffs for different transport associations.

If fare prices have been modelled in detail, they can be accounted for during assignment. The assignment method then shows how tariffs influence the passengers' route choice. Consequently, only a few people will take an expensive high-speed train for travelling a short distance if they can take a cheaper local train instead. Moreover, users can analyse the impact of fare changes on revenue. It thus allows transport associations and authorities to check how profitable it is to change a fare or introduce a new ticket type and what is the right price of the ticket to secure revenues.

Once fares are modelled, users will expect that the software calculates revenues distinctly. In other words, it should be broken down into different areas (eg transport associations, districts) as well as displayed on the basis of different aggregations (e.g. lines, operators). Flexible revenue distribution models shall enable users to evaluate several performance-based distribution schemes for several operators serving a transport association.

According to a recent survey[2] cost pressure is a major driver or regular modification of the Public Transport network. Beside the revenue estimation with fare and demand modelling, an importation factor for a cost-efficient Public Transport is the vehicle cost. In order to estimate the number of required vehicles for a scenario, vehicle scheduling (also known as line blocking) is required.

For a complete line costing and revenue calculation, which assesses the profitability and cost coverage of an entire public transport network or its service units, it is also necessary to determine the costs of infrastructure and operations[1,4,5]. An important basis for cost calculation is the number of vehicles required. For this the vehicle scheduling process is crucial. There are two approaches for this task.

VEHICLE SCHEDULING

With a basic line blocking, the planner himself defines the vehicle types of his choice. The automatic line blocking procedure completes the process on the basis of the timetable

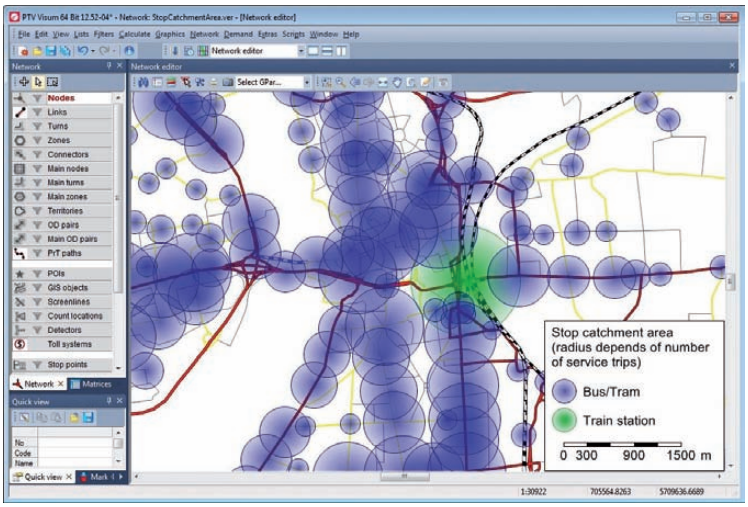


Figure 2: Simple analysis of public transport supply based on stop catchment areas

while following user-defined rules. In this context, depots and their capacities are explicitly taken into consideration. Journey-specific preparation and completion times as well as additional activities such as refuelling or cleaning are included as well.

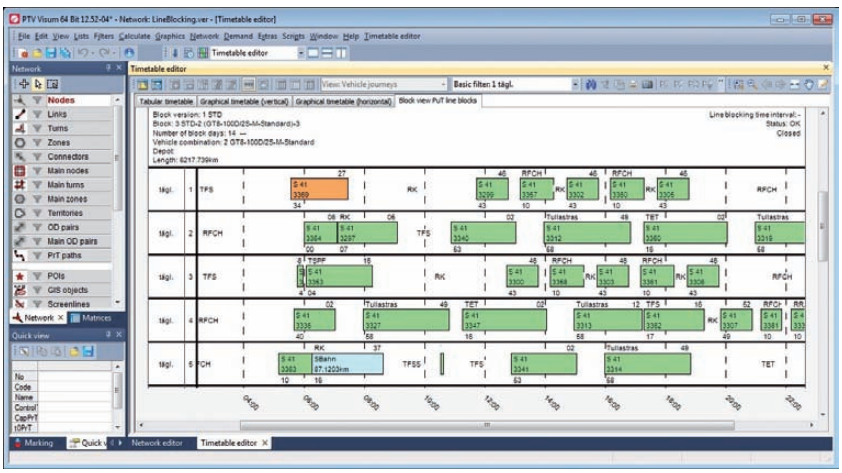
Detailed line blocking provides greater room for manoeuvre. Planners can model forced chaining or optimise the use of vehicles by also taking alternative types of vehicles into account. Instead of selecting a specific vehicle type, planners can then allocate a number of different vehicle types to the trip. The optimisation procedure then chooses the type that ensures a minimum deployment of vehicles. Here, it is again possible to integrate demand. To permit demand-optimised vehicle deployment, the vehicle choice is based on the capacity of each vehicle type in terms of passenger volume generated during assignment or using survey data. At this stage of the planning process, graphical formats such as block diagrams of line blocking results (see eg Figure 3) also assist planners in identifying and developing the network's optimisation potential in terms of profitability.

COMPACT VIEW: THE SCHEMATIC LINE DIAGRAM

Visualisation of results is essential for the success of Public Transport planning. A schematic line diagram provides an important visualisation option (see eg Figure 4). Using the schematic line diagram, planners can abstract the network according to their needs. The schematic line diagram visualises the network relationships and gives users an ideal overview of transfer stops. A wide range of graphical parameters and labelling options provide the information required.

Stops are displayed as boxes to which users may add timetable details. Information on arrival and departure times for all lines is thus provided at a glance enabling planners to ensure services with regular headways across several lines. The links between the selected stops are displayed as edges. Lines, transport systems, and service frequencies can be classified by using bars of different colours and different types of dashed lines.

Flexible revenue distribution models shall enable users to evaluate several performance-based distribution schemes for several operators serving a transport association



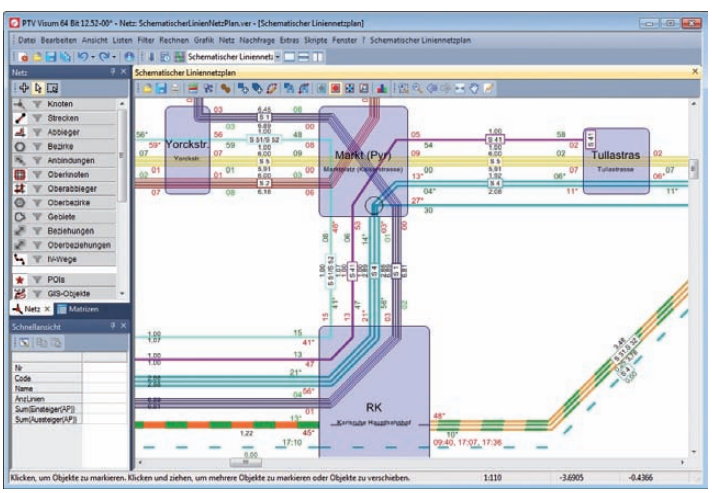


Figure 3: Block diagram: schematic display of the line blocking results.

Figure 4: The schematic line diagram provides users with detailed information on stops and routes at a glance

FYI

Dr.-Ing. Johannes Schlaich is Director PTV Visum Product Management & Services

johannes.schlaich@ptvgroup.com

www.ptv.de

Transaction stations

Transactions of data underpin any smart city concept. However, say **Arno Klamminger** and **Wolfgang Fleischer**, we cannot afford to ignore the role of financial transactions in making deployments self-sustaining realities

It is easy to believe that there is little in life that cannot be improved by the application of technology. Its all-pervasiveness and ever-increasing capabilities give rise to a tacit understanding that, in the near future, somehow everything will be better.

This is perhaps justifiable thinking when one considers the efforts of engineers over the last few decades to take us from concept and political aspiration to reality. However, systems that work well technologically but exist in a developmental bubble have one last, major hurdle to overcome: cost. Whether it be the unit price of an object or the ongoing funding of providing such as a mobility-related service, monetisation remains an issue. Indeed, it may end up being the cause of a perfectly workable solution's ultimate 'failure'.

This is an observation which holds true up and down the scale, from whole road and transport networks to the humblest travel information app and, in recent years, it has been noticeable that the 'business case' (in reality, often more of a statutory obligation) has become a topic of greater interest in transport circles. Though we have solved the major hardware and software issues, in many cases the journey to realisation is not necessarily over.

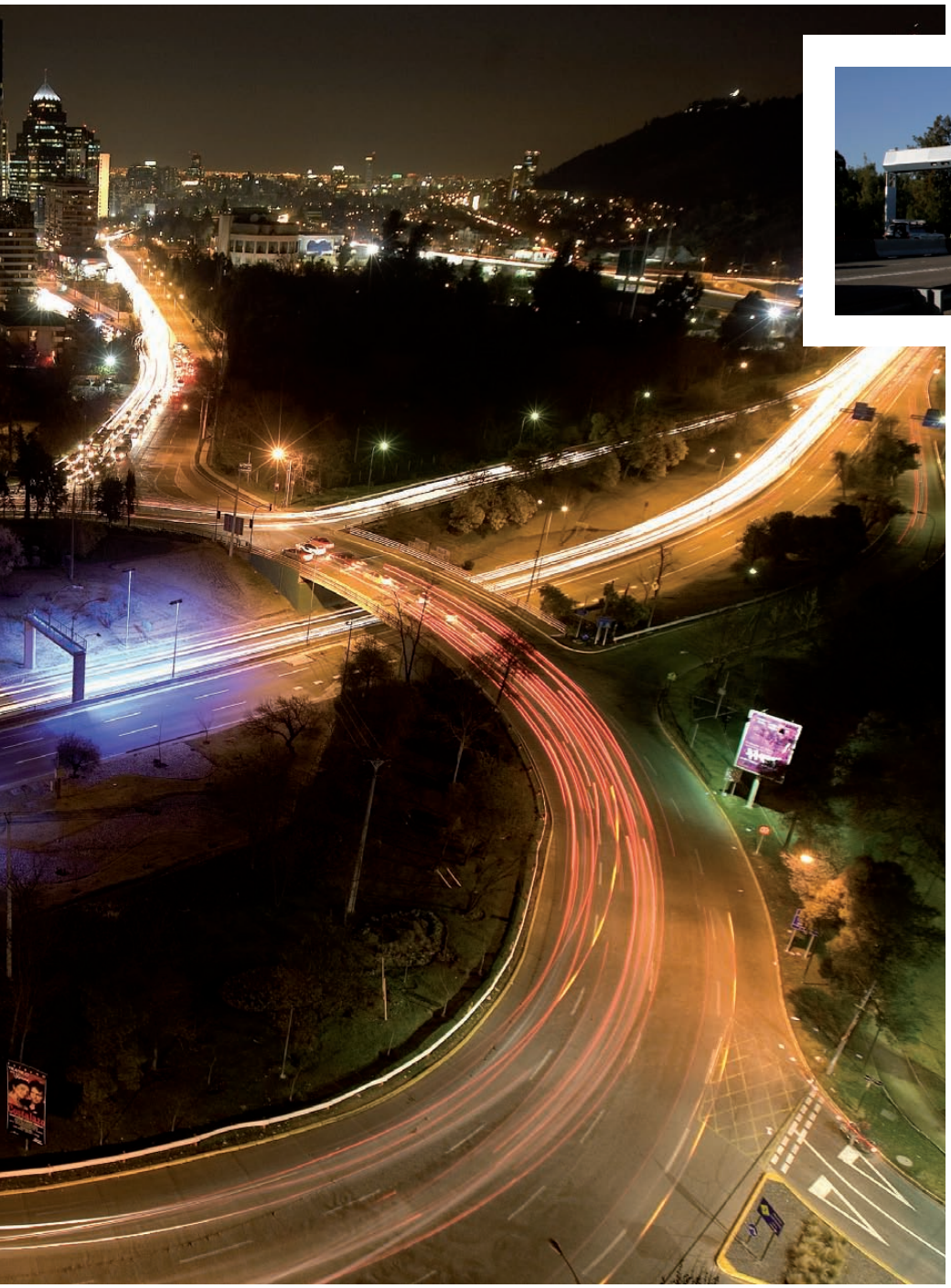
Smart city concepts allow us to think more widely and to look at the wider benefits of a given spend within

Arno Klamminger, Vice president Business Unit – ETC

Wolfgang Fleischer, International Coordination and Platform Management

Santiago de Chile's Costanera Norte Rotonda's Multilane Free Flow tolling gantries

Though we have solved the major hardware and software issues, in many cases the journey to realisation is not necessarily over



Sydney's M5 South West Motorway operates an urban MLFF system

one of the traditional silos such as transport. Better cross-town access to medical facilities, for instance, might reduce the burden of health-related issues on overall municipal budgets.

There is undoubtedly much that is of interest to be derived from gathering and combining data cross-jurisdictionally but there has to be a purpose beyond mere curiosity. It all loops back to money, because municipalities are hardly awash with it. Nevertheless, there are statutory obligations to satisfy at least minimum levels of service for utilities such as transport and mobility. There are also societal and moral imperatives involved which drive us to do rather better than that, as well as a healthy dose of professional pride.

NON-TECHNICAL OBSTACLES

Often, though, the obstacles to revenue earning are outside the systems and solutions themselves and nor should we ignore the fact that there is still considerable merit in having the individual elements of a town's or city's functioning be self-supporting to as great a degree as possible.

In transport's case, the user-pays

principle is enshrined in professionals' thinking. It continues – and will continue – to represent the most equitable way of funding infrastructures. Assertions that politicians are finally waking up to the reality and, indeed, the necessity of its implementation have thus far been proven to be over-optimistic, however; were this article being written 10 years ago, a far greater number of town and city congestion management or distance-based charging schemes would have been anticipated to be in operation than is indeed the case.

A MATTER OF CONSTITUTION

One problem is legislation. In many locations, changes to the law are needed to allow congestion charging to be carried out. There are back-door solutions to this, one of which is to use parking as a demand-management tool.

The technology with which to access parking has improved significantly in recent years and there is an abundance of apps and online registration solutions supporting road users' efforts to find places to leave their vehicles. Strategies can also be implemented which prevent the car being the automatic choice among large groups of travellers. In the city of Vienna, Austria, for instance, a large proportion of the central districts' streets has been given over to short-term parking for non-residents only. Vehicles may stay for a maximum of two hours. Commuters, whose vehicles may previously have occupied a space for up to half a day, are obliged to think again in terms of journey and modal choices.

The on-street parking solution in Vienna has actually served to make finding a space easier – with the streets freed from commuter-related congestion it is usually possible to find a space within a block of a desired destination, something that could not be said prior to its introduction. Nor is it expensive to use, costing just €2 per hour. Arguably it has even facilitated mobility, albeit of a type.

What parking does not do, however, is charge those who are on the move and we need to think more about mobility and associated charging. It might be counter-intuitive to think of parking charging as a 'mobility' charge, for instance, in that it charges for something that is static. However consider things from an aviation or maritime perspective: there, quite often, the time of departure is governed by the availability of gates or berthing spaces at a destination. We are already seeing pre-booking of parking spaces emerging as an answer to congestion and viewed in such terms a parking charge is as much a mobility charge as distance-based pricing. A more holistic mind-set could open the door to as-yet unrealised solutions.

Nevertheless, in some places we still need to address what to do about legislation pertaining to congestion charging. One thing is certain: the precise need varies widely from location to location. We need to continue to innovate in terms of solutions and somehow we need to gain or encourage the political will that will bring this about. Geographically, there are differences.

While some long-established towns and cities in Europe are constrained in terms of space and geometry and cannot simply build their way towards an answer, the situation is different in Asia. There, some of the bigger cities are moving

London's Congestion Charging Scheme came into operation in 2003

Singapore was one of the first countries to introduce an electronic road pricing scheme

We are already seeing pre-booking of parking spaces emerging as an answer to congestion and viewed in such terms a parking charge is as much a mobility charge as distance-based pricing

towards congestion charging, with plans firming up for projects involving major highways of eight to 10 lanes. Change is on the way.

SMART(ER) DEVICES

Technologically, and looking at charging in a smart city context, the pace of development is brisk. There is a presumption towards the smart device as a means with which to effect exchanges and transactions of all kinds. Especially where major revamps of conurbations' infrastructure are for whatever reason not possible or too costly, an ICT-based technology overlay using wireless communications protocols and mobile devices is a means by which 'smartness' can be achieved.

Urban Multilane Free Flow tolling in Melbourne, Australia

In the transport arena, smart devices are having profound effects. Real-time information on the move is revolutionising travel habits and making the multimodal ambition a reality – individuals are far more given to using mass transit if they know precisely when it will arrive and, if it will not, what their options are. Payment is also enjoying change. Parking has already been mentioned but smart devices which host the NFC protocol are now being used on public transport and for stop-and-go payment in road tolling schemes.

In the future, biometrics may have a presence in mass transit however extracting biometric information from an individual in a vehicle in a free-flow tolling environment might politely be described as 'problematic'. In-vehicle solutions, whether embedded or carry-in, will continue to predominate, therefore. A lot of interest has been expressed in the use of smart device-based apps to

Jakarta, Indonesia operates an electronic road pricing scheme

> ***Not too long from now, communication will be reduced to a commodity, in that many of the devices in our lives will speak to each other as a matter of course***

facilitate payment and we can expect to see these proliferate in the coming years.

ADDRESSING SHORTCOMINGS

Although smart device apps would seem to be an elegant, inexpensive solution that shifts the burden from the tolling system manufacturer of design, manufacture and distribution, enforcement remains an issue.

Not too long from now, communication will be reduced to a commodity, in that many of the devices in our lives will speak to each other as a matter of course. Camera technology is going down the same route, with high-quality digital offerings becoming available at lower and lower prices. This is fortuitous from an enforcement perspective, in that although many of the already-deployed cameras can be re-purposed to include an enforcement application (so reducing cost) there will still be a need for additional deployments to provide adequate levels of enforcement in a smart device-led environment. We can expect to see future camera systems installed in our towns and cities which have the capability to be remotely updated with additional applications which may not even have been envisioned when the original scoping and design exercises were carried out.

What is becoming more specialised is the back office – arguably, the farther back you travel from the front end of a solution, the more niche the capabilities become. Especially in an urban context, the amount of information that needs to be reconciled is huge and will only increase in size. This is already true in terms of payment services for mobility but as the cross-jurisdictional fusion of data becomes more common we will see a massive increase in the amounts of data that needs to be handled.

What this means is that the smart city environment is going to need multiple players with many different talents. There will undoubtedly be a place for 'big box' solutions, just as there will be for the humblest of apps. But ranging up and down between the two there will continue to be space for organisations of all sizes and specialities. The only limiting factor is imagination.

ABOVE: Example of the physical element of the city of Bergamo's controlled access scheme

Bergamo also uses ANPR to control access into the city centre

FYI

Arno Klamminger is Vice President, Business Unit Electronic Toll Collection at Kapsch

arno.klamminger@kapsch.net

Wolfgang Fleischer heads up the Portfolio Management & International Coordination, Business Unit Electronic Toll Collection team at Kapsch

wolfgang.fleischer@kapsch.net

www.kapsch.net

Traffex/Parkex 2015 is free to attend and visitors can register at **www.traffex.com** or **www.parkex.com**.
Traffex is organised by Brintex Events **www.brintex.com**. Parkex is organised by Brintex Events on behalf of the British Parking association.
Press contact at the BPA is Emily McCunn • Email: **emily.m@britishparking.co.uk** • Tel: **+ 44 (0)1444 447 317**

Traffex warning ahead

Traffex

21-23 April 2015

The NEC, Birmingham, UK

www.traffex.com

Traffex 2015, the 28th international traffic engineering, road safety, parking and highway maintenance exhibition, and one of the largest in the world of its kind, is set to return to Hall 5 at the NEC Birmingham from 21–23 April 2015. Organisations from the UK and across the globe will be at Traffex 2015 to display the very latest products and service innovation – many of which will be showing in the UK for the first time.

Building on the success of the last Traffex in 2013, Brintex the event organisers are confident that next year's show is set to be one of the largest in its thirty-year history, and will once again be co-located with Parkex; Europe's largest dedicated parking exhibition. The combined Traffex, Parkex Exhibition will provide visitors with the unique opportunity to see over 500 exhibitors from the world of transport and parking all in one central location.

As well as a world-class exhibition covering a vast 25,000 sqm, there will be over 30 hours of free-to-attend, CPD accredited conference sessions taking place over the three days. The seminar programme itself is being organised by ITS United Kingdom, CIHT, DfT and the Highways Agency.

This year's Traffex will include a brand new feature area that aims to highlight products and systems developed to tackle road safety issues for vulnerable groups such as pedestrians, cyclists and powered two wheeler riders. These particular groups, together with road workers, continue to face a very real and significant risk of injury on our roads. For the first time at Traffex, visitors will be able to walk or cycle around a full size "Public Highway" environment, in which cars, trucks and buses will be part of a feature layout that incorporates a working traffic signal controlled junction, controlled pedestrian and cycle crossings, a live road works area and an "after dark" viewing area for observing retro reflective safety products.

In addition, visitors to Traffex will have the opportunity of "self driving" autonomous vehicle experience, providing a first-hand insight into the latest technology available.

Bill Butler, Traffex Exhibition Director, comments: ***"Having a combined Traffex and Parkex has proven to be a great success in previous years, and we're confident that next year's show will be no different, particularly as traffic and parking issues continue to hit the headlines."***

As always, Traffex and Parkex remains free-to-attend, and will be a vital three days of networking and industry fact-finding for anyone working in the integrated world of traffic and parking management. Registration for Traffex will open in November 2014, and for more information on visiting or exhibiting at Traffex please visit www.traffex.com.

The smart money

Southern Italy is one of the regions to be considered under the Cohesion Policy 2014-20

Margaret A Pettit assesses new EU funding for 2014–2020 with the emphasis on smart cities and ITS

This article looks at the key growth priorities in the reformed Cohesion Policy 2014–2020 relating to the European Regional Development Fund (ERDF) and the Cohesion Fund where they relate to the ITS and smart cities sectors, as well as the allocations and eligibility. We also note the inauguration by the European Commission of INEA, the new executive agency for managing the TEN-T programme.

COHESION POLICY

Budgets and Eligibility

Under the Cohesion Policy 2014–2020, the budget allocations total €351.8 billion (current prices), of which just over €200 billion is for ERDF. This breaks down very roughly: Cohesion Fund €63.4 billion; the European Regional Development Fund and the European Social Fund split: less developed regions €165 billion; transition regions €35 billion; outermost regions €1.5 billion; most developed regions €55 billion; and territorial cooperation c. €10 billion.

The country receiving the largest share is, not surprisingly, Poland with €77.6 billion and opportunities are mentioned below. The next largest recipients are: Italy €33 billion, Spain €28.5 billion, followed by Romania, Czech Republic, Hungary and Portugal each receiving between €21–€22 billion and Greece €15.5 billion. (The UK will receive almost €12 billion.)

Regarding eligibility, funding applies to the regions, as follows:

Less developed regions: GDP/head < 75 per cent of the EU-27 average

Under the reformed Cohesion Policy, national and regional authorities will be required to develop strategies for digital growth

Transition regions: GDP/head between 75 per cent and 90 per cent of the EU-27 average
Most developed regions: GDP/head > 90 per cent of the EU-27 average.

The less developed regions are Portugal, southern Italy, parts of northern and central Greece, Extremadura in Spain, Poland, Hungary, Czech Republic, Slovak Republic, Lithuania, Latvia and Estonia.

The key areas of Cohesion Policy
The new Policy means regions and Member States must target EU investments on four key areas for economic growth and job creation and we look at the three of interest:

- Research and Innovation
- Information and Communication Technologies (ICT)
- Enhancing the competitiveness of small and medium-sized enterprises (SMEs)
- Supporting the shift towards a low-carbon economy

PRIORITY: ENHANCING ACCESS TO, USE AND QUALITY OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT)

- Investing in ICT infrastructure in all regions, especially in remote and rural areas and in less developed regions.
- Investing in developing and upgrading ICT tools, such as e-infrastructures for research and innovation, cloud computing, information security and Internet safety.
- Continuing the shift towards the innovative uses of ICT in coordinating the efficient use of resources in urban areas (Smart Cities).
- Significantly, under the reformed Cohesion Policy, national and regional authorities will be required to develop strategies for digital growth, as an element within their broader research and innovation strategies, in order to receive funding for investments in ICT products and services.
- Each Member State planning to use Cohesion Policy Funds for broadband investments will also have to develop a Next Generation Network Plan identifying the areas where public intervention is necessary to provide broadband access.
- A substantial share of the SME support from the ERDF will be allocated to start-ups and new business models operating in the ICT sector.

PRIORITY: STRENGTHENING RESEARCH, TECHNOLOGICAL DEVELOPMENT AND INNOVATION

- Investing in infrastructure, equipment, pilot product lines, and advanced manufacturing necessary for applied research and innovation activities, including technologies that create capabilities for further innovation in a range of other sectors.
- Facilitating the cooperation, networking activities and partnerships among different innovation actors working in the same field – universities, research and technological centres, SMEs and large firms – to achieve synergies and technology transfers.

The new strategic approach
Before ERDF investments are allocated to research and innovation, Member States and regions will need to draw up so-called smart specialisation strategies. Each region will focus on a limited set of priority areas, in which it already has a competitive advantage. It will build synergies between Cohesion Policy and other EU policies and funding instruments, such as Horizon 2020 (which will provide another €70.2 billion for research and innovation by 2020).

PRIORITY: SUPPORTING THE SHIFT TOWARDS A LOW-CARBON ECONOMY IN ALL SECTORS

A minimum share of each region's ERDF allocation will be invested in measures supporting the shift to a low-carbon economy, thus: 20 per cent in more developed regions; 15 per cent in transition regions; and 12 per cent in less-developed regions. This will ensure a minimum investment of at least €23 billion for 2014–2020 from the ERDF, while further investments through the Cohesion Fund will further support the shift

towards a low-carbon economy. Investments from the ERDF and the Cohesion Fund will include:

- Reducing emissions from transport by supporting the development of new technologies and promoting sustainable multi-modal urban mobility including public transport, cycling and walking.
- Developing integrated low-carbon strategies, in particular for urban areas, which can encompass street lighting, sustainable multi-modal urban mobility and smart electrical grids; and promoting research and innovation in low-carbon technologies.

THE FOCUS OF THE FUNDS

European Regional Development Fund

As mentioned above, the ERDF focuses its investments on several key priority areas. This is known as 'thematic concentration': Innovation and research; The digital agenda; Support for small and medium-sized enterprises (SMEs); and The low-carbon economy.

The ERDF resources allocated to these priorities will depend on the category of region.

- In more developed regions, at least 80 per cent of funds must focus on at least two of these priorities;
- In transition regions, this focus is for 60 per cent of the funds;
- In less developed regions this is 50 per cent.

Of interest is that some ERDF resources must be channelled specifically towards low-carbon economy projects, thus: More developed regions: 20 per cent; Transition regions: 15 per cent; and Less developed regions: 12 per cent.

Cohesion Fund

Under the 'low-carbon economy' priority, it aims to reduce emissions from transport by supporting the development of new technologies and promoting sustainable multi-modal urban mobility including public transport, cycling and walking, as well as developing integrated low-carbon strategies, in particular for urban areas.

European Territorial Cooperation

Under ETC, at least 80 per cent of funds will be concentrated on the four priority areas.

Urban Actions

As previously reported, ERDF action is designed to reduce economic, environmental and social problems in urban areas, with a special focus on sustainable urban development. At least 5 per cent of the ERDF resources are set aside for this field, through 'integrated actions' managed by cities. Also, a further €330 million will be allocated to innovative actions in sustainable urban development directly targetting urban authorities that will be managed by the Commission through Europe-wide calls for proposals for funding.

Poland has been the largest recipient of European Regional Development Fund investment

OPPORTUNITIES

As Poland is the largest recipient, the urban transport measures of developing environment-friendly transport systems and promoting sustainable urban mobility have been agreed and are indicated here ahead of reporting on other countries. The measures are to:

- Develop intelligent urban transport systems, urban sustainable mobility plans, develop environment friendly and low-carbon transport systems, promote clean vehicles and implementation of schemes for in-city user charging and access restrictions. Intelligent urban transport should cover the functional urban areas, in order to improve urban-rural linkages and provide access to jobs and services. Harmonise different modes of transport and service providers;

- Develop well-functioning intermodal transport system by investing in construction of multi-modal and inter-operable nodes (including connecting airports and seaports with other modes, especially railways) as well as logistic centres, including comprehensive information systems, especially along the TEN-T core corridors;
- Facilitate the shift of road freight transport to other transport modes, notably rail, through intermodal platforms, intelligent transport systems;.
- Support the development of the necessary infrastructure for the promotion of alternative low-carbon fuels in road and non-road transport.

THE TEN-T PROGRAMME'S NEW EXECUTIVE AGENCY

The Innovation and Networks Executive Agency (INEA) was officially inaugurated in March 2014. Overseeing the Agency from the European Commission are Vice-Presidents Siim Kallas (Transport) and Neelie Kroes (Digital Agenda) as well as Robert-Jan Smits (Director-General of DG RTD), Matthias Ruete (Director-General of DG MOVE and Chairman of INEA's Steering Committee), Fabrizio Barbaso (Deputy Director-General of DG ENER), and Dirk Beckers (INEA Executive Director). The new Agency is responsible for implementing parts of the Connecting Europe Facility and Horizon 2020 programmes on behalf of the Commission.

INEA is the successor to the Trans-European Transport Network Executive Agency (TEN-T EA), which was created by the European Commission in 2006 to manage the technical and financial implementation of its TEN-T programme supporting European transport infrastructure projects.

INEA officially started its activities in January 2014 in order to implement these EU programmes:

- Connecting Europe Facility (CEF) – transport, energy and digital
- Parts of Horizon 2020 – Smart, green, and integrated transport, as well as Secure, clean and efficient energy
- Legacy programmes – TEN-T and Marco Polo (2007–2013)

What is INEA's role?

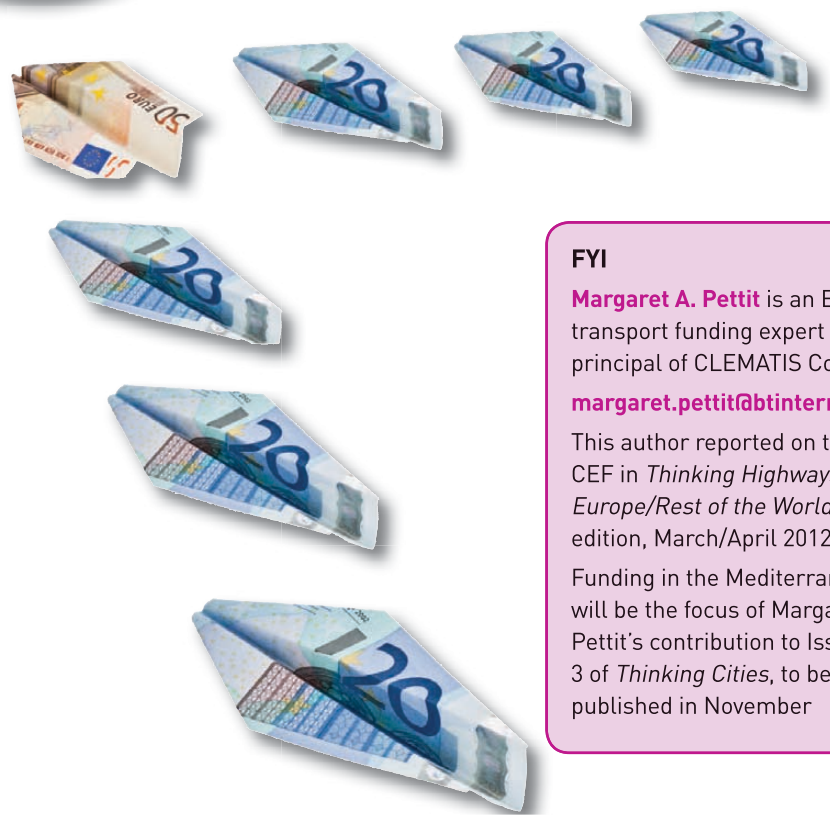
INEA's main objective is to increase the efficiency of the technical and financial management of the programmes it manages.

INEA will manage parts of the new Connecting Europe Facility (CEF)* and the Horizon 2020 (H2020) programme. The CEF is a key EU financial instrument to promote growth, jobs and competitiveness through targeted infrastructure investment at European level. It is divided into three main areas: CEF Transport; CEF Energy; CEF Digital.

It will also manage two parts of Horizon 2020, the EU's main financial instrument for the research area. The smart green and integrated transport and secure, clean and efficient energy are part of H2020's "Better Society" objective tackling societal challenges.

In total, it is expected that the Agency will manage a budget of up to €37 billion for the new Programmes (€30 billion from the CEF and €7 billion from H2020).

Also, INEA will continue to manage the remaining 2007–2013 TEN-T Programme projects, as well as the remaining projects from the Marco Polo Programme (freight logistics), which it takes over from the Executive Agency for Competitiveness and Innovation.



FYI

Margaret A. Pettit is an EU transport funding expert and principal of CLEMATIS Consulting

margaret.pettit@btinternet.com

This author reported on the CEF in *Thinking Highways Europe/Rest of the World* edition, March/April 2012

Funding in the Mediterranean will be the focus of Margaret Pettit's contribution to Issue 3 of *Thinking Cities*, to be published in November

We're all gamers

PleaseCycle's approach to getting more of us traveling sustainably more often, explained by **Crispin Möller** and **Greg Drach**

Sustainable travel is something that is on the rise. Transport for London reported an 8 per cent growth in cycling during 2010 which is the equivalent of an additional 45,000 journeys on top of the half million plus journeys being made by bike each day.

With the percentage of people in the UK also reporting to walk for at least 10 minutes continuously once a week being around 90 per cent of the population, why is it proving so hard to get people out of their cars? With 24m journeys being made in London, not to mention similar cities around the world each day, how can we get more people to think more about their travel methods?

Step up PleaseCycle. Simply put PleaseCycle help get more people running, walking and cycling more often.

PleaseCycle help organizations and local authorities engage with their audiences by targeting a number of key areas in behavioral change, a key factor in encouraging more people to make the switch to more sustainable travel methods.

Providing branded online and mobile portals allowing users to track their journeys, see what CO_2 their sustainable journeys have saved compared to driving and how much money sustainable travel can save them PleaseCycle aim to help people understand the impact their travel has on the wider environment. In turn this allows organizations and local authorities to specifically report on the reduced impact their employees or residents have on the wider area, providing key corporate and social responsibility statistics.

WHAT IS GAMIFICATION?

Providing methods of encouragement and thus getting people to think about how they travel is the first step on the road to getting them out of their car, but how does that involve gamification and where did it all start? Over one hundred years ago, Cracker Jack started to place a toy in every box of their breakfast cereals to reward children for eating more of their product. Since then, countless businesses have been using games, toys and other kinds of fun as a means of selling and promoting their products.

Moving this notion into the 21st century, gamification has become the use of game elements and game-design techniques in non-game contexts.

The term 'gamification' went mainstream in 2010 thanks to a now famous talk by game designers Jesse Schell and Jane McGonigal. Since the TED Talk focusing on the use of game mechanics in non-game contexts, the "gamification industry" has become significant with a huge number

How can we get people to think more about their travel methods?

"It is important to remember that real people use these systems. It sounds obvious, but it is easily overlooked and hard to rectify"

of companies adopting gamification as a means of increasing engagement to suit their varying needs. According to Buck Consultants, over two-thirds of employers consider gamification an effective strategy for encouraging their employees to improve their health and more than 30 per cent of employers intend to adopt a minimum of one health-focused gamified strategy in the next year.

According to M2Research, the market for enterprise gamification solutions grew in 2012 by 38 per cent and is projected to be worth US$2.8bn in 2016 and US$5.5bn in 2018, compared to US$421m in 2012.

The prominence of this market has seen a huge influx of gamification in a wide variety of companies such as Nike, Coca-Cola, Kellogg's, McDonalds and, Microsoft to name a few.

The particular branch of gamification PleaseCycle use is called behaviour-change gamification that seeks to form beneficial new habits among a targeted audience. Behaviour-change gamification can involve anything from encouraging people to make better health choices, such as eating better or working out more often, to building systems that help people save more money for retirement. Generally, these new habits produce desirable societal outcomes: less obesity, lower medical expenses, a more effective educational system, and better financial decisions.

PleaseCycle provides a tool targeted to get more people to cycle and increase cycling frequency among casual cyclists.

HOW DO PLEASECYCLE IMPLEMENT GAMIFICATION?

The successful implementation of gamification requires a number of key objectives to be outlined in order to target the desired behavioural change.

Step 1: Define main objectives

PleaseCycle's main objective is to get more people cycling more often.

Step 2: Delineate target behaviors

It is important to focus on the desired behavioral change in order to put in the correct means of measurement in place. Since behaviors and metrics are best considered together, PleaseCycle's target behaviors are concrete and specific. Some of the examples include:

- Sign up for an account on the website
- Log cycling trips at least once a week
- Create a goal
- Take part in a cycling competition
- Form or join a team
- Share your experiences on Facebook or Twitter

Step 3: Describe the users

It is important to remember that real people use these systems. It sounds obvious, but it is easily overlooked and something that it is very hard to rectify. It's important to know who the users are and anticipate and understand what their needs are and will be moving forward. It is important that the information captured is carefully analysed to provide the most relevant experience to users throughout the lifecycle of the product.

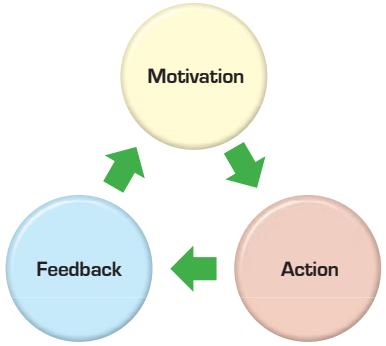
Step 4: Devise Activity/Engagement Cycles

There are two kinds of 'activity cycle' used on the PleaseCycle platform: engagement loops and progression stairs. Engagement loops describe, at micro level, what users do, why they do it, and what the system does in response. Progression stairs give a macro perspective

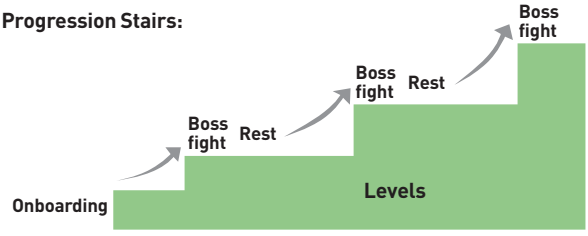
> ***Gamification has proved hugely influential when it comes to people's buying habits***

on the 'player's' journey. It's important to get these cycles right as getting them wrong means you risk undoing any behavioral change already achieved and potentially loosing the interest of the user fulltime.

Activity Cycle:



Progression Stairs:



Step 5: Don't forget the fun

Before a gamification solution is implemented it is important to take a step back and as a simple question: is it fun? Fun isn't easy to predict, but the best way to tell if the system is fun is to build it, test it and refine it though a rigorous design systems.

PleaseCycle have gone through a number of phases in order to produce products that work for the specific audiences they are asked to cater for.

Step 6: Deploy the Appropriate Tools

The last stage is to pick the appropriate game mechanics, components and elements and deliver them through an effective mechanism.

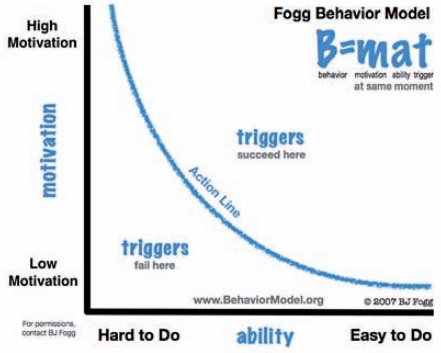
PleaseCycle are very careful about which elements are selected, constantly bearing in mind that the user experience should be fun and motivating to encourage increased usage. It is as refined balance of various elements that helps create a successful system.

DOES IT REALLY WORK?

PleaseCycle have based their latest product variation on a variety of different applied theories, putting them to the test in a couple of notable case studies which we will explore later in the article.

Firstly the science:

The *Fogg Behaviour Model* – developed in 2011 by B.J. Fogg indicates that behaviour change occurs once triggered only when motivation levels are high and/or when users' ability to complete a task is increased.



Self-Determination Theory – developed by Edward Deci, Richard Ryan and their collaborators suggests that human beings are inherently proactive, with a strong internal desire for growth, but their external environment must support this, otherwise these internal motivators will be thwarted. SDT indicates that these needs fall into three categories: competence, relatedness, and autonomy.

- "Competence", or mastery, means being effective in dealing with the external environment: learning how to cycle, route planning, preparing appropriate clothing.
- "Relatedness" involves social connection and the universal desire to interact with and be involved with family, friends, colleagues and others.
- "Autonomy" is the innate need to feel in command of one's life and to be doing what is meaningful (getting healthier, reducing the impact on the environment, saving money).

According to the theory, tasks that implicate one or more of these innate human needs tend to be intrinsically motivated. In other words, people will do them for their own

sake. It is our job to boost these motivators and make them easier to feel and achieve.

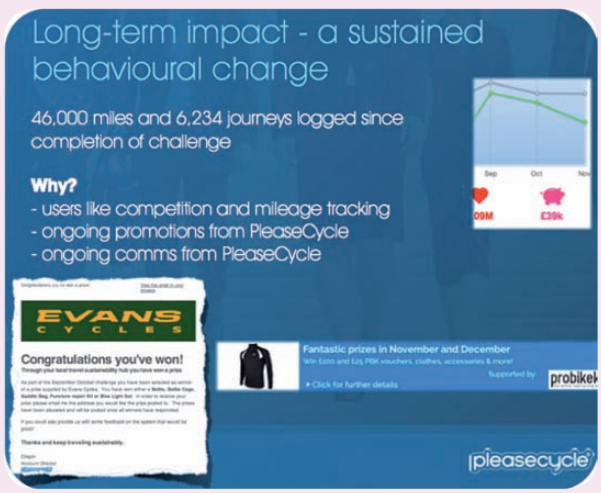
The Tools

- **Increase motivation:** PleaseCycle have used a number of gamification tools such as: badges, goal setting, tracking cycling progress, leader boards and friendly competition with colleagues.

go:cycling One Month Case Study

go:cycling is a local authority initiative based in Leeds for the West Yorkshire area of the UK. They have been tasked with getting more people cycling as both a means of being healthier and as a means of travel, relieving congestion within the City are surrounding area.

PleaseCycle carried out a one-month challenge in conjunction with go:cycling as a focal point of action, drawing on Fogg's behaviour change theory and providing impetus for people to try cycling. They enjoyed a high participation rate during the challenge as well as following it, utilising the self-determination theory and PleaseCycles various intrinsic tools following the challenge. As post challenge survey revealed the following:



- **The ability to share achievements:** Links with Facebook and Twitter encourage teams through social interaction
- **Reward:** Discounts in local shops and restaurants based on your BikeMiles are also very powerful extrinsic motivators
- **Inform:** PleaseCycle provide a lot of information on how to get started and prepare for cycling e.g. what bike and what clothing.
- **The 'Weather Widget' and 'Journey Planner'** make route planning easy and fun.
- **Triggers:** we use a number of triggers such as nudge emails; competitions and challenges to stimulate the desirable behaviour change.

CONCLUSION

At the beginning of this article we posed a question. How can we get more people to think about their means of travel and instigate a behavioural change thus benefiting themselves and others?

Gamification has proved hugely influential when it comes to people's buying habits. The volume of investment going into the sector is a clear indication that the appetite both in terms of consumers and suppliers/employers/authorities is growing. With people's travel habits beginning to shift gamification shows signs of being a key method of assisting the change and seeing that it is not simply a phase and is a key long term progression.

FYI

Greg Drach is business development director

greg@pleasecycle.com

Crispin Möller is account director at PleaseCycle

crispin@pleasecycle.com

www.pleasecycle.com

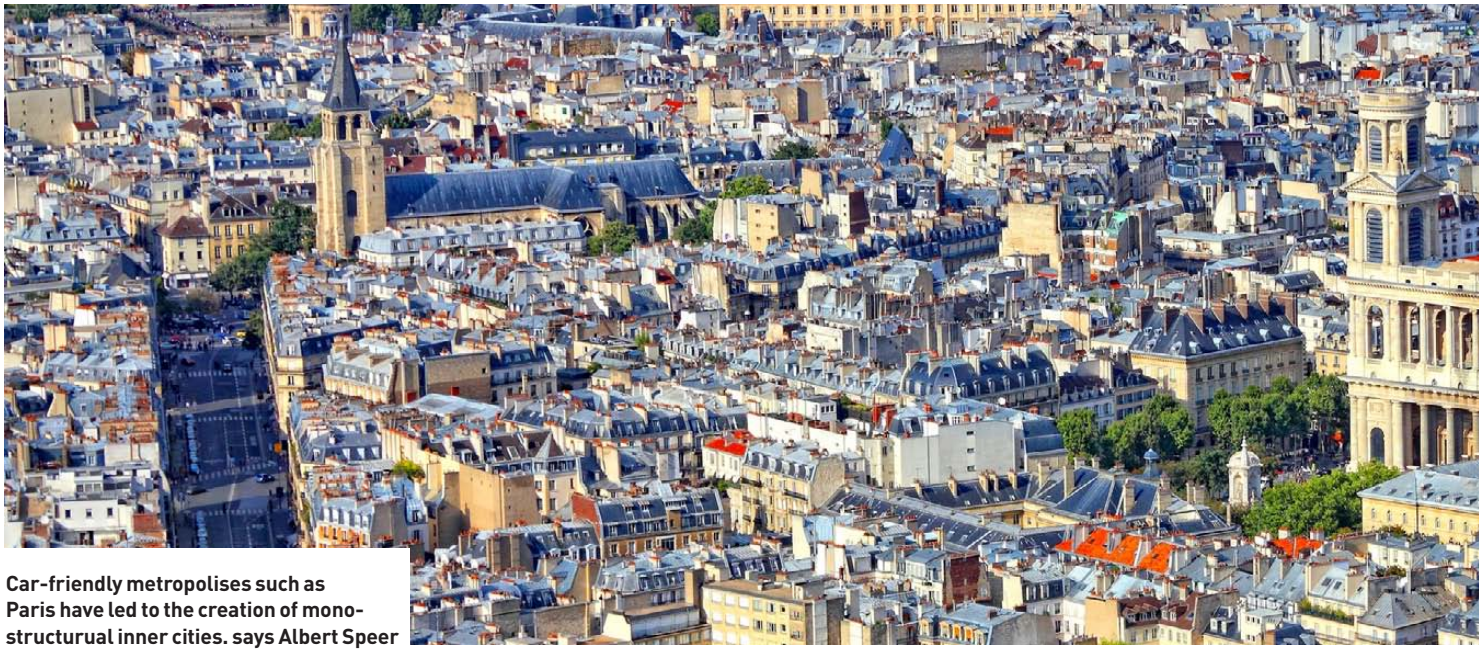
If you are interested in implementing PleaseCycle in your organisation or municipality, please get in touch at: highways@pleasecycle.com

REFERENCES

The authors used the following resources to write this article

- Video lectures from Coursera' massive open online course (MOOC) "Gamification"
- "For the Win" by Kevin Werbach
- BJ Fogg's Behaviour Model: http://www.behaviormodel.org/
- Self-Determination Theory: http://en.wikipedia.org/wiki/Self-determination_theory
- Market statistics:
  http://www.buckconsultants.com/
  http://www.biworldwide.com/
  http://www.m2research.com/gamification-2012.htm

No need for reinvention



Car-friendly metropolises such as Paris have led to the creation of mono-structurual inner cities. says Albert Speer

With booming populations and increasing transport problems part of everyday life in many cities, does this mean cities need to be redesigned from the bottom up to continue providing a decent quality of life in the future? Architect and city planner **Albert Speer** and mobility planner **Michael Dinter**, in conversation with **Eberhard Buhl**, argue that we don't need to reinvent the city, rather identify the strategies to make the ones we have better

It has become widely accepted that the so-called car-friendly city of the 1950s, with its wide traffic lanes and intersections, is not really fit for the future. Do we need to completely rebuild Europe's cities, or can we move forward with the structures that are already in place?

Albert Speer (AS): You have to ask yourself how this car-friendly city actually came about. Looking at Germany in particular, we had lost most city centres in the war. It was more or less wasteland. This created space for the vision of a car-friendly city, and most city planners yielded to this vision. Today there are many roads that didn't even exist before the war – the north-south axis in Cologne, Berliner Straße in Frankfurt and Theodor-Heuss-Straße in Stuttgart, for example. Entire street sections were simply cleared and paved over rather than being rebuilt.

Michael Dinter (MD): This wasn't the case in other European cities. That's why you still see the old, densely built structures in London and Paris.

AS: This car-friendly city has caused a lot of harm, leading to the creation of monostructural inner cities. That's why the mixed function of working and living directly in the city center, which was previously the case, has sharply decreased. It was also part of the spirit of the Wirtschaftswunder to promote suburbanization and to create satellite towns outside the city. That's how the established city of short distances became a city of long distances.

Because the city center has been turned from a living space into a business space with transport routes?

MD: Precisely – arrive by car, work, drive home again. The business district here in Frankfurt,

Monmartre, Paris – while many German city centres were destroyed in or as a result of the Second World War, Paris escaped relatively unscathed

with its banks and offices, is a typical example. In the 1970s and 1980s hardly anyone wanted to live in the city center. People began to desert the inner cities – a trend that has now clearly reversed.

As early as 1963 the Buchanan Report addressed all the major criteria that we intend to implement today – the failings of the car-friendly city – but also suggested solutions such as car-free environmental zones. Why has it taken so long for such measures to be put in place?

AS: You can't reverse social processes from one day to the next. People simply wanted to get out into the open,into the fresh air, away from ramshackle city centers and exhaust fumes...

These processes didn't take place in the megacities of Asia or Africa. How is the situation there?

AS: Well, you can't lump all these megacities together – there are some big differences. Chinese megacities are seeing rampant outward growth, but this happening under the organizational structures of a centralized government that has been stable for many years.

MD: And they have the money to really make things happen, especially when it comes to public transport. Shanghai, for example, has now become a city with public transport structures comparable to Paris or London.

That's a process I've observed over quite some time. In just two decades Shanghai built up a subway network that now has 13 lines. For Expo 2010 there were already 10 routes.

There is no such thing as a blueprint for a city that can simply be taken and applied anywhere in the world

Albert Speer

Whereas no one wanted to live in the centre of Frankfurt in the 1970s and 80s, that trend has most definitely been reversed of late

The theme of Expo 2010 was "Better City – Better Life"...

AS: Exactly, and people were quick to adopt the metro system. It's cheap, it works and it has improved the flow of road traffic in the city center. Naturally, the monofunctional living structures of high-rise blocks on the outskirts are not ideal. That's exactly what we used to have on a smaller scale in Germany: satellite towns without their own identity.

And often without functioning infrastructure...

MD: This is precisely what causes additional traffic, from these pure housing developments into the city centers or to other places where goods and services are available. In Egypt and certain other African countries it's hard to take control of this, since growth usually comes about informally. People simply settle where they see fit, without intervention from planners. The growth in China is mostly organized through large-scale plans, and the available administrative structures provide some scope for taking things in a new direction.

Does that actually happen?

AS: Absolutely. We can observe through our office in Shanghai that the idea of decentralized concentration – which means compact settlements around central cities, lots of green space in between, plus the appropriate mobility structures – is finding increasing recognition in China as a viable strategy for the future. For instance, for several years we have been developing a new residential and business district in the industrial city of Changchun in northeast China according to ecological criteria. Here it's all about having a range of sustainable functions, an integrated concept with green axes, parks and space for 500,000 residents, and public transport infrastructure with metro lines, bicycle lanes and sidewalks. This fits with the concept of transit-oriented development – the city is developed along public transport axes.

Is this an idea that works in China in particular?

AS: Not only in China. For decades there has also been a very positive vision in Cairo of creating overflow cities around the core city and connecting them with high-performance public transport axes. Unfortunately, the funds for systematic implementation are often lacking. In 1979 the satellite town Madinat as-Sadis min Uktubar, "6th of October City," was founded on the edge of the desert to the west of the pyramids. It is named after a military operation in the Yom Kippur War. The town is designed for four million people, but the public transport and road links are far from complete. We pressed for a healthy mix of functions as part of a master plan: not just living space, but industry and commerce, administration, a university campus and schools. It has to be an independently functioning town. Otherwise its residents will still be constantly commuting to Cairo, and that only aggravates the transport chaos.

Riyadh is another place where you find small-town satellite structures around the main city. Have the Gulf States managed to take things further?

MD: Riyadh is a typical car-friendly city, laid out like a chessboard with streets at right angles. When I was there for the first time 20 years ago there was no public transport at all, just shabby buses for foreign workers. Now there is a 178-kilometer metro network that was built up within a few years, plus corresponding bus lines with different functions such as shuttles and local buses. So what we see here is an entirely new public

Riyadh, Saudi Arabia, a typical car-friendly city, laid out like a chessboard

transport network being planted in an existing city. That sounds easier than it actually is, as we can observe as planners.

Where is an urban bus supposed to drive on a road with six or eight lanes? Where do we place bus stops, and how will people get to them? But the willingness to embrace a new way of thinking is there.

Is the issue of sustainability generally being well received on the Arabian peninsula?

AS: The sustainability aspect really resonates in Arabia, perhaps because people there have a greater awareness that resources may not last forever. Dubai already has a metro system, Riyadh is building one, and Qatar has opted for rail and metro transport as well. Solar energy is increasingly being used in place of oil and gas, so people are even thinking differently when it comes to fossil fuels.

Is it not simply natural to plan green cities such as Masdar in these regions that receive so much sunlight?

MD: That's right, although planners rarely have the opportunity to build an entire new city – normally it's a question of how to handle existing settlements and make sensible alterations. But we cannot simply apply what we are doing in Masdar to existing cities. I regard it more as a useful laboratory experiment, a model for a city of the future. There's a lot to be learned from it, but of course Cairo or Frankfurt pose quite different challenges.

So is it actually impossible to create the ideal city that people have repeatedly called for over the centuries?

AS: What do we mean by the ideal city? We must always think of a city in combination with its people and its various cultures! There is no such thing as a blueprint for a city that can simply be taken and applied anywhere in the world. There are concepts such as decentralized concentration, but how this can come about depends on the specific case.

MD: For our office we defined seven key elements of sustainable urban planning. First, management and strategy are important for sustainable urban planning – cross-sectional management, where all departments speak with one another, is essential. Citizen participation and transparent planning and ownership guidelines are also part of this. The second element is decentralized concentration: complete, compact settlements in the open countryside. Third, density and mixed use are incredibly important: stable structures, short distances, and an appropriate mixture of residential and commercial use. This is also something that can be achieved through retrospective concentration within a city itself. We have already

Biographies

Michael Dinter studied civil engineering at Darmstadt Technical University. Since 1990 he has worked as a transport planner at AS&P, with responsibility for the transport planning and transport technology departments. He is a managing partner of AS&P GbR.

Albert Speer Jr studied architecture at Munich Technical University and in 1964 founded an office for urban and regional planning in Frankfurt. In 1984 he and his colleagues created the office AS&P – Albert Speer & Partner – which currently employs 160 people. An office was opened in 2001 in Shanghai. Since 1970 Speer has been a member of the German Academy for Urban Development and Regional Planning. In 1972, Kaiserslautern Technical University appointed him professor for urban and regional planning, where he helped to establish the degree in spatial and environmental planning. He was a guest professor at ETH Zurich from 1994 to 1997.

talked about adequate mobility as the fourth point. The fifth is urban technology that takes a holistic approach: a recycling economy, supply and waste technology, energy-saving LED lighting networks for streets, charging infrastructure for electric cars and so on. The urban landscape, as the sixth aspect, has to do with quality of life. It includes green spaces, parks and these days also urban agriculture. Finally, we must consider the actual building technology for low energy use, from passive buildings to climate control. If these criteria are all applied thoroughly, the sustainable city can certainly become reality, and many cities are already heading in the right direction.

Sustainable cities must also be able to cope with growth or decline of the population and an aging society. Is that even possible as things stand?

AS: I don't think we have to reinvent the city, but we do have to modify its structures. One reason why many older people move back into the city is so they can go about more of their daily lives on foot, even when they are not as mobile as they used to be. The baker is just around the corner, so is the cinema, the doctor. One very important aspect for me is that a city with a good quality of life in the future absolutely has to offer easy public transport.

MD: I also see this as a reason for trams to make a renaissance, as they do not involve negotiating as many levels as subway systems.

So is this a paradigm change for you as a planner?

MD: Absolutely, and I believe London Transport was a pioneer in this regard. At the moment when you compile a transport report, the first chapter deals with individual motorized transport, the second with public transport, the third with bicycles and the fourth with pedestrians. London Transport reverses this order: the very first chapter has to tackle pedestrian transport. That doesn't necessarily mean that the content of the report as a whole is different, but as a transport engineer, if I start thinking about pedestrian transport first, I'll approach the planning differently. This certainly makes sense in Germany too, and a few weeks ago I presented the concept to our planning partners in Riyadh – they were really excited.

What could this mean in concrete terms for transport planning?

MD: Up to now when we build a road, we plan it from the inside out. We estimate how many cars will travel on it per hour and we plan the dimensions of the road accordingly: one lane per direction, two lanes or more. Whatever is left we divide up between parking spaces, cycle lanes and sidewalks – from the inside out. If we think of the city as a space for living, we have to plan the road from the outside in, starting with what you might call the peripheral uses. Do cafés need space for tables, or stores to display their goods? How much room do pedestrians and cyclists need? How will we accommodate bus stops, access to trams and subways? Once all these have their space, we can give the rest to the cars.

AS: In reality some compromises always have to be made, of course, but I think that if tomorrow's cities are to remain genuinely worth living in, this is the right approach.

Growth in cities such as Changchun City, Jilin Province in China, is mostly the result of large-scale planning, says Michael Dinter

FYI

Prof Albert Speer is an architect, urban planner, managing partner and founder of AS&P, one of the biggest urban planning companies in Germany.

Michael Dinter is a managing partner at AS&P and responsible for traffic planning and transportation technology.

http://www.as-p.de

This article first appeared in a different format in the May 2014 issue of Siemens Mobility Magazine, *COMO. Thinking Cities* version by kind permission of Siemens and edited by H3B Media.

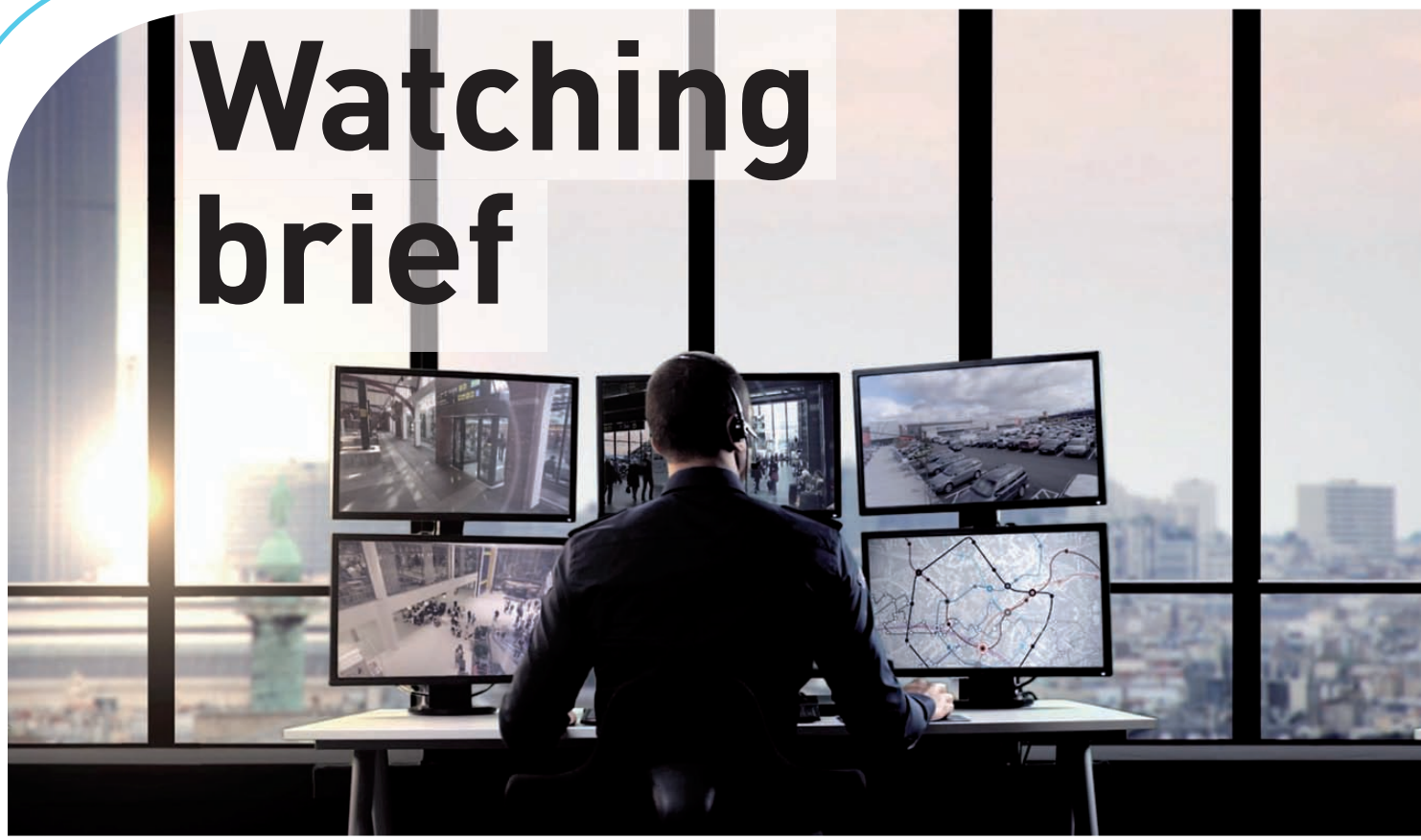
Safety and Security in Transport

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

- **Stockholm, Sweden & Madrid, Spain** – Smart camera surveillance for added smart city security
- **Smart Enforcement** – Adapting automatic traffic enforcement
- **Network Video** – Automating incident detection

Smart camera surveillance systems are ensuring that Stockholm remains a safe city

Watching brief



Smart camera surveillance and modern incident management solutions offer a new level of security for public transport, says **Patrik Anderson**

The new surveillance system on Madrid's buses has not only helped to reduce the costs for incident responses. It has also given EMT an efficient tool to prevent crime and to investigate various incidents on board

We all want to feel safe and secure, it's a basic human need. In the hierarchy of needs it comes a long way before self-esteem or self-actualisation. However, we all perceive that security differently. There are cultural and geographical differences in this perception and also a correlation to the actual level of security based on the individual's knowledge of the situation or based on the sequence of events that have occurred historically.

Surveillance is a tool that public transport transit authorities can use to both manage the present security level, in terms of reducing incidents and crime and also to address passengers' fears concerning safety and security on the transport network.

Used proactively in real-time, rather than merely recording the footage, camera surveillance is one dimension for security managers to consider when building a security system.

Another dimension is how camera

If people are aware of the benefits and the level of camera usage and incident reduction, it has an impact on deterring potential criminals

usage is communicated to both staff and passengers. If people are aware of the benefits and the level of camera usage and incident reduction, then this has an impact on both deterring potential criminals and raising the 'perceived' level of security for everyone.

In Sweden, Stockholm's transit authority, Storstockholms Lokaltrafik (SL), worked with the TV channel Kanal 5 for three seasons on a documentary where viewers can follow the operators in the security centre and watch how they interact with the people on the ground responding to the incidents.

Each episode documents how a number of different incidents are dealt with by security operators, private security personnel and the emergency services and how modern network video cameras are at the centre of the response.

In Spain, the Madrid bus transportation authority (EMT), installed a real-time surveillance system that is capable of viewing camera footage remotely from all their buses following an incident. Journalists were invited to a demonstration of the system and they then published details of it across major Madrid newspapers and TV stations so that the public could learn about it and understand all about the increased incident-handling capacity and improvements to the level of security for both passengers and staff.

The main goal in any incident management system is to not overreact or underestimate any incident when it occurs and to use the right resources early on to reduce the number of incidents or avoid them entirely.

AN INCIDENT LIFECYCLE

The lifecycle of an incident can be characterised in six distinct steps:

Detection
↓
Prioritisation
↓
Response
↓
Re-prioritisation
↓
Investigation
↓
Follow-up

Detection

This is the phase where an incident happens and is discovered. Incidents can be discovered manually when for example a passenger reports the incident via phone to the security centre, or it can be done automatically through automatic video analysis by a modern network video camera system. Examples of automatic video analysis could include overcrowding on platforms or entry into a restricted area or entry onto the rail tracks. Other types of sensors can also alert the security centre of an incident, like fire and smoke alarms, access controls and radar or other motion sensors.

Prioritisation

Once the incident is detected, it needs to be prioritised in terms of what the nature of it is. This information is then prioritised against all other activities that response personnel are currently occupied with. By using high quality video from network video cameras, operators can make an informed assessment in real-time of the incident from a remote location and decide on the appropriate action.

Response

Once the incident is fully understood by the security operators, it can be classified to follow a protocol; a set of operating procedures that have been determined beforehand in order to defuse and minimise the situation. The security centre can continually use network video to monitor how the scene potentially escalates and develops.

Furthermore, as modern network video cameras provide crisp, clear HDTV-quality video, not only can operators recognise what is currently happening they can also clearly identify the individual(s) involved. It is vital in a real-time situation to give a clear description of a perpetrator or someone in need of help (ie. clothing, height, body shape etc.) to allow the response to be quickly co-ordinated. With older camera technologies this was not really possible in many situations, but now it is. The handover between the security centre and response personnel can be made via radio, but network video also provides the ability to send live video streams to mobile devices wirelessly.

Network video cameras are based on open standards and run on any IP based network. Specifically, network video compressions like H.264, make

it easy to broadcast video streams from the scene over cellular networks into the response unit's vehicles etc.

Re-prioritisation

Sometimes an initial response to an incident is made with vague or limited information at hand. Sequences of events that have happened shortly before detection of the incident need to be reviewed and operators have to create a picture of the situation.

Another scenario may happen during an incident, when a suspect leaves the scene before responders have arrived. In these types of situations when a new priority or re-prioritisation needs to be established, network video is instrumental in keeping everyone informed.

Furthermore, live and recorded video from other nearby locations can be used to continue the search for people involved and help responders be in the right place. Key to any successful response is the speed of that response and here network video also plays a central role in reprioritisation of incidents.

Investigation

After an incident is dealt with, there usually follows a period of investigation where the facts are established and the sequence of actions reported to the authorities. Video evidence is key as it helps to show the actual scenario from many different angles. By using modern network cameras, the image quality is the same as the HDTV broadcasts we are accustomed to at home. Positively identifying people where there can be no doubt of who did what and when, is a vital benefit to any investigation process.

Especially critical are environments like stations and depots in low-light or very bright-light where traditional cameras have difficulties. Modern network video cameras have the ability to enhance any available light to create a lighter picture

Network cameras make the trip safer and save time for travellers and drivers within the Stockholm area, Sweden. "The surveillance system and the Security Project have been positive changes for us. It has given us more return than we had predicted." says Stefan Danielsson, Project Manager for SL's Security Project

and also to expose the bright light and shadows independently in a very light scene so that all details become more visible. Axis Communications with its Lightfinder and WDR (Wide Dynamic Range) technologies is leading the market in this field.

Follow-up

The final phase is the step of follow-up and learning. Here video can be used to review real incidents with staff and security partners in order for them to discuss and learn from the footage. By working this way, both newer staff members as well as experienced personnel can together create a learning organisation.

PROACTIVE VIDEO USE WITH CENTRALISED SURVEILLANCE IN REAL-TIME

To create a new level of security for public transport, centralised, real-time surveillance and the ability to coordinate response personnel is key to minimising the impact of incidents and increase the perception of security. Network video has a clear role to play in all phases of modern incident management. By carefully applying intelligent video where cameras analyse the video, security operators will also benefit from an additional detection mechanism to detect incidents early and thereby increasing their ability to respond to an incident successfully before it escalates out of control.

FYI

Patrik Anderson is Director Business Development Transportation, Axis Communications

patrik.anderson@axis.com

www.axis.com

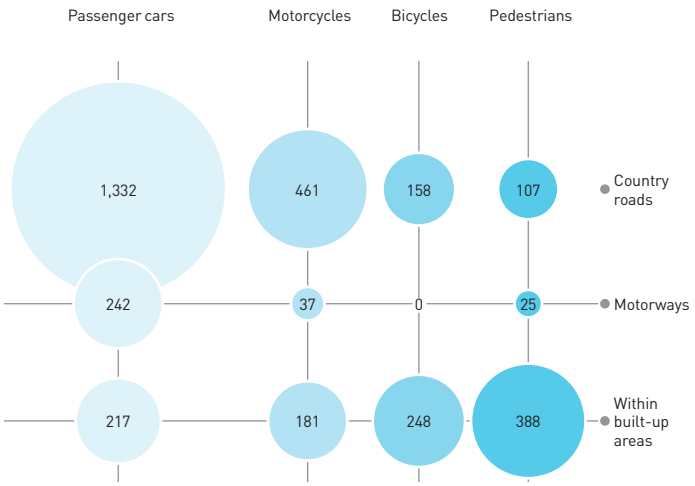
The holistic approach

Boris Wagner assesses the available options for the successful adaptation of automated traffic enforcement to urban requirements

While at 50 km/h eight out of 10 pedestrians will survive a collision with a passenger car, fatalities rise dramatically at higher speeds. At 65 km/h eight out of 10 pedestrians will be killed

Combining red light enforcement and speed enforcement makes intersection safer

Number of people killed in road traffic accidents in 2012
by type of road use and location of accident



Bicycles and pedestrians are the most vulnerable participants in urban traffic

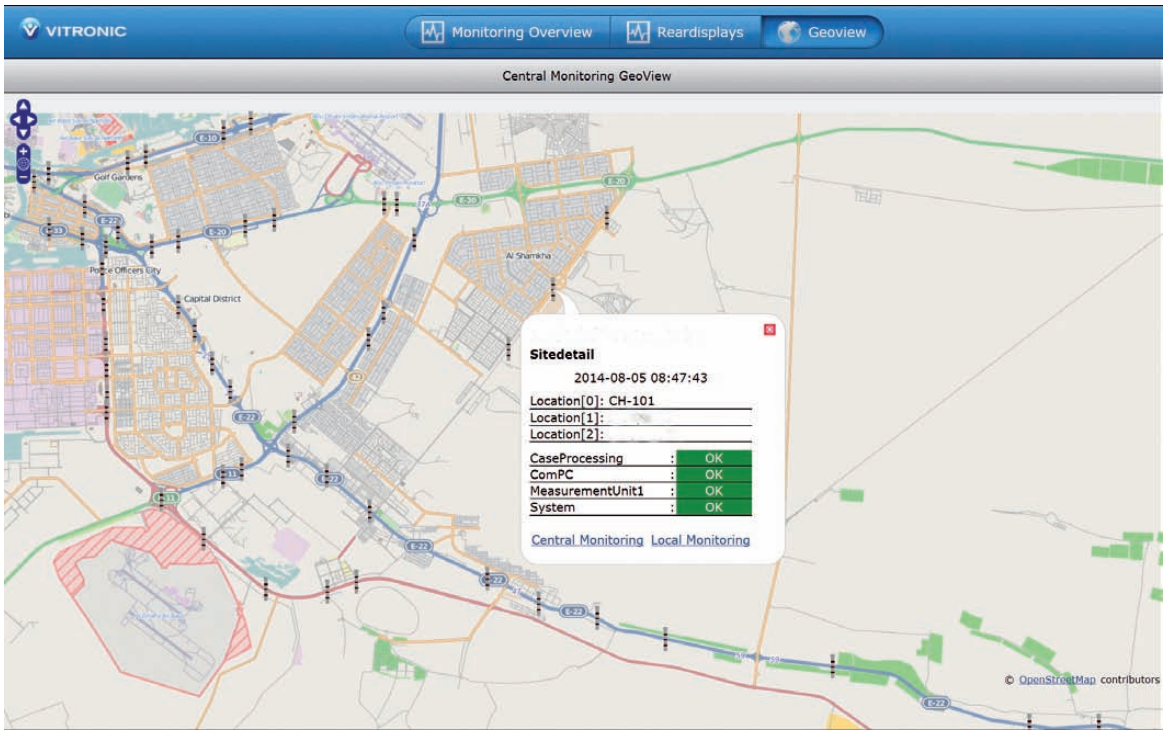
Traffic accident fatalities on urban roads have dropped by over a third in the first decade of the 21st century. This is in itself good news and signifies the progress that has been made in improving road safety. But a closer look at this figure reveals a slightly different picture.

During the same time period the proportion of fatalities in urban areas compared to the overall fatality number has increased to 38 per cent[1]. This indicates that actions to increase road safety in urban areas have been less effective than, say, on interurban roads. There are several reasons for this. For one, while speeding is the number one cause of fatal accidents both inside and outside cities, it is not so predominantly a risk factor as it is for example on motorways. Instead there are other risk factors in urban areas that are a threat to traffic participants. The number of fatalities at junctions is twice as high on urban roads as outside cities[2]. In Germany, crossings and intersections are the number one cause of traffic-related serious injuries within urban areas[3].

Another reason is that urban traffic is more complex, both in terms of participants and in terms of road topography. Cars, heavy goods vehicles, cyclists and pedestrian share one infrastructure with the latter two being especially vulnerable in case of accidents. Plus, urban road systems have a lot more junctions, intersections, and pedestrian crossings than non-urban roads. Add to this lanes reserved especially for bicycles or public transport and you get a mixture that requires an enforcement strategy that is adapted to the specific needs of urban areas.

NOTE

1 European Road Safety Observatory, "Traffic Safety Basis Facts 2012 – Urban areas", http://ec.europa.eu/transport/road_safety/pdf/statistics/dacota/bfs2012_dacota-intras-urbanareas.pdf
2 Ibid.
3 German Federal Statistical Office, "Traffic Accidents", Wiesbaden, August 2013



Networking software like PoliScan connect allows traffic managers to remote control enforcement in real time

PROTECTING INTERSECTIONS AND CROSSINGS

Red light enforcement is common and well established, but it runs short when it comes to protecting intersections and crossings. Consider the following everyday scenario: As a vehicle approaches an intersection, the traffic light turns yellow. In hope of still passing through, the driver speeds up exceeding the speed limit. Even if this extra burst of speed seems only marginal it can have disastrous effects. While at 50 km/h eight out of 10 pedestrians still survive a collision with a passenger car, fatalities rise dramatically at higher speeds. At only 15 km/h higher eight out of 10 pedestrians will not survive the collision.

A very effective way to counter this and change driver behaviour to braking rather than accelerating at yellow traffic lights is combining red light enforcement with speed enforcement. These versatile systems offer all the road safety benefits of traditional red light cameras but add continuous speed enforcement functionality integrated into one enforcement site. They are also able to monitor larger urban intersections as they can detect multiple violations simultaneously across several lanes and in several directions.

TAILGATING ON URBAN HIGHWAYS

Another risk factor that is prominent on urban motorways is tailgating. Especially during peak times drivers often do not keep the required minimum safety distance to the vehicle ahead. According to the National Center for Statistics and Analysis tailgating is one of the major contributing causes for fatal rear-end crashes in the US which result in more than 2200 fatalities and more than half a million injuries each year[4]. Studies conducted on the Rhode Island urban highways reveal that during rush hours more than 60 per cent of all drivers were tailgating with still 40 per cent being too close to the vehicle ahead during non-rush hours[5].

While speed enforcement is widespread on urban motorways, automated tailgating enforcement is

NOTE

4 Wang, J., Song, M., Assessing drivers` tailgating behavior and the effect of advisory signs in mitigating tailgating, in: Proceedings of the Sixth International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design, Lake Tahoe, California, 2011

5 Ibid.

6 Malenstein, J., Implications of innovative technology for traffic law enforcement, Washington, 2009

7 Lodoncyclist, Should HGVs be banned from the city center?, http://www.londoncyclist.co.uk/hgv-ban/

Modern enforcement technology can distinguish between different vehicle classes and allows the definition of time spans, during which HGVs would be banned from entering certain areas

rarely implemented. This is all the more surprising since the technology is available and there are even concepts to include tailgating detection into regular spot speed enforcement with additional video cameras documenting the violation. The positive effect that the deployment of such an innovative enforcement technology would have on road safety has recently been highlighted by road safety experts[6].

ENFORCING TRAFFIC BANS

Heavy goods vehicles (HGVs) are a major cause for urban traffic fatalities of cyclists. In London for example 43 per cent of cyclist deaths involve HGVs even though they constitute only 4 per cent of all roads trips[7] – a strong case for at least partial bans of HGV traffic. Authorities could prohibit through traffic for trucks for selected inner city areas or during certain time periods outside of peak delivery hours in the early mornings. The same applies for the weekends when a lot of cyclists would otherwise share the roads with HGVs. At the same time these bans would also help to improve the quality of life in inner cities by reducing pollution and noise.

A common problem with time variable bans on traffic is its acceptance by road users. As long as controls are random and the chances to get caught are slim there will be an incentive to enter the restricted zones. Continuous physical policing, while in principle effective, would be very costly because of the amount of manpower that it would require. But these limitations could be overcome by installing an automated enforcement network throughout key locations within an urban road system. Modern enforcement technology can distinguish between different vehicle classes and allows the definition of time spans, during which HGVs would be banned from entering certain areas. Connecting the enforcement sites to the traffic management center would even allow authorities to monitor compliance in real-time.

MAKING USE OF NETWORK TECHNOLOGY

Especially this live connection of enforcement sites to the traffic nerve centre of a city provides authorities with a range of new ways to react to changing traffic conditions and improve urban road safety. Vitronic's PoliScan connect networking software for example is used by several cities in the Middle East to remote control their enforcement systems in real time. Besides allowing traffic managers to adapt the enforced speed limit and import violation cases online the software offers extensive statistics on each enforcement site that authorities can use to identify and relief hot spots that have recurring violations or patterns of dangerous driving behavior.

Another example of the benefits of interconnecting enforcement with traffic management is interfacing enforcement devices with traffic information systems like variable message signs (VMS). Statistics from the European Road Safety Observatory show that the distribution of road fatalities inside urban areas varies during the week. The same is true for various times during the day, again with peaks during rush hour times. With connecting VMS and enforcement technology driving behavior can be positively influenced at certain road sections during high-risk times without having to generally reduce the speed limit on this section of road.

CONCLUSION

While speed enforcement is widely implemented and has been shown to have a positive effect on road safety there are other risk factors where automated enforcement could help reduce fatalities and injuries. This is especially the case for urban traffic as it is comparatively complex and reducing speed related accidents is just one parameter on the way to making city roads safer.

To reach that goal, traffic managers will have to adopt a diverse strategy that combines measures aimed at changing individual driver behavior such as tailgating with actions that have a more general effect on traffic like selective bans or variable speed limits. All of this can be achieved by implementing a networked enforcement management system. Instead of targeting only a singular risk factor such a system allows authorities to take a holistic approach to urban road safety.

FYI
Boris Wagner is Manager International Sales Traffic Technology Division
boris.wagner@vitronic.com
www.vitronic.com

Live AID

Patrik Anderson discusses how network video can automate the detection of incidents, not just in the city of today but the city of the future

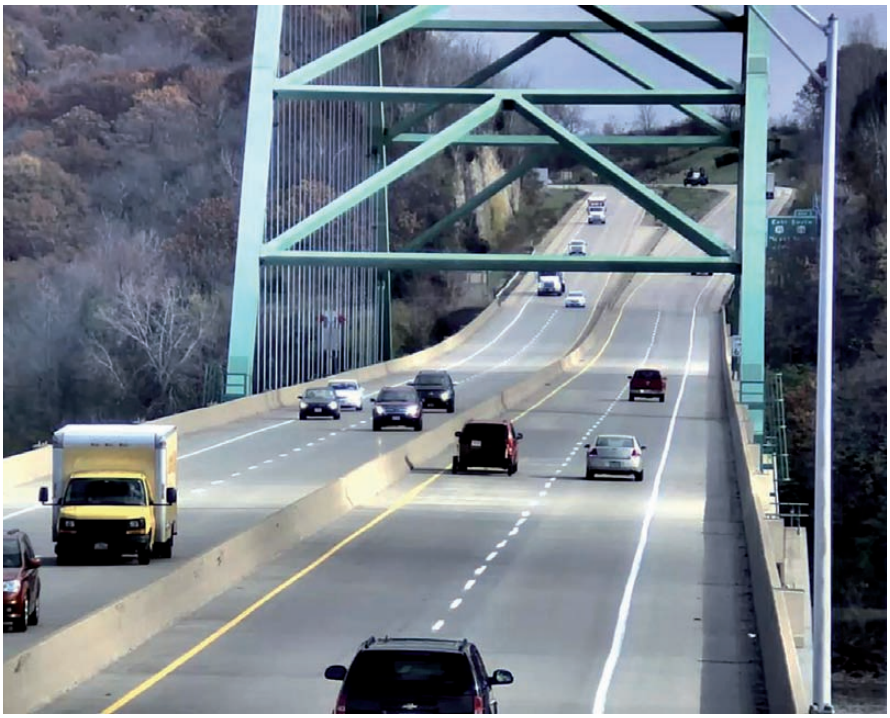
By 2025, it is estimated that almost 60 per cent of the world's population will live in urban areas. 6.2 billion private motorized trips will be made every day in cities worldwide. In order to improve and manage the expected growing traffic flows, traffic management centers (TMCs) will need to be able to detect traffic deviations early, efficiently and reliably – whether they originate from the density of the traffic flow or from incidents such as vehicle breakdowns, accidents or fire.

To do this, there is a real need to create a deeper and broader traffic understanding. Cameras are a cost-effective way of increasing traffic understanding in real time but traffic operators cannot monitor thousands or even hundreds of cameras at the same time. Today they often rely on commuters reporting incidents. In the next few years, with the unstoppable shift from analog to network

The network camera is not only an efficient traffic monitoring tool that provides a detailed view of the traffic situation at any given time, but it also can be used as a sensor to automatically detect traffic deviations and incidents

Traffic management at Manila, Philippines; "Our top priority was being able to access real-time information on traffic conditions. Timely information on situations such as obstructions or accidents that could lead to traffic jams can help tremendously in monitoring traffic effectively." Atty. Yves P. Gonzalez, Technology Evangelist, Metropolitan Manila Development Authority

DREW TRAMO
COME ROTONDA NB



City of Dubuque steers the future of traffic safety towards IP technology: "The system gives me a really good heartbeat on the city. We can go back through the footage to see what led up to accidents and get a good feel for what might help [in the future]."
David Ness, professional engineer for the City of Dubuque

video, intelligent video analysis will start to play a much more instrumental role in traffic management. Intelligent camera capabilities – often based on detection, tracking or recognition algorithms – have made it possible for network cameras to automatically alert security operators of incidents such as congestion, broken down, stopped vehicles and wrong-way driving – helping traffic control officers to more efficiently manage the traffic.

INTELLIGENT DEVICES

Unlike analog solutions, network cameras record images as digital data directly in the camera. Each camera features a powerful processor, which can be used to analyze the digital video stream in real time in parallel to delivering high quality video. Smart video applications can be downloaded into the cameras themselves, much in the same way apps reside in smartphones – so there is no longer a need to send a large number of video streams to one central server for processing. Each camera in itself becomes an intelligent device that can monitor the traffic in its field of view independently, and decide when to trigger an alarm.

Smart video applications that are available today include automatic incident alerts for slow traffic, queues, vehicles in the emergency lane, accidents, smoke or fire in a tunnel. As incidents are detected early, traffic management centers can react quickly, for example by adjusting variable message signs or traffic lights to minimize the impact. They can now make sure important live traffic information reaches all the relevant stakeholders much faster, and respond quickly to dangerous situations. This in turn minimizes injuries and casualties, the time needed to clear the incident, and the time to get back to normal traffic flow. Also, other commuters can take alternative routes and thereby reduce their travel time that will help society's savings in efficiency and lower environment impact.

As a result, the network camera is not only an efficient traffic monitoring tool that provides a detailed view of the traffic situation at any given time, but it also can be used as a sensor to automatically detect traffic deviations and incidents. This, in fact, eliminates the need to constantly transfer video from all installed cameras to the TMC for monitoring: The system can be set to automatically display video in the TMC from relevant cameras only when an incident occurs and/or when an operator requests a live view – achieving a massive reduction in bandwidth consumption.

IMAGE QUALITY IS IMPORTANT

High-end network cameras come with clever technologies that improve image quality. The traffic environment can be demanding with blinding sunlight, blooming headlights and wet pavement reflections, which are very difficult for many cameras to manage. At night, it can even be hard for traditional traffic monitoring cameras to separate one vehicle from another in the constant stream of moving headlights.

As network cameras are based on open IP standards, the video stream can be accessed securely and flexibly via a computer or mobile device from anywhere

In such cases, a network camera with Wide Dynamic Range technology can handle the different light levels by applying techniques such as using different exposures for different objects in the scene to enable objects in both bright and dark areas to be visible. This provides a better-balanced image scene and a more detailed overview of the traffic situation, and helps TMCs see vehicle and traffic details even in challenging light and weather conditions. Other image quality enhancing technologies that are available in outdoor cameras include electronic image stabilization, which reduces the effects of camera vibrations from wind or traffic itself, and automatic defogging, which automatically detects fog in a scene and digitally filters it out of view.

VIDEO IS SHARED INTELLIGENTLY

As network cameras are based on open IP standards, the video stream can be accessed securely and flexibly via a computer or mobile device from anywhere – allowing stakeholder groups such as police, road service crews and emergency services to start assessing a situation even before they arrive at the scene. The cameras can in fact produce multiple parallel video streams, for example to send a high-resolution video stream to the traffic management center and a low-resolution stream to the emergency team's mobile devices during driving.

If required, network cameras can also be set up so the incident alarm triggers the video stream from the scene to be recorded over a period of time. While traffic video streams from analog cameras are not typically recorded as a standard today due to the bandwidth and storage challenges this would create, the targeted recording of video in case of an incident can prove very useful in investigating and reconstructing what happened, especially as the improved image quality makes it a much more powerful tool in understanding the details.

In the City of Dubuque, Iowa, USA, police use footage from the 260 installed network cameras to get an accurate account of accidents and other incidents. Local citizens even use the video to settle disputes over accidents without the need to go to court. The IP cameras have become an integral component of the city's Intelligent Transportation System.

The shift from analog to digital technology is unstoppable and it has started to make its mark in traffic management, too. While adoption of the new technologies may be slower in traffic applications than it has been in security, the advantages are clear and it is only a matter of time before more TMCs switch over to more future-proof, IP-based technologies.

FYI
Patrik Anderson is Director Business Development Transportation, Axis Communications
patrik.anderson@axis.com
www.axis.com

INDEX TO ADVERTISERS

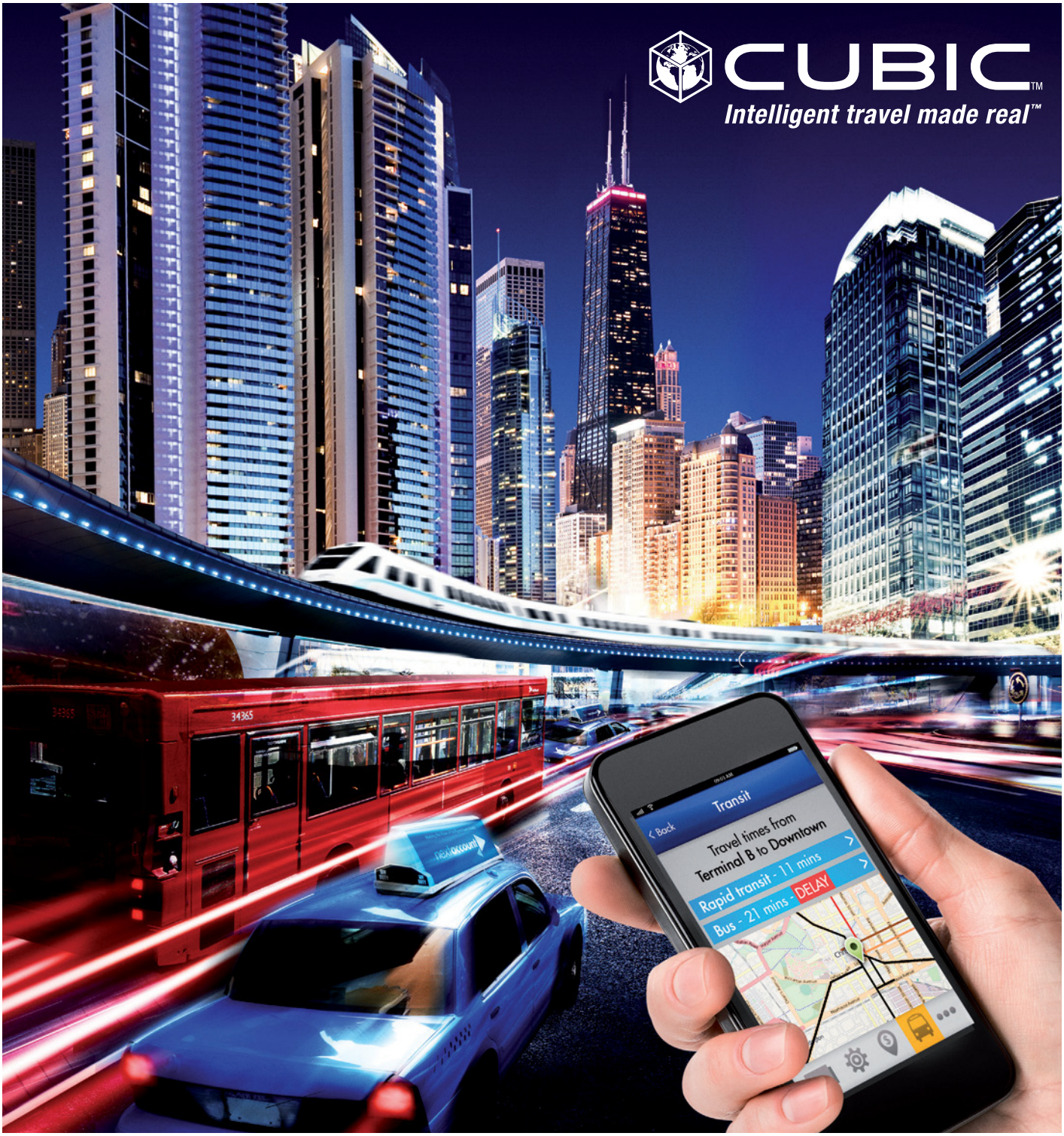
Volume 1 Issue 2 • October 2014

Your Traffic.
Your Move.

What happens today is in your hands. Whether you're faced with congestion, accidents or severe weather, it's your job to keep the traffic moving. And it's our job to help you. Our smart traffic monitoring solutions will take you straight to the heart of the action, so you can make the right move, at the right time – every time.

Make your next move now,
visit www.axis.com/yourtraffic

AXIS®
COMMUNICATIONS



Intelligent travel made real...

NextCity: Cubic's world-class integrated payment processing, customer service and financial management platforms for urban mobility.

Choose the specialist. Choose Cubic. cts.cubic.com