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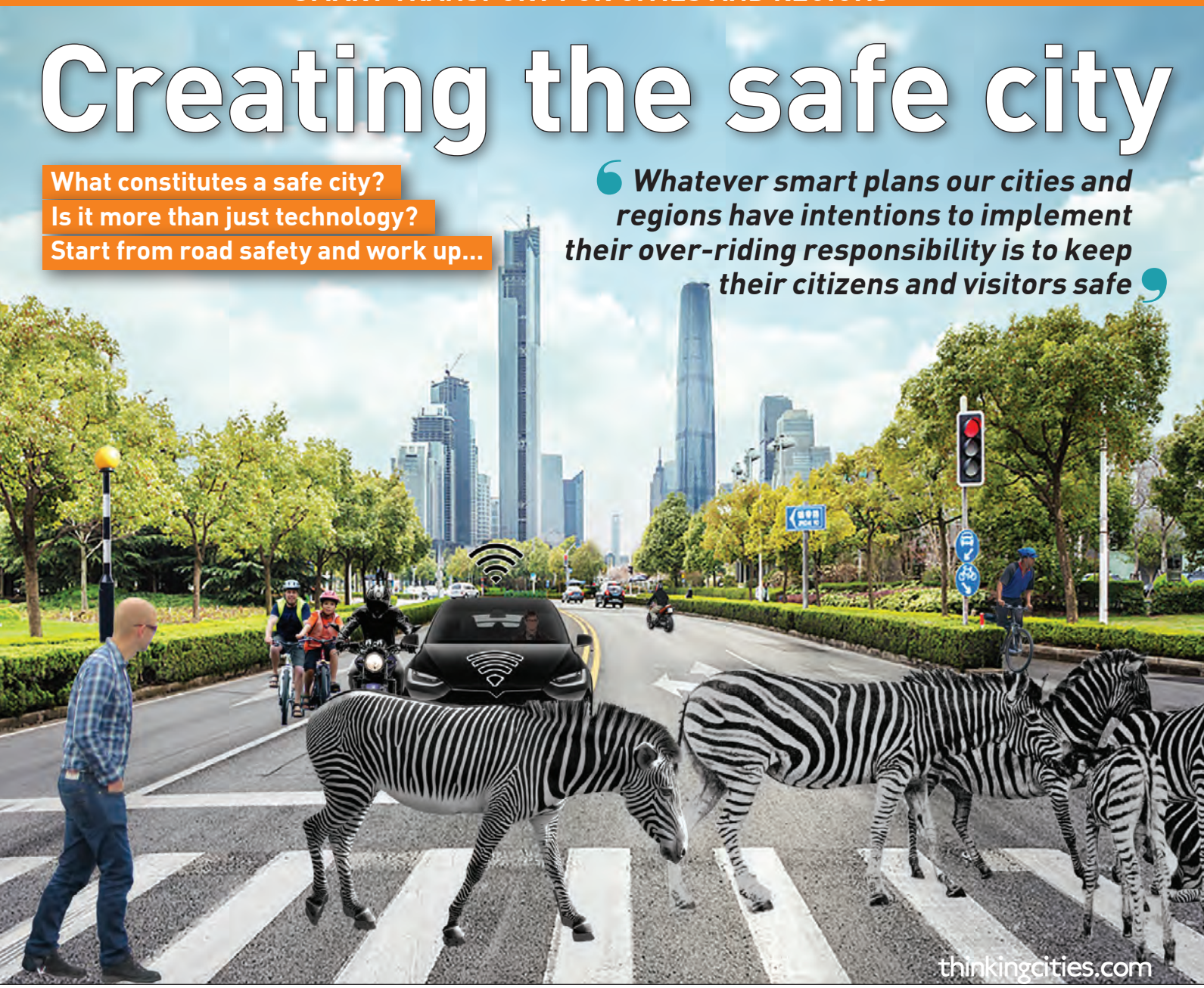
THINKING cities

SMART TRANSPORT FOR CITIES AND REGIONS

Creating the safe city

What constitutes a safe city?
Is it more than just technology?
Start from road safety and work up...

"Whatever smart plans our cities and regions have intentions to implement their over-riding responsibility is to keep their citizens and visitors safe"



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Safety begins in the home...

Karen Vancluysen and **Kevin Borras** elucidate on the general theme for this issue: safety: increasing road safety and making our cities safer for the people

We're presuming that by now you will have noticed the rather unexpected image on our striking front cover and wondered: *"why zebras?"* It's a very good question and it has not one but two answers.

Firstly, these cover zebras are most definitely subscribers to the 'safety in numbers' theory: the hypothesis that, with a larger amount of [zebras] in the city, an individual is less likely to be the victim of a mishap, as drivers get used to watching out for zebras. While balancing the shares of those using public spaces is overdue, just boosting the numbers without adapting conditions and infrastructure simply lets the crowds fight it out amongst themselves on the battlefield we call the road. We unfortunately witness the sad consequences too often.

Second, we have them traversing a busy road on a zebra crossing. What that image conveys is their safety. The zebras wear a striking outfit to increase their visibility; they are crossing at the zebra crossing; they waited for the traffic signal to be red for road users and even the autonomous, connected car (which is carrying a range of differently sized parcels although you can't see that from the picture) has come to a halt; as has the connected motorbike; and the father and son decided to wear helmets so an accident's impact could be reduced (although helmet-wearing is a whole other debate worthy of an article or two of their own). The pedestrian is crossing intelligently, not looking at his phone and nor is he distracted by a conversation but attentive of the vehicles. And no one seems overly bothered by the herd of wild animals, which is an undoubted bonus.

All this imagery touches upon just a few road safety concerns and just a few solutions. Will they make cities safe? Will, one day, our children go to school parent-free, just as we once did? Whatever smart plans our cities and regions intend to implement – smart health, smart transport, smart water, smart buildings, their over-riding responsibility is to keep their citizens and visitors safe.

We're heading into an increasingly autonomous future where more and more menial tasks are done for us by machines – this also includes driving and there's been vast quantities of debates over whether, quite simply, this is a good thing or not. Regardless of whether it is or whether it isn't, it's going to happen. Semi-autonomous cars are on our roads already and although it can be another 20 or 30 or 40 years before driverless cars are overtaking us on the E40, there is no denying that increasing vehicle autonomy is becoming less science fiction and more science fact. The issue, then, is how will 'the mix' work? A US professor of transportation calls the "decade or two, at best" where our roads and cities will be a "potentially potent mix" of supposedly infallible, autonomous vehicles driven by unfathomable computational power and fallible, human-controlled vehicles driven by people whose attention to the road can be entirely compromised by a crisp packet caught on the wind.

> ***Whatever smart plans our cities intend to implement, their over-riding responsibility is to keep their citizens and visitors as safe as possible....***

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This is why road safety is entering a whole new universe. The composition of the current transport mix (anyone who has ever walked from Amsterdam's Centraal Station along Damrak to Dam Square will appreciate that term as you have to skilfully avoid being hit by trams, bicycles, motorcycles, cars and buses) is going to change over the next few years with the advent of electric bikes and cars, microtransit, microdistribution vehicles, autonomous shuttles and a whole new set of road rules may well have to be drawn up.

Anyone over the age of 40 and from the UK will remember the Green Cross Code TV advertisements with first, 1970s pop star Alvin Stardust and latterly enormous actor Dave Prowse teaching children, and adults somewhat surreptitiously, of the dangers of not paying attention when crossing the road. The world has changed inexorably since then but the message is still intrinsically similar. Start with road safety and work up.

That message is enforced in the most powerful way possible in Michael Replogle and Julia Kite's article, 'The Apple Bites Back', on pages 84-87, in which they report from New York City's Vision Zero campaign that used horrific, personal experiences to underpin the inarguable basic tenet: saving a life is easy.

With the technology that we have at our disposal at the end of the 21st century's second decade, that people still die on our roads (and pavements) every day is shocking and entirely unnecessary. To create the truly safe, smart city, we need truly smart thinking, a vision to work towards, and to set the right priorities in order to make these zebras safe.

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Cityview

Senior transport officials from forward-thinking cities around the world discuss their plans for the future and how they are addressing the mobility issues that matter most to their citizens.

- **Madrid** – introducing Intelligent Knowledge-as-a-Service
- **Graz** - NOVELOG is changing Austria's second city for the better
- **Bologna** - The next decade of mobility planning
- **Manchester** - CityVerve: a citywide IoT experiment

Knowledge is power

Sergio Fernández Balaguer offers a behind-the-scenes guided tour of the iKaaS Project - introducing Intelligent Knowledge-as-a-Service

iKaaS, or Intelligent Knowledge-as-a-Service Platform, was a research and innovation project funded by the European Union within a specific call to promote Japanese-European cooperation. The iKaaS project involved 15 partners including European and Japanese hi-tech companies, universities and public entities. The project started in October 2015 and ended in September 2017.

The focus of the joint research is the integration of three technological fields (IoT, Big Data and Cloud Computing) to develop a platform (see Figure 1), that takes advantage of the IoT power, such as virtualization and real-time processing using large data analysis techniques, and at the same time works on the generation of knowledge that is provided to users through applications that run in a Multi-Cloud environment.

Fig. 1 iKaaS concept.
Source: iKaaS Project

Thus, the iKaaS project is aimed at developing an "intelligent being" that preserves privacy and protects resources such as large volumes of data or an analysis engine built on top of a Multi-Cloud infrastructure, which is fed with ubiquitous large-scale data collected from heterogeneous sensor networks and other data sources, including cyber-physical systems, portable sensors or social networks. An additional goal is to provide this data and analysis engine (knowledge base) as building blocks for various heterogeneous environment-related applications, lifestyle recommendations, future urban planning, research and academic analysis, location services, etc.

> ***iKaaS is aimed at developing an "intelligent being" that preserves privacy and protects resources such as large volumes of data or an analysis engine built on top of a Multi-Cloud infrastructure***

Taking into account all these requirements, the architecture of the iKaaS platform has been designed and the functional components that must define it have been determined and can be seen in Figure 2 opposite.

Ultimately, the iKaaS platform enables many players to become

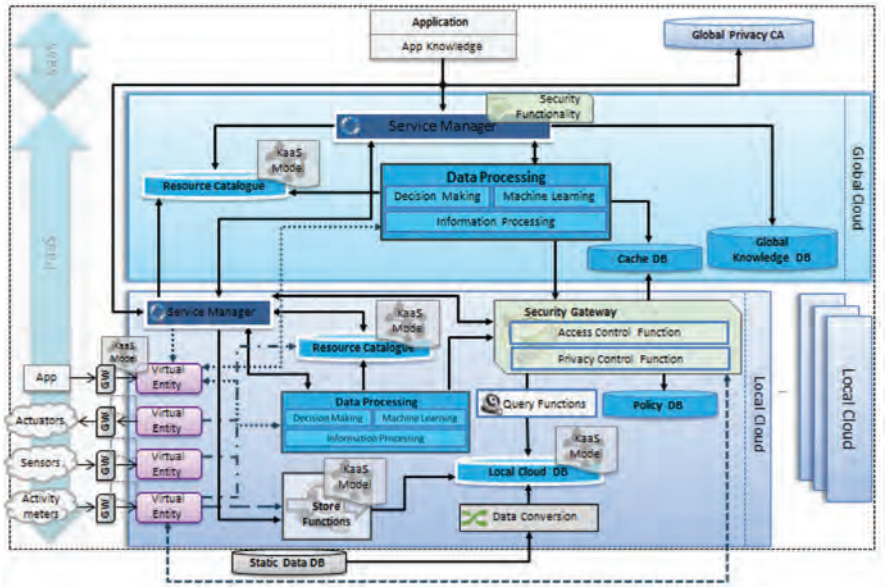


Fig. 2 iKaaS architecture *Source: iKaaS Project*

part of an ecosystem of shared services and resources in the cloud, targeting both providers and consumers. The features of the platform are demonstrated through Smart City applications that promote self-management of the health and safety of citizens, as well as the improvement of a data analysis information system for a smarter life in the city, focusing on areas such as epidemiological surveillance, such as in the following Madrid use case which is explained more in detail in this article.

MADRID ENVIRONMENTAL HEALTH SERVICE

Although Madrid is not an industrial city, its importance as a large logistics, administrative and service centre raises problems related to the quality of air that must be treated accordingly. As a big city, it is especially sensitive to environmental problems and therefore one of the biggest challenges and priorities for the next few years is to ensure proper management of the environmental impact on the health of the citizens of Madrid, preserving the environment.

Pollution, particulate matter and pollen are some of the main factors affecting the health of citizens today. These particles pose a major threat to respiratory health by increasing exposure to respiratory diseases or directly aggravating them. Elderly people and children are the most affected strata in our industrialized society, but they are not the only ones. Healthy people are also affected in their daily life, which increases the risk of developing respiratory diseases. In the city of Madrid, for example, winter and spring are the seasons in which the need for emergency assistance for asthma increases. The seasonal nature of this type of respiratory disease is the result of high pollen levels of existing species but can also be combined with a high level of air pollutants.

iKaaS in the Madrid use case

The Environmental Health Service of the city of Madrid, through the iKaaS project, focuses on pollutants and pollen and on how to improve current mechanisms to measure them and improve the accuracy of information to be provided to citizens, with the aim to reduce health-related effects, especially in the allergic and hypersensitive population. This provides real-time information on pollution levels and pollen and its distribution in the city of Madrid. It is also intended to offer other services such as complementary aerobiological data and health advice for citizens.

By deploying a new network of environmental sensors using the infrastructure - buses - of the Municipal Transport Company (EMT), it is possible to increase the number of geographical points where measurements are taken with a limited number of sensors.

These new sensors, together with the environmental network already deployed by the Community of Madrid (Regional Government) and the Madrid City Council, feeds the iKaaS system; this allows the provision of real-time information to citizens and through the ability to analyze large volumes of iKaaS data and build a new source of knowledge about pollution and pollen.

To achieve this goal, some milestones were set:

- To increase the current number of city environmental sensors including new mobile sensors in the system located on board public buses.
- To develop a local platform that will integrate all environmental devices and sensors.
- To collect and store all historical data and values in real time in a local cloud.
- To define a protocol for the exchange of data in the city of Madrid for mobility, traffic and environmental data.
- To define the semantic data layers and public data models in order to produce public and open knowledge.
- To create an open API connector for the exchange of such data.

Although Madrid is not an industrial city, its importance as a large logistics, administrative and service centre raises problems related to the quality of air that must be treated accordingly

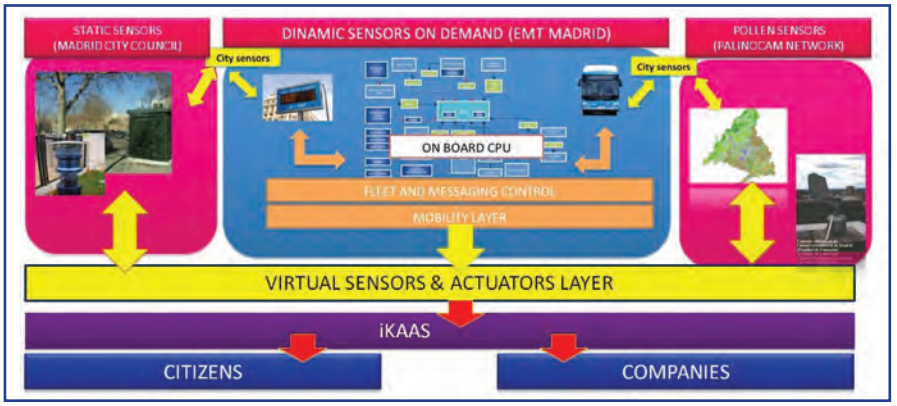


Fig. 3 General overview of the iKaaS Environmental Health Service for the City of Madrid.
Source: iKaaS Project, Madrid Use Case

Data Processing and Knowledge Generation

In addition to that, as part of the project's knowledge-generation effort, a forecast and prediction system is being developed with the aim of using the space-time characteristics of nitrogen dioxide concentrations in the Madrid fixed monitoring stations to predict future values throughout the city.

This system uses geostatistical techniques for the data modelling recorded in the fixed monitoring stations, which together with the State Meteorological Agency's (AEMET) numerical predictions of pollution and predictions provided by the ECMWF (European Center for Medium-Range Weather Forecasting) will allow the production of pollution forecasts for the entire city.

These forecasts can be used to define the healthiest route in terms of air quality between two points. Data from the different available sources is recovered, cleaned and standardized.

In the task of recovering and cleaning the data from the sensors, the Complex Event Processing (IoE Lab, 2015) developed by Atos, one of the project partners, is especially important, allowing the real-time processing and analysis of the data or events collected by the sensors and discriminate them according to complex patterns or events that are constructed manually by context experts. For example, one of the problems when working with sensors is that measurements are taken asynchronously and not all sensors provide values at the same time and with the same frequency. This makes an agreement necessary to decide when an entry can be considered to be available. This fact is directly related to the nature of the data; the ambient temperature changes more slowly in time than the wind speed, therefore, a wind sensor measurement speed will produce new values more frequently than a temperature measurement, and this will have a lower frequency than, for instance, a sensor to control the heart rate of a person.

Figure 3 shows an overview of the approach within the iKaaS project of the Environmental Health Service for the city of Madrid.

Specific services for the Madrid Environmental Health Service

Within the iKaaS project, the following main specific services have been defined by using both a web portal and a smartphone app:

Visualization portal

A visualization portal has been developed in order to visualize all the integrated environmental, airborne pollen and traffic information, in real

Fig. 4 Visualization portal *Source: iKaaS Project, Madrid Use Case*

time. Available at this IP address: 195.57.112.139:81.

User notices and warnings about pollution and pollen

This service provides notices and warnings via mobile devices to subscribed users to the service regarding pollution levels and/or pollen. These warnings are based on each specific user profile and can be received either by email, SMS or Telegram (so far).

The system also provides warnings based on the geographic position of the user, warning when approaching an area with high pollution concentration and/or airborne pollen. There is also the possibility of providing real-time warnings through the information panels located at bus stops. These warnings are made taking into account the existing regulation in the health care system.

Alternative healthy route

Taking into account users' preferences and the planned route (from A to B), the iKaaS platform is able to provide an alternative route avoiding those areas for which high pollution or airborne pollen levels are detected or established. These routes can be done either by foot, cycling or bus.

CONCLUSIONS

iKaaS has designed an open, adaptable and secure as a "whole" service framework for incorporating the deployment of optimal services including migration and parallelization, as well as distributed object management, associated storage, processing and communication of Data, aimed at allowing the reuse of applications across different domains and platforms, as well as knowledge as a service.

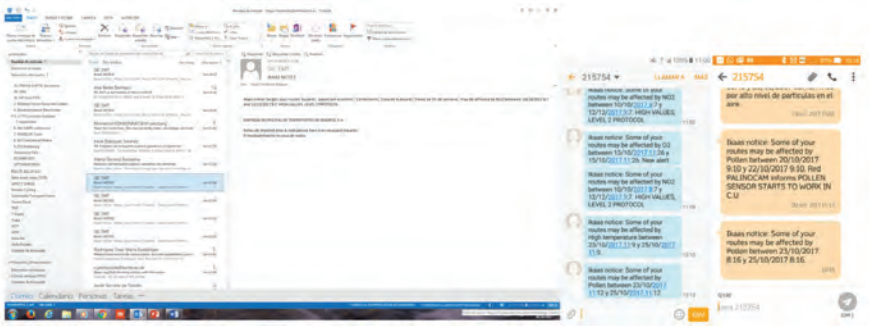
iKaaS has also developed mechanisms that allow the notion of knowledge-as-service ("Kaas", Knowledge-as-a-service).

iKaaS takes security, privacy and trust into account in a holistic and integrated way as part of the "whole", i.e. as a service architecture. This provides more security to owners of ICT objects. The platform allows sensitive data to be processed within the domain of the data provider (Local Cloud), so only indirect information (i.e. knowledge) is distributed.

Finally, iKaaS strives to interact with related standardization bodies in order to contribute to the harmonization of international standardization efforts as well as to bring the developed technologies to market.

Thanks to iKaaS, the city of Madrid improves the way of providing environmental health information including the best suitable routes for those citizens and users with health limitations, optimizing their mobility within the city.

Fig. 5 Ways of getting notices and warnings in the Madrid Use Case
Source: iKaaS Project, Madrid Use Case



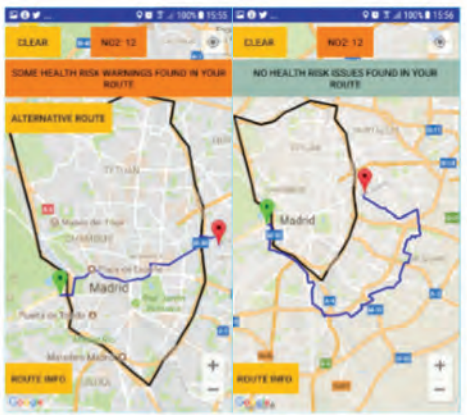


Fig. 6: Healthy route planner showing alternative route to the polluted area in the Madrid Use Case

> ***iKaaS has designed an open, adaptable and secure as a "whole" service framework for incorporating the deployment of optimal services including migration and parallelization***

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Delivered on time

Photo © Harry Schiffer

Christian Nußmuller, **Lisa Sebros** and **Peter König** chart the progress of the NOVELOG project

As Austria's fast-growing second-largest city with 290,000 inhabitants, and a functional urban area nearing 500,000, Graz has been facing new challenges over the last few years. Its geographical location on a river has made it ideal for factories since the industrial revolution, while its proximity to Vienna and the neighbouring countries of Hungary, Slovenia and Italy allow for fast cross-border commerce. Moreover, Graz has an important higher education offer, with over 60,000 students in its eight universities and specialized schools. All these factors lead to an ever-increasing attractiveness of the city, which has a yearly growth rate of over 5 per cent since 2013 (4000 extra inhabitants per year). There are, however, two sides to the dynamism of the middle-sized city, as it has brought along questions and challenges that need to be addressed.

THE PROBLEM AND HOW TO SOLVE IT

Two main challenges that Graz currently faces are air pollution and road congestion. The city is located in a topographic basin, meaning that its further development can extend towards the South along the Mur River or, preferably, happen through a substantial qualitative densification of the building plan.

The latter has been embraced in the Smart City Graz Strategy, adopted in 2013, that provides guidelines for the current and future development of Graz. This basin situation does not only affect land use: the surrounding mountains imprison the particles emitted by the various industries

Photo © Vivian Hertz

Photo © Harry Schiffer

based in the urban area of Graz, domestic heating and the combustion engines in transit on the roads.

Regarding private vehicles, the mobility share of private cars has remained stagnant over the last few years, mostly because more people are moving to the borders of the city, where the public transport service is not as dense as in the centre.

The city administration is currently in a reflection phase about policies and tools aiming to reduce air emissions.

But individual mobility is not the only cause for congestion and consequent pollution happening in Graz. As every other city, the capital of Styria needs a constant flow of vehicles to assure its logistical functions: waste collection, street cleaning and deliveries of all kinds: goods delivered to shops, food, and private orders. This constant circulation makes a few questions rise: is the current use of trucks and minivans efficient? How could we avoid peaks of delivery vehicles blocking entire areas, such the central pedestrian zone at certain hours?

SOLUTION THROUGH THE PROJECT

The trans-European NOVELOG Project aims to address these questions by enabling better knowledge and understanding of urban freight distribution and service trips in order for cities to implement effective and sustainable policies and measures and facilitate stakeholder collaboration for sustainable city logistics.

The CIVITAS-2020 project, funded under the European Commission's Horizon 2020 Programme began in June 2015 and runs until 31 May 2018. It involves 28 partners, among which are the pilot cities of Athens,

Deliveries were made in the evening of the day of purchase for a small fee, or could be planned for any other day or time for a higher fee, allowing citizens to continue shopping without having to carry bulky or heavy bags

Turin, Rome, Barcelona, Mechelen and Graz, as well as the case study cities of Gothenburg, Venice, Copenhagen, Pisa, the London Borough of Barking and Dagenham and the Emilia Romagna Region. Over the last three years the project has focused on strengthening the capacity of local authorities and stakeholders regarding the elaboration and implementation of sustainable urban mobility policies. In the pilot cities, test measures were deployed at a small scale, while case study cities assessed ongoing measures. All the urban freight transport measures considered by the projects pertain to two main cluster categories: administrative and regulatory schemes and incentives, and cooperative logistics.

In Graz, the pilot project BringMe addressed the topic of business-to-customer deliveries.

THE BRINGME PLOT IN GRAZ – CONCEPT AND LESSONS LEARNT

In Graz, most of the UNESCO World Heritage historic centre has been a pedestrianised zone since the 1990s. As in most European cities, there is a large concentration of shops, some of them established for generations. Shoppers can take home their purchases on foot, by public transport, bicycle or car, but parking spaces are restricted, cost money and are located a few blocks away from the shops. This difficulty of access for private cars is driving many customers towards the four shopping malls near the city borders, threatening the businesses in the centre.

This situation led to the conception of the BringMe pilot project in Graz, a shop-to-customer delivery service using e-cargo bikes. Deliveries were made in the evening of the day of purchase for a small fee (7.90), or could be planned for any other day or time for a higher fee, allowing citizens to continue shopping without having to carry bulky or heavy bags. The pilot involved the local cooperative of around 50 shops in the city centre. As a partner, the City of Graz helped to promote this service, but did not co-fund the operation.

BringMe had already started with the EU/IEE-project Smartset on efficient urban freight transport (2013-2016) and the private smart logistics company Fuhrwerk operated this service. With NOVELOG, the service was refined and extended to more partner shops in the city centre. However, major hurdles kept the pilot implementation from developing into a success.

First, the service suffered from a lack of publicity – even in the partner shops, meaning that most shoppers weren't able to learn about this innovative transport option. Second, the price of the service was deemed to be too high by customers, who have become accustomed to free delivery schemes. The price, however, was

Photo © Harry Schiffer

The NOVELOG project has paved the way for sustainable city logistics in Graz. The cooperation between cities across Europe has raised awareness among the administration of the City of Graz

decided in order for BringMe to be able to function without public funding. These factors combined led to a mitigated success of the pilot project in Graz. If the market uptake was inconclusive, it allowed the development of a new cooperation between shops in the city centre, the municipality and an independent logistics company. It also made evident the need for a logistics micro-hub in the direct proximity of the city centre in order to optimize deliveries and eventually reduce costs.

Overall, the NOVELOG project has paved the way for sustainable city logistics in Graz. The cooperation between cities across Europe has raised awareness among the administration of the City of Graz and its partners about this topic. The case studies were essential in bringing forward elements replicable in Graz. While the project will end in May of this year, Graz has already planned the implementation of a smart locker system in its new Smart City district, like the one in Mechelen, and discussions have started with the relevant partners about the development and implementation of a logistics micro-hub next to the city centre.

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Francesco Ripa talks to **Helmuth Moroder**, CEO of SRM Reti e Mobilità, Bologna's Mobility Agency, at the Decongesting Europe: New Approaches to Free Our Cities' conference, that took place in Brussels in March 2018

Photo © Tommaso Bonino

The power of positive doing

Helmuth Moroder

Photo © Vivian Hertz

Photo © Neva Divani

Bologna will soon have a new generation bike-sharing system, which will be affordable and accessible and will be regulated as a part of the public transport service

TC: What are Bologna's most important challenges in terms of mobility planning in the next 10 years?
HM: Individual motorized transport still amounts to around half of all the trips made in our city. A major challenge we face is the change of this trend by shifting a part of these trips toward more sustainable modes of transport, such as cycling and walking. Only 4 per cent of journeys are made by bike. We want to reduce significantly the modal share of motorised transport to 20 per cent. This will require an enormous collective effort. As I said, cycling is the transport mode that should most benefit from this shift. We want to increase the cycling modal share to 17 per cent by 2030. If we consider an average European city, perhaps it is not that big of an achievement, but for Bologna it's an enormous challenge.

TC: What are the steps that have already been taken towards achieving these results?
HM: In terms of infrastructure, over the past 10 years the efforts have been considerable. We now have 170 kilometres of cycling lanes, which for a city of 400,000 inhabitants is a great result. The cycling infrastructure is far from being perfect though: we can still not talk about a real "network", as many cycling lanes are not yet connected. This will certainly require further work, but I do not think is the main problem. We should focus on the actions that will turn a share of car rides under 1 km into bike rides. That, I think, is a dramatic figure. The modification of this behaviour will be achieved using the carrot, rather than the stick. We regularly promote behavioural change campaigns in favour of more sustainable transport modes. One example we are particularly proud of is the European Cycling Challenge, which was first tested in Bologna in 2011 and then expanded to other European cities in 2012. Since then, we have organized and actively participated in every edition of the challenge. We then invented "Bella Mossa", a programme that rewards citizens for their sustainable travels within the city. The hard and soft measures go hand in hand: infrastructure and behaviour.

Furthermore, Bologna will soon

have a new generation bike-sharing system, which will be affordable and accessible. It will be regulated as a part of the public transport service, and SRM will manage the contract service and the operator will have to respect its obligations. This is how we prepare the ground for more cycling in Bologna. Infrastructure on one side, behaviour and services on the other - a combination of hard and soft measures.

We should make our citizens understand that cycling more benefits everyone: the ones who cycle, the ones who breathe cleaner air and the city as a whole. Furthermore, we should not forget the climate objectives. We should take charge of this responsibility. We cannot allow ourselves to think that this is something that others should take care of. Each one of us has a share of that responsibility.

TC: Can you tell us about the role of data in mobility planning decision-making?

HM: The campaigns I have mentioned allowed us to gather us a lot of data on how citizens move around the city, which proved to be essential for our work. Sometimes we even collect more data than we are able to read. But collecting is not enough: mobility data also needs an informed interlocutor that is able to make good use of it.

The Sustainable Urban Mobility Plan (SUMP) can be very useful in that sense: the working group that has been established to work on the SUMP can be a good interpreter of that kind of data. I would say that decisions based on data are just as important as those based on good and bad practices at the European level. Events like the FLOW-TRACE Final Conference are very useful to benchmark with other cities and understand what could be useful and what was not possible, and why. Of course, every city is different so there is the need to re-adapt all the findings to the local situations. But the dialogue dimension enabled by the network is essential.

Bologna was among the signatories of the FLOW-TRACE declaration on putting walking and cycling on an equal footing with other modes to reduce the impacts of congestion

Photo © Vivian Hertz

I think that in our meetings we should focus more on what did not work. We tend to talk too much about the positive sides of our initiatives. Telling others what we don't advise them to do to avoid the same mistakes that we made is equally important

TC: Bologna is very active at the European level. How important is this networking dimension for the city?

HM: Being part of a European network that allows us to confront ourselves with other cities is paramount for us. First, because it encourages us. Otherwise, when we set ourselves very ambitious goals, some may say that we are crazy. They would come to me and ask, "What planet do you live on?". In our network, some cities have reached or even largely passed those same goals.

This shows us that we're not asking for the moon — these are some very realistic and feasible things. On the other hand, I think that in our meetings we should focus more on what did not work. We tend to talk too much about the positive sides of our initiatives. Telling others what we don't advise them to do to avoid the same mistakes that we made is equally important.

One overall benefit of being part of a network is that you are in good company, you never feel lonely. This helps you to throw the rock a bit further than common sense would suggest. These days, it takes quite some bravery to take bold actions towards more sustainable mobility. But the needs we must address are too urgent and they oblige us to move forward faster than some would like to.

FYI
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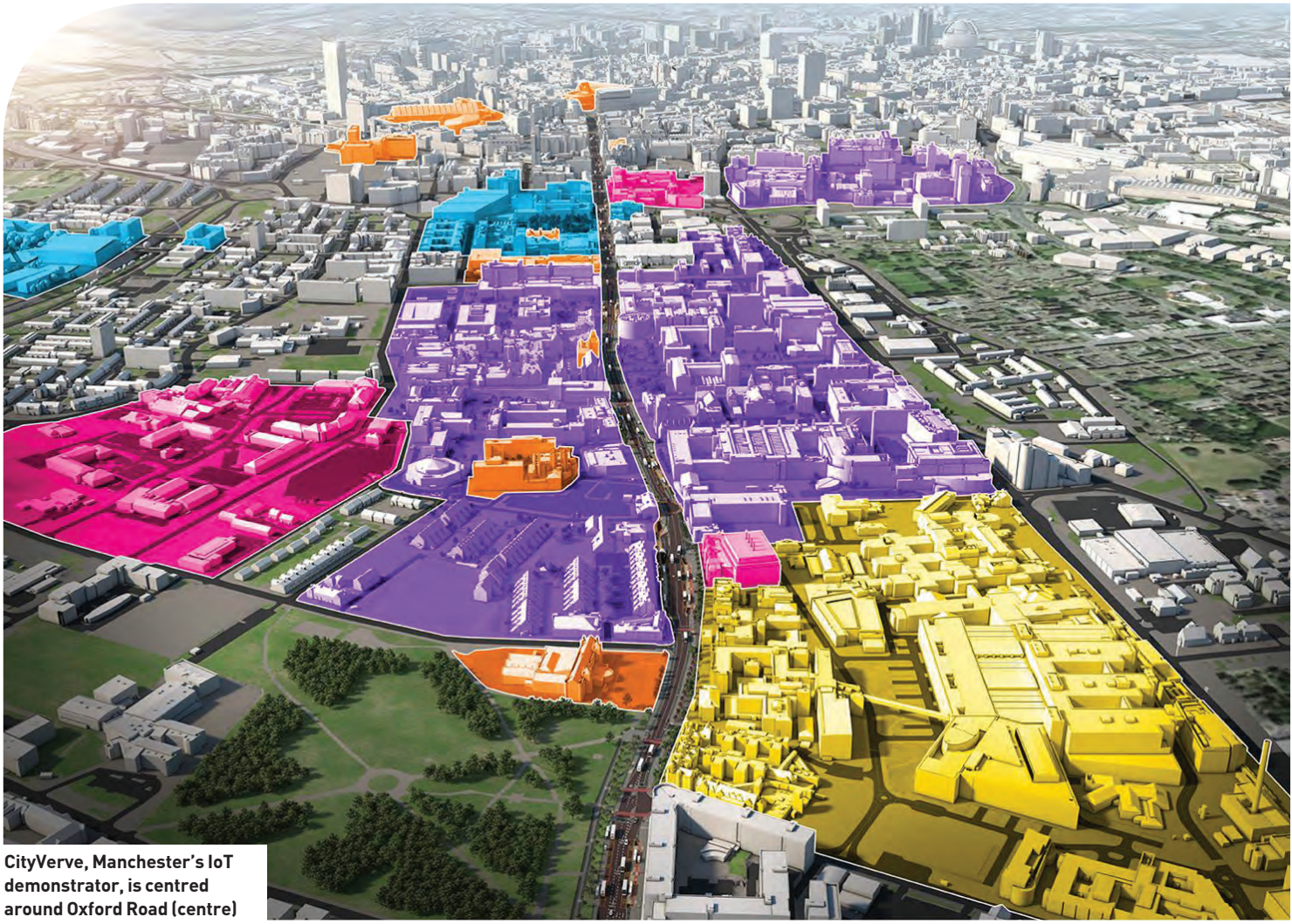


CityVerve, Manchester's IoT demonstrator, is centred around Oxford Road (centre)

Better together

CityVerve – the smart city demonstrator that has inspired Manchester, by **Mark Duncan**

Technology is transforming our cities. It is empowering governments, businesses and citizens to tackle society's greatest challenges in new innovative ways – and Manchester, Polis president for 2018, is leading the charge.

A collaborative project led by Manchester City Council, CityVerve is the UK's smart cities demonstrator. It is made up of 20 organisations, ranging from public, corporate, SME, NHS (National Health Service)

> ***CityVerve has evolved into a project that has been showcasing examples of how IoT technology can improve life for people living and working in the city***

An example of how CityVerve has looked to enhance the quality of care through a Smart Homes deployment is the implementation of passive sensors within homes designed to collect baseline data, such as air quality and activity levels

and University sectors, who have united to explore how the Internet of Things (IoT) can be used to transform the city and create endless possibilities for the people of Manchester.

The project's short-term aims have been focused on exploring how we can improve the health and well-being of Manchester's citizens, the efficiency of its transportation links and the quality of the local environment, whilst identifying the potential to create new business and job opportunities.

Through the lessons learnt in Manchester, the longer-term aim is to commercialise the model for smart cities everywhere.

CityVerve was established in July 2016 and now, almost two years later, we can reflect on what began with a call from Innovate UK for smart city demonstration proposals. Since, it has evolved into a project that has been showcasing examples of how IoT technology can improve life for people living and working in the city.

THE 'BOTTOM-UP' APPROACH AND INTRODUCING THE PLATFORM OF PLATFORMS

The project follows a 'bottom-up' approach, ensuring the project is real and relevant by listening to its citizens. This is being achieved through art and culture installations, a local community platform as well as the community forums which collectively aim to improve city livability.

What binds CityVerve is a series of cross cutting work packages that cover data, visualisation, art and public realm, for example – CityVerve relies on a 'platform of platforms' – a secure 'catalogue' of data that can unite applications. This network infrastructure has enabled the collection, interpretation and use of data, coupled with a flexibility to accommodate the growing and ever-changing Manchester.

On this platform, CityVerve has deployed a series of use cases over the course of the project, focused around four citizen-centric areas;

Travel and Transport; Energy and Environment; Health and Social Care and Culture and the Public Realm.

TRAVEL AND TRANSPORT

The first of the four themes focus on the delivery of an efficient, reliable and attractive public transport system. This ranges from reducing congestion to enhancing public safety.

CityVerve has many data-relevant components, but where does the data come from? How is it gathered? And how can it be used to inform and improve facets of the community? One of our use cases for example uses connected bike lights to demonstrate how this can be done.

140 of See.Sense's sensor-enabled ICON bike lights were given to volunteers across Manchester with the technology capable of ensuring a cyclist's safety on the road whilst gathering a broad range of anonymised sensor data.

The data gathered can range from information on the quality of the road surface to highlighting near misses and traffic incidents. Such devices enable us to learn more about Manchester's cyclists and how they're using their city, not only from a travel and transport perspective but also how it is affecting other pillars of the CityVerve projects, including energy and environment.

ENERGY AND ENVIRONMENT

This theme covers the energy management of our buildings, the cleanliness of our streets and the sustainability of Manchester.

By working with commercial landlords and local authorities who are managing public spaces ranging from libraries to town halls, we have explored the potential to enhance the management process of facilities across the city through smart facilities management.

See.Sense have provided 140 sensor-enabled bike lights to volunteer cyclists

Both public and private sectors can benefit from the data collected with the lessons learned and the knowledge gained capable of creating one strong, equally beneficial smart city

This is visible in Compliance Cost Reduction which focuses on addressing the high costs faced by landlords when complying with regulations on matters such as Legionella disease in water piping. By automating this monitoring process, we are not only

improving health and safety but also saving costs and reducing wasted water.

To ensure the facility management is sustainable across the board, it is important that sufficient energy storage systems are in place. By reassessing the common processes for storing energy, CityVerve has focused on establishing how buildings can be best manage energy during peak periods, and reducing reliability on the energy grid in the process.

This commitment is showcased through the Tesla Powerpack System at the projects HQ, Manchester Science Park. The next generation building management system is capable of managing energy consumption whilst allowing the site to shift from commercial tariffs and reducing the carbon footprint of the site.

HEALTH AND SOCIAL CARE

The focus here is on alleviating the pressures of modern day challenges faced in health and social care. This comes from reducing burdens on A&E (accident and emergency) admissions, decreasing health inequalities and improving health outcomes through driving self-care and earlier public health interventions to tackle costly chronic conditions upstream.

We have applied IoT technologies to neighbourhood support teams to improve their efficiency and effectiveness. In the past, these teams have relied on paper-based solutions which is insufficient when it comes to meeting the challenges of growing demand and shrinking budgets.

An example of how CityVerve has looked to enhance the quality of care through a Smart Homes deployment is the implementation of passive sensors within homes designed to collect baseline data, such as air quality and activity levels, the ability to understand this information enables us to understand the effects the home environment can have on peoples' health and wellbeing.

Another IoT technology which has been explored is smart inhalers, which have been developed to utilise data compiled by monitoring systems to aid suffers of Chronic Obstructive Pulmonary Disease (COPD) – a lung condition which causes breathing difficulties.

In the UK, a total of 1.2 million people have been diagnosed with COPD. There is a particularly high incidence of COPD cases in Greater Manchester and for this reason, a smart healthcare solution has been introduced.

By developing a smart inhaler capable of monitoring usage and establishing when prescriptions need refilling, the deployment enables GPs to track the welfare of their patients in an informative, yet secure manner.

The implementation of such devices can only benefit the efficiency of the NHS. The government recently announced it is going to train its staff in AI and robotics underpinning that leaders understand the importance of introducing technology to empower both its staff and patients.

Aside from IoT technology, CityVerve is aware of the importance of adopting a holistic approach to health and social care. PlaceCal – a community-sourced calendar aimed at helping people of all demographics find out about activities in their local area – underpins this. Pulling on the knowledge of citizens, PlaceCal offers an online platform whereby the community can see all the small events in their area: the coffee mornings, sewing groups and computer classes that are all just around the corner.

CULTURE AND THE PUBLIC REALM

Manchester is a city renowned for its creativity, diverse nature and the way it embraces change and new ideas. These beliefs sit at the heart of the city and led to the creation of CityVerve's fourth theme – exploring how technology can enhance the culture and arts of Manchester.

The intangible nature of IoT makes it difficult to show citizens how it can be deployed across their city. To counteract this, CityVerve has looked at ways in which the technology can be made visible to the naked eye in an engaging manner.

A use case which amplifies this is the Manchester Plinth – a platform

which presents art through augmented reality (AR). The platforms utilise the power of AR to bring artwork to the streets of Manchester, enabling a larger and more diverse audience to explore and engage with them.

By its very nature the Manchester Plinth challenges our understanding of space in urbanised areas, and demonstrates how they can maximise the capacity of limited space. Posing these types of questions illustrates how CityVerve has challenged how we develop the public realm.

TWO YEARS OF CITYVERVE

CityVerve boasts an array of tangible achievements already. This includes the deployment of 140 smart bike lights; 240 facility management sensors (with another 429 coming) and the engagement of over 4000 residents within the health and social themes.

This quantitively highlights the success of the project, but what CityVerve set out to do was build a demonstrator capable of showcasing how a smart city can be built and how that can enhance the living stands of its citizens.

As the project nears the two-year mark and, ultimately its conclusion, we can begin reflecting on the project and what it is has done for the city of Manchester and how it can be used an example for cities globally.

Above: CityVerve was prominent at the launch of the Mi-IDEA innovation centre located at the heart of Manchester Science Park
Below: Manchester Plinth presents art through augmented reality

A COMMON GOAL

To develop technology that can deliver a smart city, collaboration between public and private sectors has been imperative. By working together through design and implementation, we have been able to ensure transparency of data and knowledge. Both public and private sectors can benefit from the data collected with the lessons learned and the knowledge gained capable of creating one strong, equally beneficial smart city.

However, arguably the biggest learning wasn't about the technology that built a smart city but processes that surrounded its creation and implementation.

A smart city has thousands of moving parts; talkative bus stops; smart inhalers; community-sourced calendars, to name a few, yet with each component there is likely to be a different owner and therefore different contractual obligations. This underpins the importance of developing partnerships and working together to manage these projects in a coordinated manner to best achieve a common goal for the city. This is where the value lies.

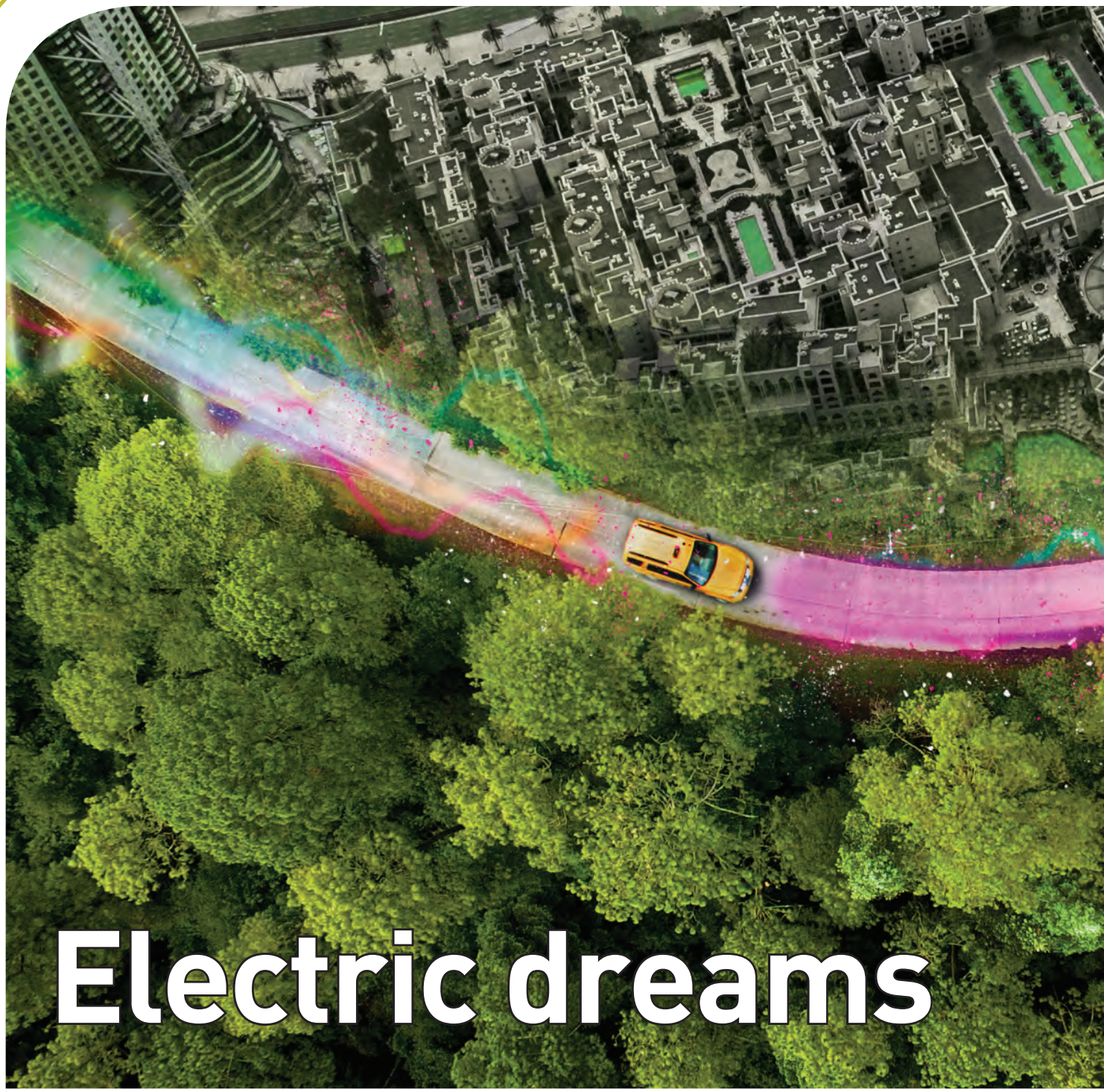
The CityVerve project has brought together talented organisations in sectors ranging from healthcare, to art and the environment. In communicating the challenges faced within each sector, we have been able to offer a truly citizen-centric approach and have understood the importance of collaboration in ensuring not one aspect of Manchester is isolated. Ultimately, we are better together.

FYI
Mark Duncan is Strategic Lead - Resources & Programmes, Manchester City Council and CityVerve.

Environment and Active Travel

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

- **SEEV4-CITY** - Maintaining sustainability principles and tackling energy management challenges
- **Brussels** - Bike Citizens' PING! If You Care project
- **FLOW** - The impact of walking and cycling on urban congestion



Electric dreams

SEEV4-City: Towards a mobile, clean energy grid in the City

Maintaining sustainability principles and tackling energy management challenges are crucial tasks for cities today. **Florinda Boschetti** and **Hugo Niesing** wonder how transport policies can contribute to solve the problem

In European cities renewable energy production is hampered because large installations are limited by their intermittency. Energy production and consumption do not fit seamlessly

In the coming years, Europe is committed to reducing its carbon footprint in the energy and transportation sector by cutting greenhouse gas (GHG) emissions by 20 per cent by 2020 and by 40 per cent by 2030 compared with 1990. While the EU as a whole is on course to meet its 2020 targets and seeks to have a 20 per cent share of its gross final energy consumption from renewable sources by 2020, some Member States are at the forefront in expanding the numbers of electric vehicles. Enabling clean and green transportation by increasing the number of electric vehicles powered by renewable energy sources is a top priority for Europe's public authorities, companies and concerned citizens.

However, an increase in the number of electric vehicles and demand for renewable energy production creates a challenge. The growing number of EVs is causing a new energy demand in cities that needs careful planning. Also, most of the time a significant amount of renewable energy supply does not match EVs' demand for electricity. Due to this mismatch between demand and supply, EVs aren't always charged with renewable energy and this impacts the existing large energy demand peak in a city, leading to undesirable effects on the electricity grid.

CHARGING SMARTLY

A number of cities across Europe are piloting solutions to tackle these challenges by optimising the use of electric vehicles and renewables (PV) through Information and Communication Technologies (ICT). When implemented effectively, smart charging mitigates CO_2 emissions, increases clean kilometres driven and results in less impact on the grid, which may consequently reduce grid investments which would be otherwise needed, increases the matching of energy demand-supply and improves energy autonomy.

The implementation of Smart Charging (where the timing of EV charging is controlled to benefit network operation), V2G (where EVs are used as energy stores, enabling a better balance to be achieved between energy supply and demand) and the other 'ancillary' services they can provide are collectively known as "Vehicle 4 Energy Services" or V4ES.

Smart charging is applied by coordinating EV charging demand with the varying output of locally generated renewable energy, with the aim of minimising grid impacts and battery degradation, whilst maximising energy autonomy and economic benefits. Different operational environments and levels for smart charging or V2G integration exist, these are known as Vehicle 2 Home (V2H), Vehicle 2 Business (V2B), Vehicle 2 Street (V2S) and Vehicle 2 Neighbourhood (V2N).

As all cities are struggling with the transition towards clean mobility and more energy independence while reducing their carbon footprint, what can Energy Management Systems (EMS) do for clean energy and mobility? EMS can determine energy fluxes and optimise the use of energy generated locally, can help storage and integrate energy in an electric vehicle battery.

Current initiatives in this field exist on a small scale and address only a particular theme, mobility management or energy consumption systems. In European cities renewable energy production is hampered because large installations are limited by their intermittency. Energy production and consumption do not fit seamlessly. Large scale renewable energy creates peak production when demand is low, resulting in energy transport, conversion and related losses. Energy demand is more predictable and can partly be adapted to production.

Here are some city case study examples.

Amsterdam is preparing for an increase of electric cars and more renewable energy generated locally in the city. With its strategy the city wants to optimise the interaction at district level between prosumers and EVs. Any excess in PV energy production will be diverted to smart charging stations and an increase in network demand will reduce the power supply to the charge points. Households will not experience any change in the way they use electricity, but their excess of production will be diverted - when possible - to charge EVs parked in the district.

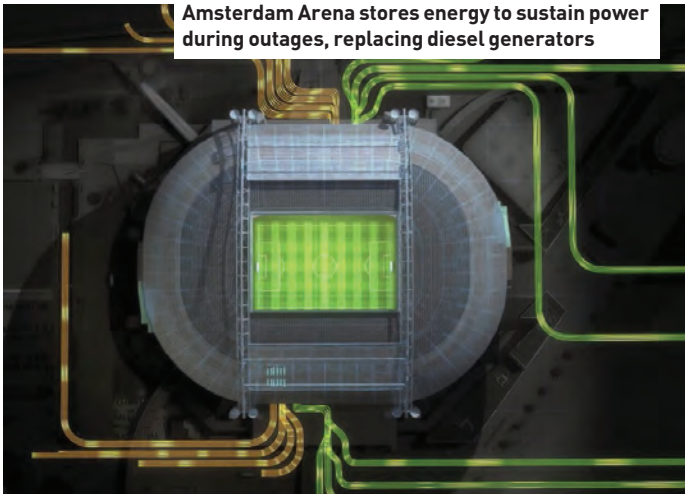
Amsterdam prepares for an increase in electric cars

In March 2017 the city started a "flexible charging" project with partners Nuon, Liander and ElaadNL. By steering the charge flow of electric cars' peak, loads can be avoided and the demand can be matched to the availability of locally produced sustainable energy.

The design of the current electricity grid has not taken into account the arrival of electric cars. At this stage, there is no direct problem, but an uncontrolled increase of chargers on the low voltage grid might lead to peak demands that exceed grid capacity. Therefore, it is necessary to start testing how smart charging helps to overcome this. By monitoring the charging data, Amsterdam wants to make sure cars are always full enough for the next trip. The pilot begins with 200 public charge stations with two sockets each in the centre, the West, New West and South of Amsterdam. The charging speed is adjusted on the basis of the use of the electricity grid. At the start of the test, charge speed for electric cars is increased during outside peak hours. This means they will be charged faster than normal at this time of the day. Only during peak hours (between 16.30 and 19.30), when other devices demand more power, the cars are charged more slowly and with less power. With this method, more e-drivers can use the same charge point and less public charge points are needed.

Another pilot in the city is located at the Amsterdam Arena. This is a V2B that includes an Intelligent Energy Management system along with RES and Primary control reserve services. This pilot presents a different magnitude of the V2G experience with an energy consumption comparable to 270 households. Amsterdam Arena is carbon-neutral; currently, 10-15 per cent of its annual consumption is generated from its own 4200 solar panels, with the other 85-90 per cent coming from wind energy supplied by the Arena's energy provider (green electricity). The renewable energy

produced ensures a supply of clean energy to charge EVs, which translates into reduced CO_2 emissions, as well as an increase in clean kilometres. Moreover, Amsterdam Arena is interested in energy storage and V2G applications; thus, they have installed stationary 2nd life batteries (to phase out diesel-fuelled backup generators in case of black-outs), and V2G bidirectional chargers on the premises. Furthermore, the Arena has potential to contribute to a reduction of 1500 tonnes of CO_2/year through PCR services.



Amsterdam Arena stores energy to sustain power during outages, replacing diesel generators

Vulkan in Oslo is one of the most advanced charging garages in Norway and indeed in the world. The Vulkan project represents the future mobility house for professional EV users; it exemplifies the fusion between the building and transport sectors, most needed to boost the electrification of transport. During the day, the Vulkan site operates as a 'Centre for professional users of EVs' like taxis, electric freight vehicles and EVs for crafts and services. Vulkan allows for the pre-booking of charging timeslots, flexible charging, battery storage, smart grid systems and quick charging. At night, Vulkan offers free residential parking for dwellers in the neighbourhood. This creates a flexible and cost-efficient site for the promotion of EVs. Currently, Vulkan is equipped with 100 AC chargers, 2 DC quick chargers, battery storage, smart grid systems, flexible charging and V2G functionality. The next stage will include super quick chargers, battery storage with second-hand batteries, V2G solutions for both AC and DC charging, and possibly, inductive charging.

"Use our electric vehicles as energy buffers!" That is exactly what the city of Kortrijk, Belgium wants to do in the future. Kortrijk, with 76,000 inhabitants, strives to be the first city in Flanders to become energy neutral. The local pilot site consists of municipal sport facilities, a depot for city services, a PV-installation roughly three-quarters of the size of a football pitch (yearly producing enough green energy to cater for 22 families all year round), a smart charging station and currently one Nissan E-NV200, an electric delivery van: the pilot aspires to become a small power plant. The energy produced by the PV-installation is used by the depot and sport facilities, but any excess energy will be injected into the EV, stationary battery or e-bikes on site to be used when necessary.

By means of a smart charging station, the electric delivery van will not only be charged, but also discharged. The regular driving hours of the mailman and his daily predetermined trajectory provide clear boundaries to implement smart charging algorithms. A rise in energy autonomy is expected to save 33.4 tons of CO_2 emissions. These numbers will only increase when more EVs will be purchased by the city of Kortrijk. Plans for expansion to other city service buildings are already being considered and fit in the ambitious plan of being the first Flemish energy neutral city.

Moving north to Loughborough, UK where a small pilot is running with a single household, with a single EV, equipped with PV panels, which regularly produces more energy than it consumes due to a demand/generation misalignment. Through ICT integration, when the EV is parked at the house, it will charge or discharge in response to the household's electricity demand and solar energy production forecast. As a result, it is expected that the distance travelled by the EV using zero emission PV generation is expected to increase dramatically.

Finally, Leicester, UK is piloting Vehicle to Business. This pilot studies the pros and cons of controlled and bi-directional charging at an office location. Between June 2016 and June 2017, the EVs used 2,996kWh; around 15 per cent of annual PV production. The EVs travelled 10,587 miles. EV utilisation is expected to increase; leading to an increase in ultra-low emission kilometres.

These six pilots are receiving financial support by the Interreg North-Sea Region SEEV4-City project. The main aim of SEEV4-City is to develop this concept into sustainable (commercially and socially viable) business models and well-established city planning. Energy and mobility are separate domains, but SEEV4-City aims to integrate these field into city-oriented Sustainable Urban Mobility and Energy Plan (SUMEP).

FYI

Florinda Boschetti is Senior Manager at Polis

Hugo Niesing is SEEV4-City's project coordinator

For more information about the project visit **www.northsearegion.eu/seev4-city** or contact the SEE4-City project coordinator Hugo Niesing: **h.niesing@hva.nl**

Images: Bike Citizens unless stated

Small button, big data

Founders of Bike Citizens Andreas Stückl (left) and Daniel Kofler (right)

PING if you care! **Simone Feigl** discusses cyclists contributing to a better traffic infrastructure in cities

In 2017 Mobiel 21, the Flemish organisation for sustainable mobility, launched the PING if you care! pilot campaign in Brussels, together with Bike Citizens. In early 2018 the evaluation of the Brussels PING if you care! campaign was accomplished by using the Bike Citizens analytics tool and analysing results from surveying and the overall campaign. The PING if you care! campaign, financed by the Cabinet Debaets, regional government of Brussels, allows people to

Additional observations showed that the 'pinging' behaviour of the participants differs. It is necessary to put the PINGs into the right context or to clear double PINGs of the same participants

actively engage in the development of their city. With the PING button, participants can mark situations and spots which they perceive as unsafe or where they feel a conflict. By doing so, they create a clear image of the traffic situation for cyclists.

The PING button (figure 1) is around four centimetres in width and can be attached to the handlebar or clothing. The button communicates with the Bike Citizens app via Bluetooth. Participants of the PING if you care! campaign can 'ping' (ie, activating the PING button) bottlenecks in traffic, which will then be automatically marked on a map in the app and on the campaign website using GPS technology. Communication with the target group is key.

A short introduction explains to participants in which situations it is useful to 'ping'. For instance, potholes in the road or a traffic sign hidden behind branches. Besides responses on infrastructural defects, people also collect data about traffic situations, which are not covered in other statistics, like for example ignoring priority in traffic. Results show that emotional conflicts and conflicts with other road users are often pinged. The PING button allows cyclists to mark how many times a car is parked on the cycle lane or how many times they have been "doored" on their route. Cyclists can categorise and comment on their PINGs straight away or at home. To guarantee high representation of the results, the participants of the campaign were chosen considering different factors: residence, age, sex and cycling experience.

Important in this campaign is the communication and engagement with the target group. Mobiel 21 started the campaign with a successful event in

The PING button and connect with the Bike Citizens app

Heatmap of the PING if you care! campaign

the heart of the city. Dedicated newsletters, a 24-hour helpdesk and lively Facebook community supported the creation of a highly motivated group of 'pingers'. Communication and sharing ideas and news was needed in order to keep participants using the PING button during the eight-month campaign period.

PING HEATMAP – CYCLED TRACKS AND PINGED SPOTS

The heatmap (figure 2) visualises cycled tracks as well as 'pinged' places in the city. The brightness and concentration of the lines show where the most people have cycled. The bigger the circle, the more PINGs have been marked on this location.

The heatmap provides first insights as to where improvements for cyclists will be effective. In Brussels in 2017, cyclists 'pinged' more than 36.000 times. The PINGs

Free demo version of Bike Citizens Analytics available

A 30-day demo version of Bike Citizens Analytics is available for cities, urban planners and traffic planners. Please send your request to: **info@bikecitizens.net**.

PING if you care! in other cities

The PING if you care! campaign can easily be adapted to other cities. It is not only about negative emotions: Also positive situations can be 'pinged' to provide a big picture of the traffic situation. If you are interested in conducting a campaign, please send a request to **info@bikecitizens.net** or **ping@mobiel21.be**.

More people on bikes in cities can bring about positive effects, not only for cyclists themselves, but for all residents

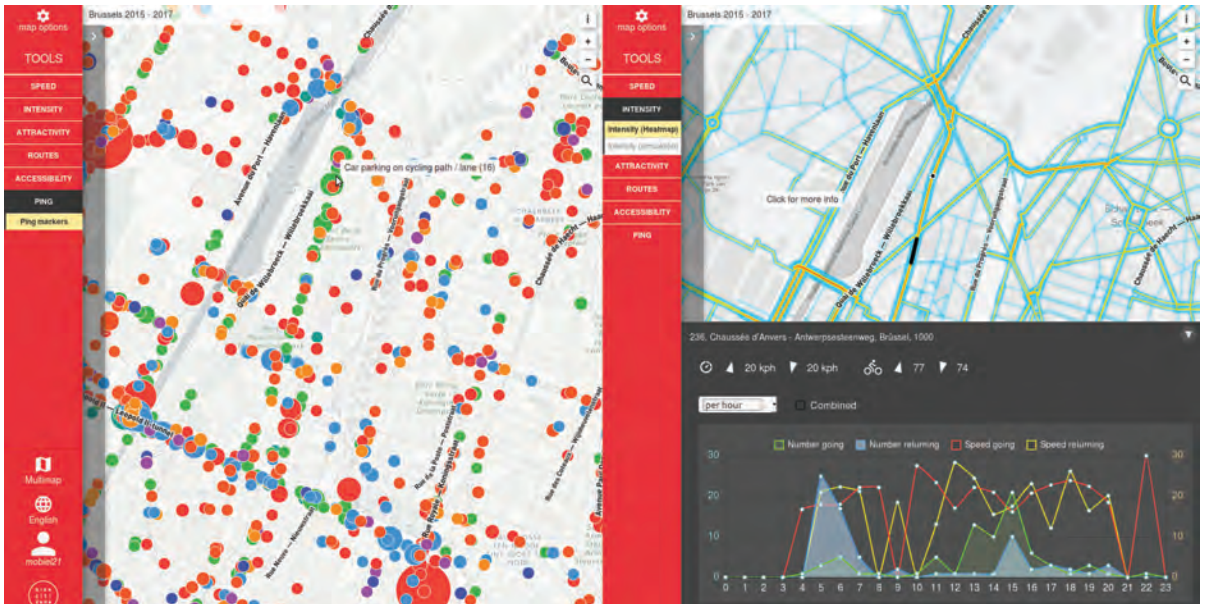
are correlated with the uploaded tracks, comments and the other cycling data using the Bike Citizens Analytics GPS data analysis tool. After the analysis of the data gathered during the pilot campaign the interpretation of the pinged places, clear recommendations will be sent to the regional government of Brussels, Cabinet Debaets. This will ensure that all the contributions of participants will be taken into consideration. Which means that they will not be drifting around on one of numerous online platforms gathering user feedback on streets.

Elke Franchois, Evelien Bossuyt from Mobiel 21 and Adi Hirzer of Bike Citizens are currently working on the data analysis of PING if you care! and Hirzer said: "PING if you care! allows for improvements on different levels. It is mainly about investigating the best approaches and utilising given budget resources wisely." He also offers a first insight to the results:

The comparison of PINGs and GPS routes lets draw conclusions on the significance of the PINGs. Figure 3 shows an example: A segment of the Antwersesteenweg, Brussels, catches someones eye because of a high amount of PINGs of the category 'parking on the bike lane' (left screen). The detailed analysis of the cycle data shows a morning peak and a slightly lower peak in the afternoon (right screen). This indicates that the segment of the route is mainly used by commuters and school pupils. Tightened control by parking officers could bring a fast and cheap improvement of the situation.

Additional observations showed that the 'pinging' behaviour of the participants differs. It is necessary to put the PINGs into the right context or to clear double PINGs of the same participants (a feature that is integrated in the tool).

PINGs that are referring to interpersonal conflicts have to be analysed differently to PINGs treating



Bike Citizens Analytics screenshot: different PING categories are displayed in different colour. The size of the circles represents the amount of the PINGs
Image: Bike Citizens, OpenStreetMap Contributors, Mapbox

infrastructural issues. Interpersonal conflicts are often singular incidents, just affecting the involved people, but still can point out solutions that can be managed locally. Contrary to that, the accumulation of a certain conflict all over the city could be solved by accomplishing an information campaign.

HOW PING IF YOU CARE! CONTRIBUTES TO AN IMPROVEMENT OF PEOPLE'S HEALTH

PING if you care! does not only help cities to understand the actual traffic situation and to provide better infrastructure for all traffic participants, it also engages the people, both in providing a better infrastructure and giving traffic participants a voice. This helps them to contribute to a more bicycle-friendly city and steadily improves the conditions for cycling in cities. Thus, people tend to cycle more often, they feel more appreciated on their bikes and benefit from a better traffic infrastructure.

More people on bikes in cities can bring about several positive effects, not only for cyclists themselves, but for all residents.

Better health due to better fitness

Due to daily exercise on the bike people get fitter and healthier. As a study of the Austrian Mobility Research shows, about a quarter of the people tested who used the bike for 12 weeks, could improve their fitness and reduce their body fat values.[1] Also, cyclists have a lower sickness absence rate than users of other transport modes (7.4 days compared to 8.7 days), as a study in the Netherlands showed.[2]

About Bike Citizens

Bike Citizens was founded 2011 in Graz by former bike messengers Daniel Kofler and Andreas Stückl and is located in Graz (Austria) and Berlin (Germany). The aim of Bike Citizens is to make urban cycling more attractive in order to contribute to the improvement of the quality of life in cities. To reach this goal, Bike Citizens develops products that offer urban cyclists a platform for information and exchange. Together with cities, companies and organisations, Bike Citizens works on solutions that provide navigation, promotion and analysis for bicycle traffic.

About Mobiel 21

The social profit organisation Mobiel 21 stands for sustainable mobility in Flanders, Belgium and Europe. For Mobiel 21, sustainable mobility means a balance between social, ecological, economic and health aspects. Its mission is to create an environment that is accessible in an environmentally friendly and safe way. Mobiel 21 was founded in 1982 and works with governments, stakeholders and companies.

Better health due to less emissions

Because bicycles produce much less emissions than most other modes of transport, cyclists contribute to a better air quality. Cities with better air quality count less lung diseases amongst their inhabitants. VCÖ monetised the advantage for the health system: better air quality can save cities between 210 and 478 per person per year.[3] Also, cycling emits less noise, which can prevent the onset of noise-related psychological issues.

The higher the modal share of cycling the lower the ratio of injured cyclists

In an 18 year period cycled kilometers more then doubled in Austria (from 1995 to 2013) whereas the amount of traffic accidents with injured cyclists only rose by 20 per cent[4].

Also, a research project from UCL (University College London) showed, hat cycling is safer than driving for young males (17 to 20 years old). Male car drivers face almost five times greater risk for fatal injuries than cyclists at that age.[5]

Considering the wide range of benefits of cycling for people and cities it is highly recommended to make cities more bicycle friendly. PING if you care! is a suitable campaign to start this process towards a bicycle-friendly environment and thus, cities with bigger quality of life.

FYI

Simone Feigl is Head of Communications at Bike Citizens

Elke Bossaert (Mobiel 21) and **Adi Hirzer** (Bike Citizens) are driving forces behind PING if you care!

info@bikecitizens.net

www.bikecitizens.net

Facebook: **@BikeCitizens.net**

Twitter: **@BikeCitizens**

Instagram: **#bike_citizens**

NOTES

[1] GOAL project 2003, Austrian Mobility Research, 20 good reasons to cycle, 2010, http://trendy-travel.eu/docs/Brochure_trendy_cycling_EN.pdf, accessed 28th of February, 2018
[2] TNO Knowledge for business, Reduced sickness absence in regular commuter cyclists can save employers 27 million, Leiden, 2009
[3] VCÖ, Mobilitäs ist ein Gesundheitsfaktor, VCÖ-Factsheet, Vienna, 2012
[4] https://www.facebook.com/radlobby.at/photos/a.10150406580227185.311425.261915882184/10153980410247185/?type=3&theater
[5] UCL – University College London, London, 2012, http://www.ucl.ac.uk/news/news-articles/1212/06122012-cycling-risk accessed 28th of February, 2018

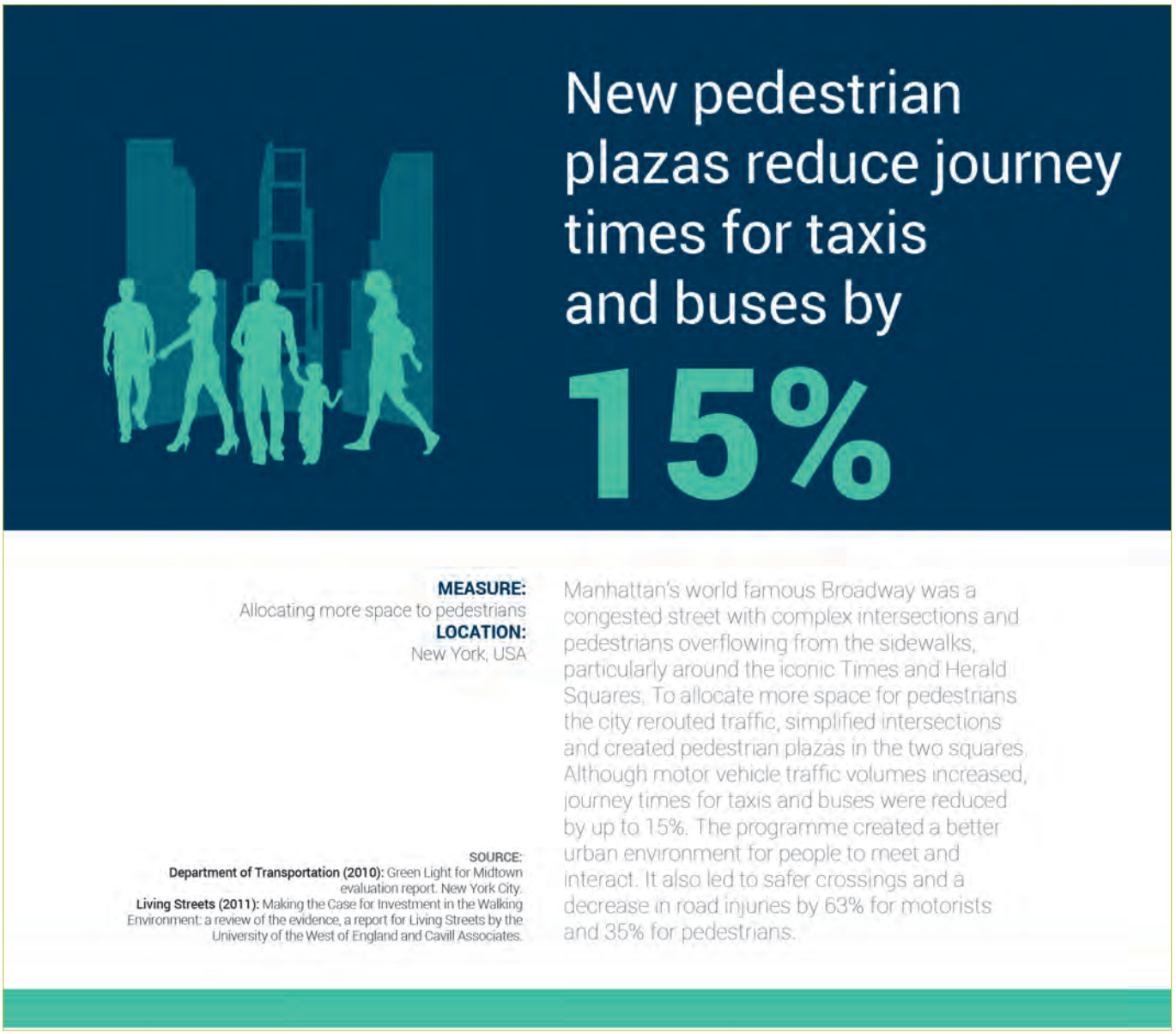
Decongesting Europe

What is the impact of walking and cycling on urban congestion? **Pasquale Cancellara** and **Dagmar Köhler** looked for answers through the FLOW project

Cities around the world are all worried about traffic congestion that costs nearly 100 billion in the EU alone. From a survey[1] carried out within the FLOW project we know that nearly half of European political and administrative decision-makers worry about congestion when introducing walking (41 per cent) and cycling (48 per cent) measures.

The common challenge in all major European cities is: how to enhance mobility while at the same time reducing congestion, accidents and pollution? What if walking and cycling measures can actually help reduce congestion?

The CIVITAS project FLOW undertook serious research on this question over the past three years. With



transport modelling market-leader PTV in the consortium, a significant amount of work was carried out to include walking and cycling in transport modelling, develop an impact assessment tool, train the users and test the tools in FLOW partner cities.

Among the number of publications, reports and recommendations issued by the consortium is 15 Quick Facts for Cities which has proved to be one of the most popular publications that ongoing European transport projects have issued in recent years. This little brochure lists some surprising facts about what happened in cities that put in place measures that support walking and cycling.

For example, an interesting "Quick Fact" comes from the FLOW city Lisbon which showed that reducing the crossing distance and the curve radii on a busy street in the city centre did not increase congestion despite the reduction of road space for cars. At the same time, this change in the intersection layout made pedestrians feel safer (+18% per cent) and less pressured to cross the street (-14 per cent) while bringing about a traffic-calming effect as drivers now approach the intersections at slower speeds.

Thanks to the FLOW project, Dublin decided to pedestrianise an entire T-junction in front of College Green, one of Dublin's and Ireland's most prestigious addresses.

The modelling carried out within the FLOW project showed that pedestrianisation and consequent re-routing of public transport would allow 700 more people to get

About the project

The EU-funded project FLOW developed transport analysis tools designed to better assess the impacts of walking and cycling improvements on transport system performance. The project hypothesis was that existing tools do not accurately evaluate walking and cycling, and therefore walking and cycling improvements are generally not implemented, or even considered, as measures for improving transport system performance. The FLOW project ran from May 2015 to April 2018 and has received funding from the European Union's Horizon2020 research and innovation programme.

The **FLOW final conference**, organised in synergy with the EU project TRACE (which develops walking and cycling tracking applications for behavioural change), attracted more than 200 urban transport professionals in Brussels on 13-14 March 2018 to discuss how walking and cycling can help reduce congestion. The event, entitled "Decongesting Europe: New approaches to freeing our cities", concluded three years of research and included a declaration signed by high level decision-makers stating: "We believe in making all modes count in urban transport. Let's put walking and cycling on an equal footing with other modes to reduce the impacts of congestion!"

For more information:

FLOW Quick Facts for Cities (available in 11 languages) – booklet of examples of walking and cycling improvements that have reduced (or not adversely impacted) congestion; counters popular image that walking and cycling measures increase congestion.

Implementer's Guide to Using the FLOW Tools for Multimodal Assessments – summarises investigation results, presents recommendations, describes how to use FLOW analysis tools, impact assessment tool and transport model improvements; includes full bibliography.

FLOW Multimodal Analysis Methodology of Urban Road Transport Network Performance – describes FLOW multimodal transport analysis tools, their development and recommendations; includes bibliography.

Analysing the impact of walking and cycling on urban road performance: a conceptual framework – documents background research results and sets forth the conceptual framework used to develop FLOW tools.

through the bottleneck during peak hours.

Dublin's approved plan shows the importance of collecting mora data for walking and cycling. Often cities cannot prove that people are walking and cycling, so they cannot show that improving walking and cycling facilities will improve transport and reduce congestion. At the same time, it shows the multimodal perspective of urban road network performance, one of project's key recommendations of considering moving people rather than vehicles.

WHAT CAN A PROJECT'S DISSEMINATION WORK PACKAGE ACHIEVE?

The FLOW Quick Facts show how well implemented walking and cycling measures around the world can help to manage congestion, increase capacity and improve the flow of traffic for everyone.

After the Quick Facts were published in May 2017, the NGO Arquitectúria in Valencia contacted the FLOW Dissemination Manager, Polis, and requested to organise an event to present the FLOW project and its Quick Facts.

The NGO discovered the Quick Facts publication through a campaign that FLOW partners ran on Twitter. For 15 weeks during the summer of 2017, one Quick Fact was promoted on Twitter every Monday morning using the structural hashtag #DidYouKnow (i.e. #DidYouKnow that #cycling improvements lead to less #CarTraffic, faster #PublicTransport & more attractive spaces?).

This generated lots of interest on the web, people engaged in discussions and started to translate the publication into other languages. The Spanish NGO also got in touch, pushed for a workshop in Valencia and translated the Quick Facts into Spanish.

The event took eventually place on 21 February 2018 in Valencia and kicked-off with a "walkshop" guided by the architect and promoter of the event, José Luis Gisbert Elio. He was joined by the Mayor of Valencia, Mr. Joan Ribó i Canut.

The group walked from the Valencia city council offices and passed through several key points of the centre in order to provide the participants with hands-on evidence on the city's current walkability conditions.

The destination was the University of Valencia where the the Mayor received the participants and opened the event that presented FLOW to city officials, local decision-makers and urban planners

NOTES

[1] The FLOW Decision-Makers Baseline Survey describes the views of administrative and elected decision-makers across Europe.

[2] *Ribó reivindica el derecho a caminar y critica que se ha favorecido el coche de forma "desmesurada"*, Europa press, https://bit.ly/2Jp7Z4J

A new way to manage the kerb space

servicing of inner cities is transformed

reduced congestion

improved air quality

ev-zones

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Car-free zone leads to almost 30% fewer inner-city cars

MEASURE:
New pedestrian area
LOCATION:
Paris, France

Parc Rives de Seine is a new eight hectare car-free space for walking, cycling and leisure, and a UNESCO World Heritage site in the centre of Paris. Until recently, the area was a congested expressway along the river with heavy motorised traffic. Six months after the quayside was pedestrianised, Paris registered 1,349 fewer cars (28.8%) each day in its city centre (February 2017 as compared to 2016). The phenomenon of "disappearing" traffic is known as traffic evaporation and is explained by Braess' paradox, which states that the complete removal of congested routes can reduce traffic volumes because individuals change their itineraries, schedules, frequency of travel or mode choice.

SOURCE:
City of Paris (2017): Moins de véhicules et moins de pollution depuis la piétonnisation de la rive droite.

and also marked the launch of a new platform called Valencia Camina ('Valencia walks').

Today, the new citizens' platform Valencia Camina aims to promote walking and cycling, highlight and monitor current mobility challenges in the city and contribute to make active travel really count among all other modes of transport.

"Is there something more natural than walking?", asked the Mayor of Valencia in his introductory speech. If since the second half of the 20th Centuries cities have disproportionally encouraged motorised modes of transport as a symbol of progress, added the Mayor, now more than ever it is important to reclaim this right.

"It is very important that people realise that you cannot assess urban mobility only from the point of view of motorised traffic but that it has to take into account also how accessible are the walking and cycling infrastructures."[2]

Pasquale Cancellara and **Dagmar Köhler** are FLOW Dissemination Managers at Polis
pcancellara@polisnetwork.eu

The FLOW 15 Quick Facts for cities are available in 11 languages and can be downloaded from the FLOW website, where all of the project's publications are available: **http://h2020-flow.eu**

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

A frictionless future

How innovation and the mobility revolution will change the way we get around cities, by **Rachel Karitis**

The transportation world is changing faster than ever before; there have been more changes in the past 5 years than in the 100 that came before it. Along with this comes an overload of information, with commuters facing an abundance of choices and the accompanying onus to determine which is best suited to each individual trip.

Uber, Lyft, and other similar companies have brought ridehailing services straight to our phones. Within those, you can choose to share a ride or take your own. ReachNow (from BMW) and car2go both offer the ability to use a car for one-way trips; Zipcar offers the same but for two-way trips. Bikeshare is available docked or dockless, traditional or electric.

That's not even to mention what's proving to be available sooner than we even imagined. Some estimates think 95 per cent of new vehicles could be autonomous by 2040. Elon Musk's proposed Hyperloop would make traveling between Washington, DC, and New York City faster than driving in traffic from Washington, DC, to parts of Northern Virginia.

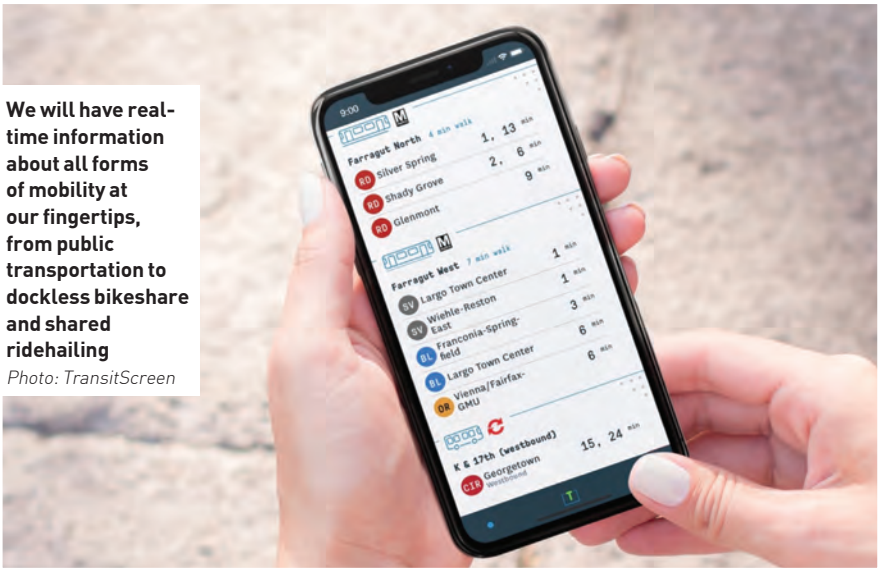
The availability of all these options indicates one thing above all else: personal vehicle ownership will eventually be phased out in favor of the sharing economy. The number of ridesharing and carsharing trips combined in the United States nearly doubled from 8.2 million users to 15 million users from 2014 to 2016, and the trend has only continued since then.

How will our infrastructure adapt to accommodate so many choices that all belong to the greater public? The future of mobility is frictionless.

WHAT IS FRICTIONLESS MOBILITY?

Frictionless mobility is one in which all modes of transportation are fully connected, increasing the rider experience and thereby increasing the number of people who choose this way of life. Everything will be optimized using the Internet of Things, from information about arrivals to paying for rides to transferring to a different mode.

Barcelona's superblocks aim to create mini-neighbourhoods that will give the streets back to the people from cars
Photo: Bert Kaufmann, Creative Commons 2.0



We will have real-time information about all forms of mobility at our fingertips, from public transportation to dockless bikeshare and shared ridehailing
Photo: TransitScreen

Information will be in one place, rather than users having to seek out endless apps in the hope of figuring out the best possible option for their trip. TransitScreen has already begun to solve this problem, curating live displays for building lobbies and public spaces to show real-time data for all nearby mobility options. The company's mobile app allows users to carry this information in their pockets. As time goes on, these will only become more prevalent, making every commute easy to plan.

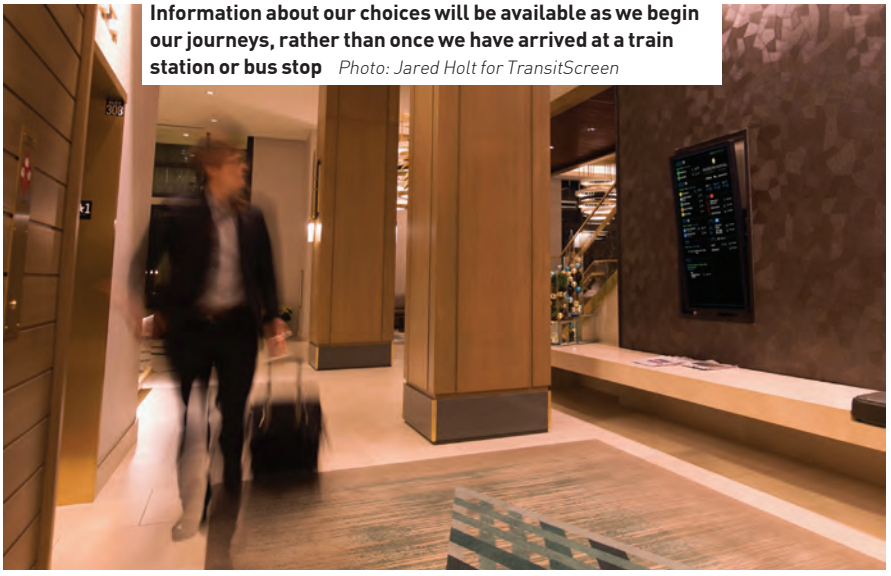
Payments will be handled with one centralized system, via either a card or an app. Users would be able to board the bus having already paid for the ticket on their phone, eliminating the need to search for spare change and speeding up the overall boarding process.

The bus would also display real-time arrival information for subway transfers and bikeshare availability, and vice versa.

HOW WILL WE GET THERE?

This future is going to depend on huge changes in our infrastructure to make all this a reality. This is where the Internet of Things will come into play. IoT is built on the cloud and involves data-gathering sensors, which will eventually be able to improve traffic flow and optimize our public transportation systems. It's also mobile and instantaneously connected, blending interactions together seamlessly.

The number of ridesharing and carsharing trips combined in the United States nearly doubled from 8.2 million users to 15 million users from 2014 to 2016



Information about our choices will be available as we begin our journeys, rather than once we have arrived at a train station or bus stop *Photo: Jared Holt for TransitScreen*

This will require changes on a political level before the changes can be made on the individual level; governments will have to commit serious levels of funding to transforming our streets.

Some cities, such as Barcelona, Paris and London are already making strides. Barcelona's superblocks are meant to give the streets back to the people instead of to cars; Paris and London have both made moves to ban cars entirely from the cities' busiest pedestrian throughways.

Policies like this must be maintained and then pushed further; thought must be given to redesigning the streets themselves. With the introduction of ridesharing services (and an increase in online distributors delivering more packages than ever before), the way we think about curbside pickup and dropoff is essential.

Having dedicated space for these vehicles, rather than parking spaces, in cities' downtown areas is one major change to expect.

WHAT WILL THE OUTCOMES BE?

It cannot be ignored that the ongoing proliferation of cars on the road is a huge factor in our more-relevant-than-ever collective environmental situation. In the United States, transportation contributed more to greenhouse gas emissions than any other sector - and it has shown no signs of slowing down.

There are many reasons for this and they will all have to be addressed. In many communities outside of cities, people have no choice but to drive to and from work and other activities due to lack of access to adequate public transportation. This will require long-term investments in increasing access so the option to choose a more sustainable lifestyle is available.

That being said, there are many people in cities with perfectly fine access to transportation who still choose not to take it, and this is the key demographic which must be addressed. Some of the largest reasons people choose not take public transportation are a lack of easily available real-time information and unexpected delays.

With frictionless mobility, these issues will become a thing of the past. Real-time information will become ubiquitous, at the beginning of and during a commuter's decision-making process. Once streets are redesigned to give equal weight to each mode of transportation, bus delays will be eliminated thanks to dedicated bus lanes. Cars will not be held up by Ubers waiting for passengers. Bikes will have lanes of their own, decreasing fear of being hit.

We can expect to see an increase in overall ridership thanks to these changes, but the choice of how to get somewhere comes down to a cost-benefit analysis. It may be done quickly, without even consciously thinking about it. In the future of frictionless mobility, the benefits of choosing public transportation over traditional car ownership will beyond a doubt outweigh the costs.

The possibilities offered by the Internet of Things are endless; it is difficult to fully comprehend their extent at this time. A frictionless future will likely stretch beyond just our mobility and how we move around cities; it will continue to change the way we get our groceries, the way we shop, the way we interact with the world and people around us. One thing, however, is certain: Given the exponential rate at which technology and innovation are evolving, it is closer than we think.

FYI
Rachel Karitis is Director of Marketing at TransitScreen
rachel@transitscreen.com

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Mix and Move!
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Ciarán Cuffe, foreground, is the Dublin City councillor who champions sustainable mobility

A moving story

At the "Decongesting Europe" event, the final conference of the FLOW and TRACE EU projects, the city of Dublin presented some of its work on tackling congestion. **Chloé Mispelon** of Polis interviewed **Ciarán Cuffe**, the city's elected official tasked with addressing the issue of mobility

Ciarán Cuffe chairs Dublin City Council's Transport Committee. He is passionate about walkable, bikeable, and liveable cities. He has served two terms in Ireland's national parliament, and was a Minister of State with responsibility for climate change, planning and sustainable transport. In Government he reformed the Irish planning system to focus on evidence-led decision-making and published legislation to tackle climate change. He also chairs a Masters Programme in Urban Regeneration and Development at the Dublin Institute of Technology. He is currently undertaking an MSc in Cities at the London School of Economics and holds degrees in architecture and urban planning from University College Dublin.

Polis [CM]: Dublin has been very visible in the FLOW-TRACE final conference, Decongesting Europe. What were the reasons for this visibility?

Councillor Cuffe [CC]: I'm pleased with that. Our transport team is involved in several projects focussing on car free area and also on improving public transport, walking and cycling. We also have been able to build on strong in-house competencies in traffic modelling. We work closely with national level too.

Proposals for a pedestrianized plaza in the city centre focus on the College Green area

The vision of the city has changed. We have moved away from car-dominated cities to people-friendly cities and somehow we have learned from our mistakes

CM: Could you give an example of a key project that you are working on?
CC: I would say that our main project currently is the pedestrianization of College Green [a three-sided plaza in the city centre]. It is our flagship project because it is the heart of the city for symbolic reasons but is also a huge transport meeting point where people coming into and crossing the city collide.

CM: How did you convince your city colleagues to go for pedestrianisation?
CC: The arguments we used are mostly safety and volume of people that would be able to cross. This is a bit different than our traditional approach, when we usually focus on environment and social benefits.

CM: ...and how did you convince the public?
CC: We have been working for two years to understand the challenges of the place, we have been engaging with several stakeholders: hotel managers, car park operators... We have organised workshops with citizens. The city architect, for instance, hosted a workshop very early in the process. We are using the "planning for real" tools which is based on 3D models and triggers bottom-up approaches. The overall process is still a work in progress: public enquiries are taking place this week.

CM: What was (or is) the hardest part of this project?
CC: Making changes to bus routes. The city centre is quite dense so we had little possibilities for rerouting. This will imply that passengers will have to walk a bit longer distances between modes. That was something difficult to get through. We also faced lots of concerns of extra traffic in parallel routes from residents and businesses.

CM: Are there other projects in the pipeline?
CC: In the north of the city we will redevelop Mountjoy Square and we would like the inner city to become a cultural quarter. We will reuse the tools used in the FLOW project on College Green to reallocate road space.

CM: You have been a city councillor for 27 years, what is the most striking thing you have noticed?
CC: The vision of the city has changed. Internationally too. We have moved away from car-dominated cities to people-friendly cities. We have somehow learned from our mistakes. We now focus on more people on the street, better landscaping, more activities, better for women, more child -riendly. I am very inspired by the work of Jane Jacobs. Already in the '60s she understood the issue of comprehensive redevelopment, even though the road agenda was highly prevalent at that time.

CM: Thanks for sharing your thoughts and good luck with the implementation of the pedestrianisation scheme. We are looking forward to seeing how it transforms the city centre.

FYI
Chloé Mispelon is a project officer at Polis

A different train of thought

Digitalisation is not always the answer in the smart city, says **Clive Hinchcliffe**

Could Ultra Light Rail (ULR) be the quality cost-effective 21st century answer to the movement of people and goods? Trams and LRT have long been known for their abilities to transform cities and regions and encourage people to swap the car for public transport, however, their high cost has meant limited application.

What if you could reduce the cost by up to 60 per cent whilst at the same time retaining the benefits provided by traditional trams and

LRT systems? ULR has this ability because of its low axle weight of 5 tons or less, considerably reducing infrastructure costs whilst options such as onboard energy supply and brake energy recovery reduce energy costs and emissions.

Innovative track technologies such as the LR55 can be installed one rail at a time into the existing road surface. There is no need to move underground utilities which would result in yet another cost saving in respect to laying track within the street environment. This track system has been in continuous service in the city of Leeds, UK, for more than 20 years without the

"ULR has turned what was an under-utilised branch line into a vibrant transport link integrated into the daily lives of the community of Stourbridge..."

The previously under-utilised branch line in Stourbridge

need for any maintenance except regular inspections.

Certainly one of the jewels in the ULR crown is the highly commended service operated by Pre Metro Operations Ltd between Stourbridge Town and Stourbridge Junction near Birmingham in the UK's West Midlands.

This has turned what was an under-utilised branch line into a vibrant transport link integrated into the daily lives of the community of Stourbridge...all because of its conversion to ULR.

The service previously operated by a DMU offering an infrequent service, used to carry just 250,000 passengers per year. Following the conversion, passenger numbers have soared to +600,000 per year whilst emissions have reduced by 80%. By the same token, the reduction in operational costs is attributed to the innovative Class 139 railcars designed by Parry People Movers.

The key innovation includes brake energy recovery using flywheel technology – this has reduced the size of the motive power unit (gas engine; presently LPG but conversion to bio-methane is expected when local facilities allow) to just 2.4 lt for a 60-passenger vehicle.

Due to the rapid acceleration & braking combined with the quick turn-around available with this type of vehicle, a 10-min service is now operating from early morning till late at night, 7days/week and has one of the highest reliability rates of any rail service in the UK; operating at 98%+. The low axle weight has reduced the cost of track maintenance and wheel wear in a package that has improved the balance sheet.

So, what about higher customer flows? Can ULR match existing trams when it comes to large number of users? The simple answer is: Yes, it can with trams up to 300-passenger capacity and multiple unit trains from 200 passengers upwards.

PRESTON GUILD LINE

Preston, situated in Lancashire in the north-west of the UK, became a city in 2002. TramPower is now bringing trams to the people of Preston. As one of the most convenient methods of travelling, the City Class trams of TramPower will help ease congestion and parking

problems currently experienced in Preston, a city with a population of just under 115,000.

The Guild Line is the first of a proposed four-line network, which will connect many key parts of the city with Park & Ride stations outside the city centre. It will also connect many areas of the city to the railway station, retail parks, hospitals, football stadium and the University.

The Guild Line team is working with Preston City Council and Lancashire County Council to deliver an integrated project that improves the environment and status of the city. Plans for stage one of a tramway pilot project in Preston have been given the green light.

The plans which will see a stretch of the former Longridge to Preston railway line reinstated in Deepdale, were approved by Preston City Council's planning committee in November 2017.

Powered by renewable sources of energy, such as wind and solar power, the trams are environmentally friendly. Even with a full capacity of 200 passengers, the tram will use less energy and be as quiet as a family car. The Preston tram network will also enhance existing cycle routes and pathways, encouraging cleaner and greener transportation in Preston.

The benefits of ULR are being exported to countries outside Europe. With a two car 200-passenger train for a client in the Sultanate of Oman and a 120-passenger railcar for a client in Turkey, this particular vehicle won a Global Light Rail award for Engineering Excellence.

Both are designed by Transport Design International who are also the project leaders of the Revolution Very Light Train (VLR) project sponsored by the UK RSSB to develop the next generation of passenger railcars with an axle weight of 5tons or less. This will facilitate cost-effective connectivity of regional, rural and suburban areas. The vehicles will be built at a specialist designed centre in Dudley and is due for completion in 2019.

Transport Design International's 120-passenger railcar for its Turkish client

TramPower's City Class trams in Preston in NW England

FYI
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CITIES AND REGIONS FOR TRANSPORT INNOVATION

OFFICIAL SIDE EVENT

FROM DATA TO POLICY:
NEW APPROACHES FOR DATA-DRIVEN AND SMART ROAD SAFETY POLICIES IN CITIES AND REGIONS

23 May 2018
9.00-10:30
Hall 4

SPEAKERS:

Dagmar Köhler, Road Safety Coordinator, Polis

Michael A. Replogle, Deputy Commissioner for Policy, New York City Department of Transportation

Kevin Webb, Director, SharedStreets & Open Transport Partnership

James Bradford, Global Product Director, iRAP, International Road Assessment Programme

Melinda Hanson, Director Global Designing Cities Initiative, NACTO

Peter Kronberg, Safety Director, Volvo Group

Graziella Jost, Projects Director, European Transport Safety Council

Jane Lupson, Bus Collision Reduction Programme Manager, Transport for London

Moderator: Karen Vancluysen, Secretary General, Polis

What are the keys to success in effective local road safety policies? How to address safety and sustainability in an integrated way? Which safety data is most needed by cities? Can vehicles become safer for all road users?

The side event is organised by Polis in cooperation with ETSC, iRAP, NACTO, NY City DOT, the Open Transport Partnership, TfL and Volvo Group.

WE LOOK FORWARD TO MEETING YOU IN LEIPZIG!

Inside the nerve centre

CIVICAT, the Traffic Information Centre for Catalonia has been recently fully remodelled, incorporating the latest technology to improve the service to the region's citizens, as **Eugenia Doménech** explains

Whether it's images captured by roadside cameras, aerial images taken from the light aircraft of the Catalan Traffic Service, messages on road information panels, changes in variable speed limits on access roads to Barcelona, traffic management in special operations, management of the VAO Bus Lane on the C-58 motorway, management of information during environmental incidents or specific plans, such as NEUCAT (snow plan) - everything starts or finishes with the CIVICAT. The Road Information Centre for Catalonia (CIVICAT) manages mobility on the roads of Catalonia from the land and from the air. Inaugurated in the year 2000, the control centre was completely remodelled in 2017, incorporating the latest technological developments to improve the service for our citizens.

The Catalan Traffic Service, through the CIVICAT, provides comprehensive real-time management of the Catalan intercity road network, more than 12,000 km of roads and motorways, 24 hours a day, 365 days a year. As regards daily mobility and leisure mobility, as well as special operations, the control centre works nonstop to provide road information to users as quickly as possible, minimizing impacts and promoting safer mobility. The Director of the Catalan Traffic Service, Eugenia Doménech, stresses this point: "the CIVICAT

This comprehensive renovation of the CIVICAT places it at the same technological and operational level as other European control centres

works every day of the year to help us to better manage road safety and mobility on the roads of Catalonia."

One important example of a special operation is Easter, one of the festive times of the year that registers a higher mobility demand and presents more road complications throughout the territory. It is characterized as a period of transition between winter and summer mobility, therefore, a special device is implemented which includes, among other things, installation of special measures at various points of the road network where there is more congestion: lanes configured in the opposite direction, roundabout operations, restrictions on the movement of heavy vehicles, etc.

For the management and control of mobility throughout Easter, the Catalan Traffic Service deploys an important number of technical and human resources:

- Approximately 250 km of installed traffic measures.
- 1 twin-engined airplane for tracking devices.
- 40 teams of special traffic measures.
- 32 truck installation platforms.
- 23 lightweight vertical signalling vehicles.
- 13 mobile variable signalling cars.
- 4 mobile road information teams.
- 135 signalling operators of measurements.*
- 11 operators of traffic restrictions.
- 14 traffic management technicians at CIVICAT.
- 3 flight crew, operators and traffic management technicians.

A COLLABORATION OF INFORMATION

Technicians and operators at the CIVICAT integrate road information from more than 500 cameras distributed across the road network, with the support of airborne resources, EMIV vehicles (Mobile Road Information Units) and road professionals. In addition, one of the principal sources of information for the CIVICAT comes from the Mossos d'Esquadra regional police force that provides data relating to assistance at on-site incidents. The Centre also works in coordination with the different concession holders of the Catalan intercity road network and with Google, through the Waze application.

A large part of the information services carried out by the CIVICAT in regard to traffic conditions is reflected on the website for traffic incidents (cit.transit.gencat.cat), on the Traffic Map (http://mct.gencat.cat/), in the "Trànsit" App (iOs and Android) and on the more than 130 variable message signs and 930 variable speed and lane signs.

Eugenia Doménech emphasizes that the work carried out at the CIVICAT to effectively manage problematic transit routes is "an essential part of citizen services, as well as fundamental to improving road safety, which is, in short, our aim."

In regard to technical matters, the key improvement to the new Catalan road control centre has been the change of the videowall, which now has additional high-definition screens to provide a more complete picture of real-time traffic conditions and enable the receipt of images relayed by aerial means. In this regard, it is possible to visualize up to 180 cameras simultaneously and manage eight applications at the same time, including Traffic Map, variable speed, weather radar or the VAO Bus Lane. Moreover, the new videowall enables the appropriate tools to be established according to the different special operations, combining cameras, vehicle counts and applications in each case. The exciting feature of this new videowall is the minimum separation between the two rows of ten 55" monitors (0.9 mm pixel to pixel). The flexibility offered by the system is almost unlimited. It is the first videowall with these features to be implemented in Spain.

Improvements have also been made in the network architecture and servers to gain efficiency and performance, and a totally standard and easy-to-integrate traffic image delivery system has been developed for other administrations, entities or media communications.

PEACE AND QUIET

An advance in the comfort of the CIVICAT's operators has been the concept of a silent room, consisting of the installation of all the computer equipment in the annexed room of CPD, leaving the operators just the peripheral equipment (screens, keyboards) to look after. In this way, apart from the reduction of noise caused by PCs, an improvement in the ambient temperature is also obtained. In the integral CIVICAT remodeling, lighting has also been renewed, from halogen to LED lighting, meaning it is now possible to regulate its intensity based on the current need.

This comprehensive renovation of the CIVICAT places it at the same technological and operational level as other European control centres.

TECHNICAL SPECIFICATIONS OF THE NEW VIDEOWALL

- 20 55" LED screens with comprehensive management
- Full HD maximum resolution
- Decoding and simultaneous visualization of 180 images
- Up to 8 simultaneous applications
- Scalability of images and applications
- Renovated voice and data processing installations
- Improvement of the uninterrupted power supply system
- LED lighting
- Integration of connectivity elements with worktables
- Renovation of all of the facility's computers and furniture
- Establishment of predefined scenarios for special operations (combining cameras, applications and vehicle counts).

Finally, CIVICAT is permanently in contact with the various forces of the order and security, such as Mossos d'Esquadra or Civil Protection, for the coordinated management of any emergency situation.

Moreover, in Catalonia there is the CECAT (Center for Operational Coordination in Catalonia) which is the centre of coordination and information on the structure of civil protection of Catalonia and looks after the good management of emergencies through the coordination of the different operational bodies, agencies and institutions involved in the resolution of situations in which the activation of an emergency plan is required. Its ultimate goal is the security of people, their property and rights, as well as the foresight and minimization of the effects that they may suffer in case of an emergency and concentrates it all in a single centre for all the organisms and organisations involved.

FYI

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Ahead of the kerb

Unlocking the city authority's most valuable asset – the kerbspace. **Neil Herron** reveals Grid Smarter Cities' innovative booking platform

The 'decriminalisation' of parking enforcement in Britain in the mid-to late-1990s created a situation where local authorities started taking over parking enforcement from a 'criminal' regime where fines were issued by the Police or Traffic Wardens to one where councils were responsible and could not only issue PCNs (Penalty Charge Notices) but also keep the revenue generated.

This Klondyke style 'gold rush', however, created what was perceived by many as a Draconian enforcement regime where common sense went out of the window and PCNs were the answer to many local authorities' cash shortages. This not only created a hostile landscape between the motoring public and the authorities but it created a wider impact and cost on businesses. For years these costs were silently and grudgingly accepted by the freight and commercial industry as a 'cost of doing business' but signs of strain were beginning to show.

In 2008 Gordon Telling of the Freight Transport Association estimated that PCNs were costing the freight industry £350m per annum with an associated processing or administration burden running way beyond that. There was even a 'millionaire's club' where the members consisted of companies receiving more than £1m of PCNs a year!

Something needed to give and in 2009 the seeds of Grid Smarter Cities were starting to be sown. What was apparent was that cities needed the freight industry to survive – we need beer in the pubs, food in the shops and restaurants, parcels delivered to the home and business. We need utility and telecoms companies to install, repair and maintain services and coaches and taxis to do business in a manner that was intelligent, efficient and without incurring massive costs for interacting with the kerbspace.

Concepts were proven, patents filed and platforms were developed and the 'Kerb' system was born - ahead of its time, but ready for the perfect storm when operators, authorities, businesses, cities, and high streets were ready to embrace and adopt such a solution: the bookable kerbspace.

WHAT IS KERB?

Kerb is a Real-Time Dynamic, Intelligent Kerbside Management Solution for Cities: the solution addresses the problem of limited and inflexible kerbside with an innovative, patent-protected, ready-for-market solution with global potential that can deliver additional capacity, adaptability and resilience to the kerbside with the ability to integrate seamlessly with other technologies.

In essence, the application allows commercial vehicle operators to opt to pay and park, load and unload on previously unavailable kerb space in high density, urban areas. Operators use the application to reserve a defined location on restricted kerbspace during an available time slot for a fixed fee. This pre-booked space becomes a 'Virtual Loading Bay' (VLB) or Virtual Parking Bay (VPB) allowing drivers to load and unload in close proximity to their delivery point without causing congestion and without the risk of receiving a Penalty Charge Notice (PCN) and saving time and fuel. City Authorities determine the fee and the

locations to be exempted. This can be time and vehicle specific to give preference to certain vehicles (eg zero/low carbon vehicles) and to 'nudge' behaviour into off-peak times.

Using Kerb helps city authorities address air quality issues on a macro level by reducing congestion and circling, as well as addressing issues on a micro level, creating behavioural changes through incentivisation and intelligent management of traffic flows. It similarly creates cost certainties (for fleet operators and councils alike) as well as well as efficiency savings from optimised deliveries.

Other benefits of the solution include:

- Efficient planning multiple drop-offs, reducing CO_2 emissions.
- Utilises kerb space on routes that traditionally prohibit loading and unloading – allowing deliveries at previously difficult to reach locations.
- Saves money by reducing the time and mileage spent searching for available kerb space.
- Reducing PM, NO and CO_2 emissions in keeping with "Corporate Social Responsibility" and International air quality standards.
- Sending 'real-time' updates to Civil Enforcement Officers (CEOs) reducing the issuing of PCNs.

SUPPLY AND DEMAND

There is overwhelming support for such a solution with its significant environmental (included in Air Quality Action Plans provided by UK national and local government bodies) and economic benefits for commercial vehicle operators and local authorities in comparison with the existing regime of PCNs that is currently a 'stick with no carrot' method that doesn't seem to please anyone.

The solution is replicable and repeatable for London Boroughs and provincial cities who will be able to opt-in with as many or as few VLBs and

VPBs as they wish, as well as having the scalability to solve the same problems internationally, with cities around the world experiencing the same kerbspace supply and demand issues.

The penny is starting to drop for cities and local authorities that the most important piece of real estate that they own is the kerbspace and, if managed correctly, can be flexed and time-sliced to create 24/7 value proposition.

As we move to the future where car ownership is going to decrease and on-demand electric taxis start to appear (whether driven or autonomous), there is going to have to be a management system so these vehicles can be 'held' in areas rather than continually circling. Intelligently allowing access to the kerbspace again will be key critical in managing city traffic and urban mobility.

The idea of a new airport being created where all the planes turned up at the same time wanting to access the limited number of runways of course sounds ludicrous. In many ways we should look at congested areas of cities in the same way, where the kerbspace is dynamically managed through a booking platform rather than the free for all that currently exists.

Some examples of how the kerbspace can be managed and time-sliced include:

- Virtual Loading Bays – where loading is currently prohibited but where 'opportunity windows' can be opened up by lifting the restriction for a certain vehicle to be at a certain location at a certain time when their presence least impacts on network flow.
- Virtual Holding Bays - areas for construction freight vehicles waiting to be called in to make their delivery, keeping them out of central areas to avoid unnecessary congestion and air pollution from the circling in city centres as they wait for space to free onsite.
- Virtual Loading Extensions – where loading is time limited the Kerb system will allow the operator to extend the period required to avoid suspending a delivery, moving the vehicle or incurring a PCN.
- Other iterations of the technology include Virtual Coach Bays, Electric Vehicle Bays, Disabled Bays, Courier and Click and Collect Bays...the list goes on.

So it now turns to Grid Smarter Cities to work with cities to address these increasing pressures we face at the kerbside. As new technologies like autonomous start to emerge, the demands are only going to become more complex. We need to be smart about how technology, and the data that sits behind it can influence how we best use the kerbside.

FYI

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Social and Economic Challenges

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

Special delivery

Microdistribution and last mile solutions from European research projects in Barcelona

Seeking to optimise and improve the problems associated with last mile traffic, Barcelona is implementing the last mile distribution of goods with electric cargo bikes within different European projects. The GrowSmarter lighthouse project is assessing the impact of this solution and its replicability to other cities

Recently, the popularity of online shopping has led to more delivery trucks visiting residential areas, resulting in increased emissions, noise levels and traffic hazards. Smarter, integrated deliveries can cut overall traffic and provide better information on delivery times, while the use of cleaner vehicles will help to reduce local pollution levels.

Last mile delivery of goods is a new approach to reduce congestion, lowering emissions and diminishing delivery times in dense urban areas. The use of electric tricycles improves the delivery operations in pedestrian areas where

conventional vehicles have limited access, while also reducing time, costs and mileage for conventional carriers.

Barcelona has approached this solution through the participation in different European projects. At present, within the GrowSmarter project, Barcelona is evaluating the environmental impact of this solution and finding new sustainable business models to be replicated in other European cities.

BARCELONA'S APPROACH

Barcelona Municipality's SUMP (Sustainable Urban Mobility Plan) contains a number of actions to improve the sustainability of mobility in the city and make it more efficient, equitable, safer and healthier. One of the freight action lines concerns micro-distribution. The concept of micro-distribution is that shippers use trucks to bring parcels to a trans-shipment point or microplatform, and from this point cargo-bikes (or trikes) are used to make the last mile of delivery .

Barcelona Municipality has enjoyed a long tradition of collaborative European projects in the field of city logistics, and the investigation of solutions based on cargo-bikes can be dated back to the SUGAR project (a transfer case study). The SMILE project of the INTERREG programme was the first pilot trial with EU co-funding and this was followed by NOVELOG, an

Barcelona will share its experiences to other cities after evaluating the economic sustainability of the solutions and its environmental impact. This knowledge will provide opportunities for replication into the European urban structure

H2020 project that enabled the action to be taken a step further.

In 2015, Barcelona became a lighthouse city as part of the GrowSmarter project. Within this project, Barcelona will share its experiences to other cities after evaluating the economic sustainability of the solutions and its environmental impact. This knowledge will provide opportunities for replication into the European urban structure. Besides, it will create a qualified market for these solutions and give support to the growth and to the transition towards a smart and sustainable Europe.

VanAPEDAL's collaboration with DHL

VanAPEDALis a start-up Last Mile Operator that has been pro-active in the development of Barcelona's micro-distribution actions. It recently invested in fleet management applications to safeguard against theft of its latest generation of cargo-bikes. As the longest-established cargo trike operator in the city it also offers cargo-bike repair services. It is currently leading a trial of improved trans-shipment in collaboration with DHL, one its core clients.

THE WORK

The microdistribution concept was introduced in the city in three phases. The first phase – SMILE - is referred to as the subsidy approach, and saw a collaboration between the Municipality and the cargo-bike start-up company vanAPEDAL.

The SMILE pilot trialled two services – Shared-Box and Exclusive-Box:

Shared Cargo-Bike

- Limited number of packages per operator/day;
- Parcels of different shippers share same box;
- Service subsidized by publicity (during pilot by city council).

Exclusive Cargo-Bike

- A company subcontracts the whole tricycle;
- Performs only its deliveries in the area;
- e-tricycles/riders are branded with original company logo.
- Private contract between LMO and the shipper company.

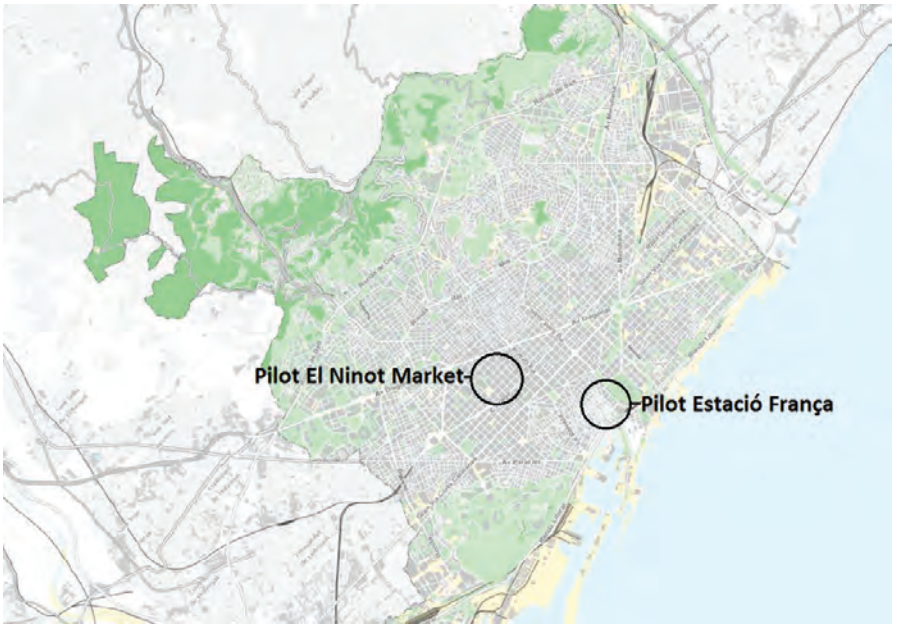
The pilot promoted a shared cargo-bike service. This achieved some success in breaking the logistics chain, with more than half a dozen shippers taking part. It enabled vanAPEDAL to establish some new exclusive cargo-bike services, and it confirmed this latter service as the one that shipper companies prefer.

A second phase of microdistribution

development saw the Municipality working within the framework of the H2020 NOVELOG which had as its primary objective the development of tools to assist cities in the process of implementing measures to reduce the impact of the last mile deliveries and to provide guidance.

A pilot test was carried out in this project, where the idea was to reduce the costs that Last-Mile Cargo-trike operators (LMO) face without using a subsidy to intervene in the market. Thus, the Municipality cedes (in a concession model) off-street space so that the Last Mile Operator avoids paying the rental of the space and the overnight parking of the cargo-bikes. In exchange, the LMO provides data to the Municipality and assumes the compromise to be a neutral operator: this means working with any carrier requesting their services. The data and knowledge generated is then used by the city to improve its services and possibly extending the model to other areas.

The third phase is under development and taking place as part of the solutions implemented in the H2020 GrowSmarter project. Due to the proximity of the Estació de França microplatform to the neighbourhood where GrowSmarter is demonstrating smart city solutions, CENIT and fellow GrowSmarter partners IMI, I2CAT and IESE Business School approached vanAPEDAL to extend the collaboration further. This time, Barcelona will be evaluating the economic sustainability of the solutions and its environmental impact to provide replication opportunities to other cities.



FINDING SPACE

One of the main concerns of this model is the location of the distribution platform. The first pilot experience, conducted within the SMILE project, performed operations from an on-street spot where a provisional container was placed. It was soon rejected by neighbours and the townscape department due to the externalities caused on the street such as noise, public space occupation and the movement of parcels on-street. For this reason, in 2015, the Mobility Services department searched various types of off-street public premises: municipal markets, car parks, some public transport stations, and other spaces owned or leased by the City Council. The spaces require approximately 100m^2 in total on the street level; this includes the administrative area, plus a place to make the trans-shipment activity. In addition, another space, not necessarily on the street level, was needed to park/store the bikes at night.

By 2016, two sites were secured and the refurbishment works started. The microplatform at Estació de França was assigned to vanAPEDAL and ECOPOL (another last mile operator), took up the concession of the El Ninot Mercat platform.

ENVIRONMENTAL IMPACT

In January 2017 the evaluation period of the solution implemented started. CENIT, a transport research centre, has coordinated the evaluation work of the NOVELOG and GrowSmarter trials. The main objectives were to introduce a more efficient and effective freight transport system in the city and analyze the reduction in CO_2 and vehicle kilometers due to shift from conventional vehicles to electric bikes.

Since the operation of the services began, 14 delivery tours were made each weekday, primarily by cargo-trikes, with each tour delivering a daily average of 56 parcels. Over 80,000 parcels were delivered over the five months

Since the operation of the services began, 14 delivery tours were made each weekday – primarily by cargo-trikes – each tour delivering a daily average of 56 parcels. Over 80,000 parcels were delivered over the 5 months: the monthly average of delivered parcels has been 16,301 (total for the two platforms). The result is an order of magnitude improvement on the traffic handled during the previous SMILE (subsidized service) trial.

The work within GrowSmarter includes I2CAT's prototype sensors installed in three of vanAPEDAL's cargo bikes. Information about the routes can be visualized along with the concentration of a wide range of pollutants, noise levels and other atmospheric values. The sensors are powered by the tricycle battery and were installed under the tricycles to minimize the risk of robbery or vandalism. External antennas with long cables were used to enhance the coverage of the GPS and the communication links. The information captured through the sensors will help to validate the difference in pollutant concentration between the pedestrianized areas and the outer areas where the micro-platform is located. Also, it will provide the possibility to analyze the routes covered and propose more optimized paths.

CENIT's work shows that there is a positive contribution to GHG emission targets, and to improved air quality (in streets having a high concentration of pedestrians) and hence to Barcelona's SUMP goals. This improvement is due to the reduced number of vehicle kilometres needed by conventional vehicles to perform deliveries since e-bikes takeover this duty. Whereas bikes and trikes have covered 19,000km during the pilot phase, the same deliveries would have needed approximately 36,000 truck vehicle-kilometres.

The two platforms piloted provided a reduction of air pollutant emissions with special importance in CO_2 emissions where a combined reduction of 9,472kg was achieved (the trial was assessed over five months).

Air pollutant emissions savings during the first 5 months of 2017

Air pollutants emissions savings (kg)	Estació de Franca	Mercat del Ninot	Both platforms
CO_2	6172	3301	9401
NO_x	72	5	77
PM	39	3	41

The GrowSmarter trial will be further developed during 2018 to assess the business models of collaboration that could underlie a permanent service of this kind. So far, the average percentage of successful deliveries has been 92.73 per cent. This value has increased over time, and it is seen by mobility experts as encouraging in particular as conventional carriers usually have lower figures.

REPLICABILITY

The model being tested by the GrowSmarter project could be replicated in other European cities that fulfil some requirements. Such a service can only be sustainable in high-density areas of a city where the number of shipments makes it profitable to deliver them by bike.

Old quarters of cities, especially in pedestrianized areas, are the most suitable locations for this type of solution. Also, the local environment is very important since cooperation among different stakeholders is crucial for the success of such an initiative. Different models to the one tested in Barcelona could be used, and a key question is what level of public intervention is required – if any. In Madrid, for example, in the context of the Frevue project, public space was allocated to any logistics operator that performed the last mile using an electric vehicle. Several companies joined the trial and shared this space as a crossdocking and parking area. Although successful, the trial ended because the municipality needed the space for other uses. In London, a trial carried out in the framework of the Lamilo project also required public funding to set up an urban consolidation centre which succeeded in reducing the number of vehicle trips as well as the kilometers driven, but did not establish a clear, sustainable business model without the intervention of the public authority.

CONCLUSIONS

Last mile delivery of goods has become a good solution to reduce congestion, lowering emissions and diminishing delivery times in dense urban areas. Electric tricycles are widely recognised as being the more suitable vehicle for small shipments as they improve the delivery

Electric tricycles are widely recognised as being the more suitable vehicle for small shipments as they improve the delivery operations in pedestrian areas where conventional vehicles have limited access

Barcelona has been transformed into an urban laboratory, piloting projects and services that make the city more open, efficient and friendly

operations in pedestrian areas where conventional vehicles have limited access, while also reducing time, costs and mileage for conventional carriers.

Despite all these benefits, the implementation of microplatforms still has several challenges to cope with. E-commerce has largely increased the demand of last mile deliveries in cities that, in turn, have lowered the unitary fees charged per delivered parcel, threatening the profitability of carriers. This reality adds even more uncertainty to such measures and should encourage municipalities to intervene in some way to foster innovative delivery systems that avoid adding congestion and pollution to the city.

Financial sustainability is one of the major concerns when thinking about long-term sustainability and replicability. The role of Public Authorities is critical to foster the introduction of sustainable last mile delivery services in cities and has to be reviewed. At the end of the evaluation period, the outcomes of the GrowSmarter project will provide a better understanding of the business models that can support such solutions, and whether cargo-bike start-ups can remain independent by diversifying the microdistribution business with higher-value messenger services, electric bike repairs, and consultancy services to other last mile operators.

The solutions presented can contribute to mitigate climate change, and public-private partnerships are the means by which the public authority gains the knowledge to evaluate such policies. To GrowSmarter we need to find paths that can promote, scale-up and replicate so as to make a higher number of cities and citizens can take-up the challenges and secure the benefits.

FYI

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This article is based on presentations made at the NOVELOG 3rd workshop, Barcelona (January), Citylab symposium, Rome (October) 2017, and GrowSmarter outcomes.

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Francesco Iacorossi reports from the Italian capital, a city that has just launched its Sustainable Urban Mobility Plan, @PumsRoma

The people have spoken

PUMS
Piano Urbano della Mobilità Sostenibile

At the end of the four-month consultation phase, from 18 September to 18 January, over 2,600 proposals had been submitted and over 1,600 members of the public had registered to participate in the sustainable planning and development of urban mobility in the city of Rome.

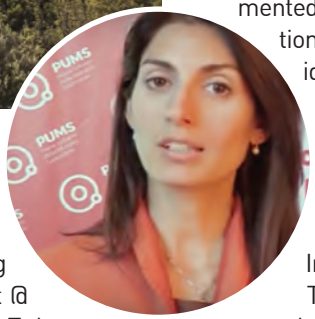
Back in 1972, the late Giorgio Gaber would sing "La libertà è partecipazione" or "Freedom is Participation" a perception paving the modus operandi in both health and social care policy. Finally, decades later, the participatory approach has arrived in the shape of Rome's Sustainable Urban Mobility Plan (SUMP).

The launch of the SUMP in Rome marks one of the most participatory and dynamically inclusive interventions to date in any European City. Trust-building has played a key role in the development and planning approach that has raised the hope of the administration in the strive toward a sustainable future of our city.

Sustainable mobility has become the responsible norm as a strategic planning instrument for local authorities for the well-being and improvement of citizens' daily lives. Emphasised by European Commission transport policy, it is aimed at fostering the development and integration of sustainable practice across all methods of transport throughout Rome. The recent implementation of the SUMP amongst the heritage and archaeology of the "Eternal City" represents a significant turning point for urban mobility within such a significant historic landscape.

In September 2017 the Mayor of Rome, Virginia Raggi (pictured opposite), officially launched the

The launch of the SUMP in Rome marks one of the most participatory and dynamically inclusive interventions to date in any European city



Piano Urbano della Mobilità Sostenibile (PUMS) portal, www.pumsroma.it, along with a twitter account @PumsRoma and a YouTube channel. On the same day Linda Meleo, Deputy Mayor of Mobility of Rome, released the following statement: "The goal of this administration is to provide the city with a competitive transport system and recover the historical infrastructure gap with other European capitals, exacerbated by the poor settlement development of the last 15 years. In order to achieve this objective we have adopted the SUMPS to guide us in the planning of the city and precisely define the priorities in relation to available resources."

Through innovating inclusion via social media platforms, alongside traditional communications methods, the portal both disseminated information while empowering participants to communicate ideas and concepts in order to problem solve and identify key areas where the Sustainable Urban Mobility Plan (SUMP) could be implemented effectively in future interventions. Enabling a holistic approach identified eight key targets for the SUMP to be implemented: Public Transport, Private Transport, Urban Logistics, Cycle Networks, Green Zones, Road Safety, Disabled Access, Innovation Data Technologies.

The leading priorities were proposals for Public Transport, scoring highest at 881; Cycle Networks at 551 and Private Transport in third place with 331 proposals. Urban Logistics and particularly Road Safety were also high areas of citizen concern. Recently as part of the new Administration, life-saving work has been carried out by the Road Safety Centre, together with developments in the subsequent creation of the "Consulta Cittadina Sicurezza Stradale" (city road safety), to actualize and implement the new, highly sought-after Road Safety Program.

This novel, empathetic and bi-directional approach has empowered significantly more citizens and allowed, for the first time, the exchange and consideration of a broad selection of stakeholder opinions. By bringing together a representative set of concepts and challenges to the decision-making process across institutional partners, both public and private, and members of the public the new administration of the city of Rome aims to achieve ground breaking progress in the fields of road safety, soft mobility, urban transformation and sustainability within a globally significant site of ancient cultural and religious heritage.

All the proposals are now under scrutiny by the SUMP steering committee which, by the end of June 2018, will produce an official document.

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#RomainMovimento

Joined-up thinking

Successful cities are investing in intelligent infrastructure, says **Gordon Feller**

Just as the Internet transformed our businesses and reshaped our personal lives, it's now transforming our cities. Everything urban is now getting connected – from healthcare to education, government services, buildings, physical security systems and much more.

Cities embracing these emerging tools – let's call them connected technologies – are the same cities that will be leading the future. These are the cities with a much better chance of becoming truly sustainable in three domains: environmental, social and economic.

Cities around the world already compete with one another for talent and capital. Urban community leaders are pressing for answers to tough city problems: overcrowding, pollution, budget and resource constraints, inadequate infrastructures and the need for continuing growth. Harnessing the power of technology has become one important means for addressing seemingly intractable problems. For those cities seeing some success with tech-powered initiatives, it's become a new way of solving problems – and doing so from new angles, in ways that might not yet have been tried before.

The goal is to transform cities into "smart and connected" communities – but how, exactly? By using intelligent networking capabilities to weave together people, services, community assets and information into a single pervasive solution.

What we're seeing around the globe in hundreds of cities is that a smart/connected city strategy acknowledges

> ***What we're seeing around the globe in hundreds of cities is that a smart/connected city strategy acknowledges the essential role of the network as the platform to help transform physical communities to connected communities***

the essential role of the network as the platform to help transform physical communities to connected communities. It also encapsulates a new way of thinking about how communities are designed, built, managed, and renewed to achieve social, economic, and environmental sustainability.

The foundation for the city of the future will be the network and the information it carries, enabling the delivery of vital services from transportation utilities and security to entertainment, education, and healthcare. Everything will be connected, intelligent, and green: from office buildings and appliances to hospitals and schools. Citizens and businesses enjoy unprecedented levels of collaboration, productivity, and economic growth without compromising the environment. Managing and operating a smart/connected city means being efficient, coordinated, and secure.

DRAWING ON RESOURCES

Investing in advanced urban infrastructure has been underway for some time. It's required the commitment of new dollars to build key city assets, such as wireless and wired networks. Meanwhile, environmental imperatives are real – to reduce the city's carbon footprint by dramatically improving how we use of resources (oil and gas and water and electricity); to replace commute-to-work-to-compute (when you can computer and communicate from anywhere on any device); to reduce traffic congestion for those who do commute; etc.

Previous centuries saw industrial infrastructure such as rails, roads, and telephone lines paving the way for new cities and new connections. The 21st century is about urbanization based on information, with the digital network serving as the underlying platform. Today, urban infrastructure including homes, offices, cars, public transport, hospitals, schools, energy, and appliances are all getting connected via wired or wireless infrastructure to the Internet. The Internet has expanded into an "Internet of Things", reaching well beyond traditional computers and mobile devices.

Successful cities are using their information/communications networks as a platform to plan, build, and manage day-to-day operations will gain significant new efficiencies in every aspect of community life: enhancing productivity among city employees, improving availability and access to public services, and creating new models to generate needed revenues. These communities are reaping significant benefits, including:

- Improved city management
- Continuous economic growth
- Enhanced quality of life for citizens
- Sustainable urbanization

During the 1980s, the Internet's development and expansion was hampered by disparate networks unable to interoperate with one another. The multiprotocol router solved this problem by "translating" across networks, paving the way for the development of today's all-encompassing Internet.

Today, urban centers are struggling with dozens (and, in some cases, hundreds) of different systems and protocols that do not interoperate. If these systems converge onto a single open-systems based network, significant opportunities for productivity, growth, and innovation are unleashed.

INTEGRATED INTEROPERABILITY

One compelling 'city of the future' vision is a community that is run on networked information providing integrated services. Using intelligent networking capabilities, a smart city can achieve their goals when city

leaders focus on creating smart/connected communities that bring together new public and private partnerships in a common purpose: sustaining economic growth, engaging people of all ages and abilities, solving ongoing environmental problems, building a stronger quality of life.

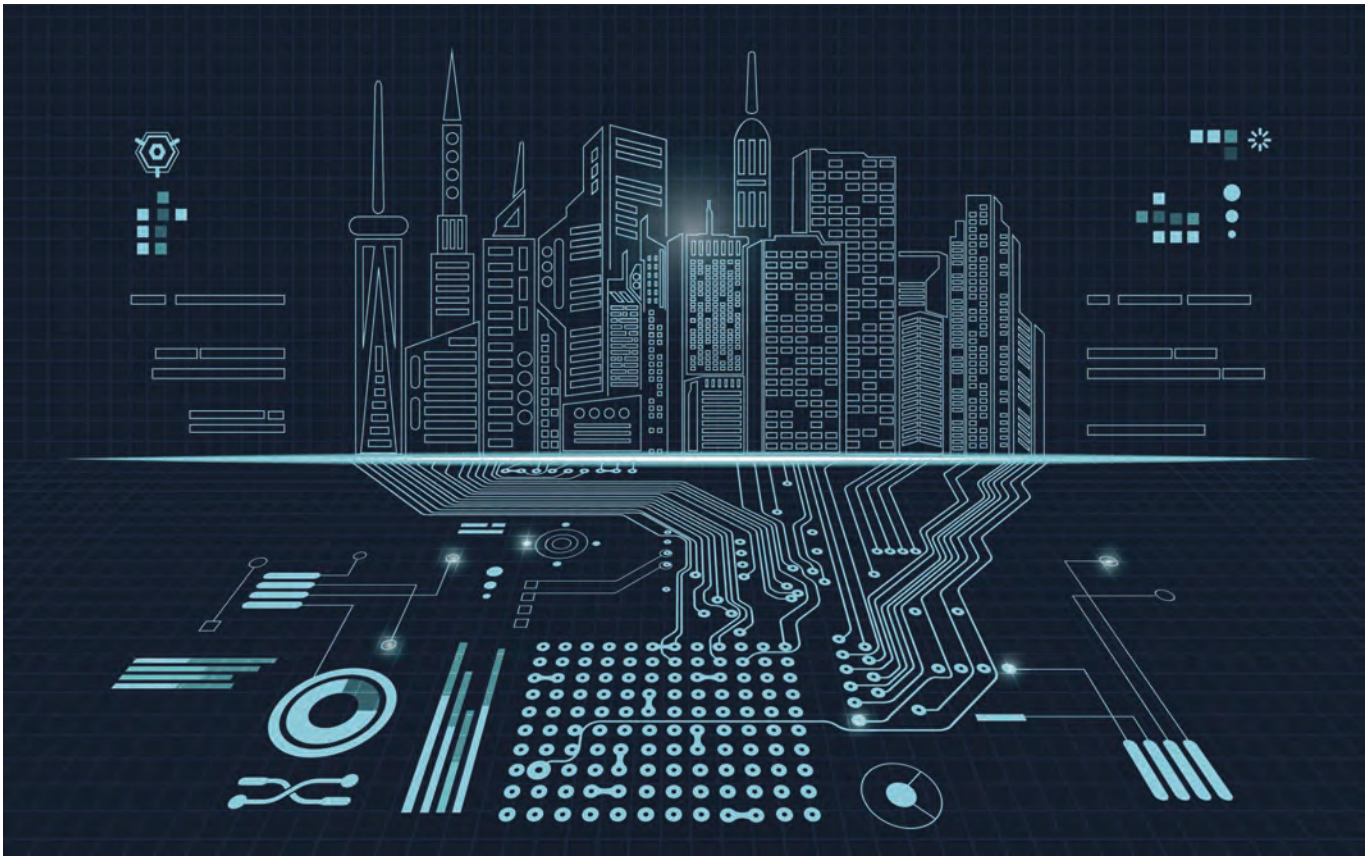
Making a city smart/connected requires working with city residents in a comprehensive way – from idea to execution. It means taking advantage of industry solutions built on the network as an open, integrated platform, a broad ecosystem of partners and innovative business models to change how communities are designed, built, managed, and renewed. A smart/connected community enables citizens, mayors, developers, urban planners and other community stakeholders to address the challenges and opportunities of an urbanized world. It drives economic, social, and environmental sustainability.

Facilitating efficient delivery and management of services within a community is one key element of the process. This helps to deliver comprehensive services to residents and businesses in a connected community. It's necessary because of enabling the management and operation of a connected community means share information and collaborate across a community's ecosystem – government agencies and private sector partners.

The hard part will be transforming the city resident's experience as they live, work, learn, and play. In a smart/connected community this become possible by leveraging real-time information and applications. With the network as the underlying service delivery platform, public and private partners deliver services for home, work, school, hospitals, malls, stadiums, travel, and government. And this is what drives economic, social, and environmental sustainability.

It's more than technologically possible to achieve these lofty goals: efficient delivery of key citizen services

The foundation for the city of the future will be the network and the information it carries, enabling the delivery of vital services from transportation utilities and security to entertainment and education



– anytime, anywhere. One of the core responsibilities of governments is to protect and serve citizens. Whether it is crimes, fire, accidents, or natural disasters, every city has a unique mixture of safety concerns. Education, healthcare, and entertainment are a prime focus for the constituents of any community. Stringent budgets, limited resources or time, and handling vast amounts of data all make managing cities a mammoth task.

Imagine a government experience that is engaging, where you can access the information you need to live, work, play and learn in your community. Public safety and security are stable and government offices and community transportation systems are designed for citizens of all ages.

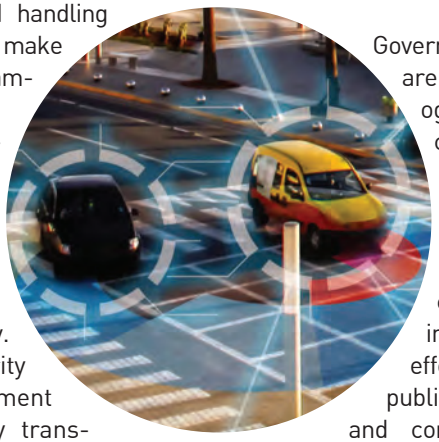
A smart/connected city government is more connected with constituents, plus it's managing (and reducing) operational costs. City governments are tapping into technology that enables constituents to do new things, such as accessing real-time information whenever they need it.

Consider the commuter experience: Highly secure, intelligent, multimodal transportation systems are only possible when a city is making it possible real-time communications to enable collaboration – which means ensuring for such steps as safety and security organizations to connect with real-time data.

TRADITIONAL RECIPE

What are the ingredients for success? There are among the critical elements which we've seen in the most successful cities: build the foundation in ways that engage citizens of all ages and abilities; promote prosperity by attracting a new generation of employees; ensure public safety by connected disparate city assets.

Highly secure, intelligent, multimodal transportation systems are only possible when a city is making it possible real-time communications to enable collaboration



Government agencies are using technology to become connected, contain costs, and better serve the needs of an on-demand culture. They're increasing the effectiveness of public safety, justice, and corrections agencies, improving workforce productivity and enhancing quality of life.

For this to happen there is one key ingredient which must be present: a foundational, open-architecture platform that enables an ecosystem of companies (local and otherwise) to create and deploy new smart services and applications to citizens as well as people that manage and operate the urban infrastructure.

What does that look like? These are some of the key characteristics:

1) It enables seamless integration with a multiplicity of software and hardware products
2) It's based on extensible and open industry standards.
3) It provides an open framework for integrating third-party smart service and application offerings.

What's the long-term vision here?

- Fostering social sustainability is a key goal for any smart/connected community. This means enabling citizens to enhance their quality of life and increase their standard of living by creating a healthy and interactive environment.
- Achieving economic sustainability means creating new job opportunities for citizens. As new businesses and key industries flourish, they help to drive economic growth.
- Promoting environment sustainability means reducing the environmental impact caused by the improper management of resources that flow into and out of the city, especially waste streams.

Futuristic city solutions are already here with us today and they can help to make big urban goals possible.

FYI

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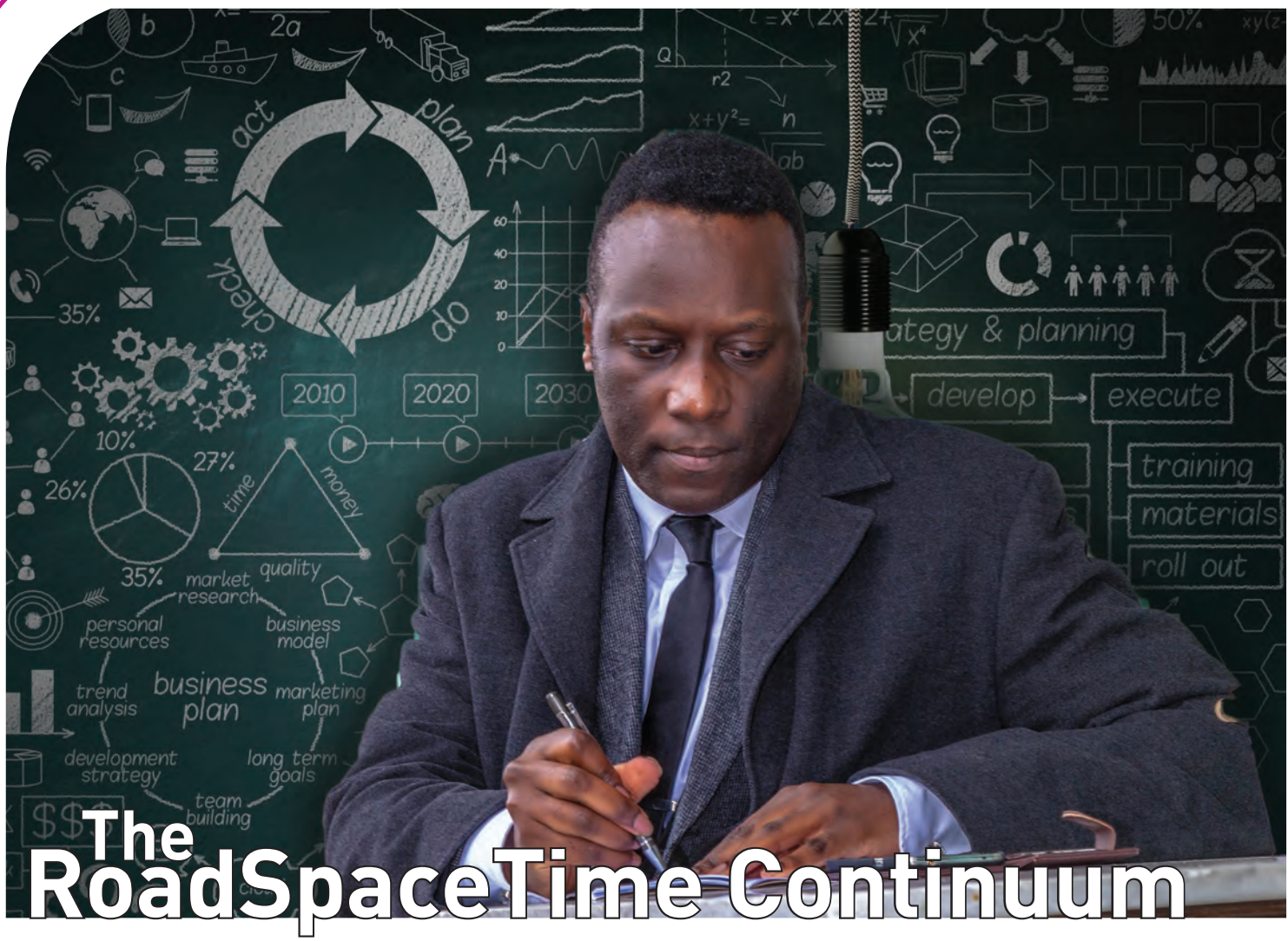
Next events

Ann Arbor Mobility Summit, 14 June, Ann Arbor, Michigan
Meeting of the Minds Annual Meeting, 27-29 November, Sacramento, California



The RoadSpaceTime Continuum

A Transit Exchange for the 21st Century – with a decade of hard work and perseverance finally destined to pay off for **Eric Masaba**, the creator of TEXXI explains how the concept works and how it has its origins in the pure mathematics of high finance

Fleet Routing typically takes place at a command and control level, but a new form of road and traffic management is now possible combining blockchain, geolocation, social networks with decentralised network concepts with predictive analytics that would eventually become an artificial intelligence (AI).

This system will replace the modes of road and motorway (highway) financing currently used, by providing an anonymised store of value for people so that anyone can invest in the road system independently of banks or their government and get a certain return every day.

> ***"More alarming is the overall increase urbanisation rate that will place 90 per cent all humans in cities by 2050. China alone will move 400m people into cities by 2030..."***

Since everyone must travel and travel is a useful and easy to understand commodity, assuming a country is not destroyed, transport within that country will always have value.

Texxi – a history

How the Transit Exchange System, using a fusion of ideas from a plethora of sources, came into being and why it will be the transport model of future cities.

1992 - 1993: National Grid Technology and Science Laboratories, Overhead Lines Division, Plant Technology. A project examining the effect of weather conditions on electricity transmission infrastructure and demand management.

1993 – 1995: Royal Air Force, Officer Cadet Flying Programme, University of London

1995: Sponsored summer project ("The Role of Computers in Transportation Technology") Made possible with the kind assistance of Imperial College Department of Aeronautics, The Minsitry of Defence, NASA, the Department of Defence, the Royal Air Force, the Royal Academy of Engineering & the Royal Aeronautical Society.

1997: Project on RideSharing at Ecole Centrale De Lyon Professeur Christian Vial, oversaw this project using groupware technologies and ideas (distributed, encrypted databases). We dubbed it Project Lugh, after the Celtic deity for whom Lyon is named.

1998 – 2003: Exposure to financial operations in banks and hedge funds Front-office, back-office and middle office computer systems at investment banks and multinational firms

2003 – 2004: Constructing a Capital Structure Arbitrage system for Xaraf LLC Credit Default Swap/Convertible Bond trading and Capital Structure Arbitrage trading strategies. It is here I came up with my credit contagion ideas that turned out to be so prescient. 2004 - Present: Texxi (Transit Exchange XXI) Founding, Research, Presentations, Business Strategy

THE 'WHY'

Increasing urbanisation is posing significant problems to many of the world's cities, especially the very largest megacities whose infrastructure cannot cope with the demand for transport by millions of users daily.

As human population increases, even more alarming is the overall increase urbanisation rate that will place 90 per cent all humans in cities by 2050. China alone will move 400m people into cities by 2030.

The need to find new road financing options while at the same time keeping the road open to all those who need to use it, regardless of their income level has collided with the dual imperatives of using fewer barrels of oil per passenger kilometre travelled and reducing fossil fuel emissions.

Petrol Duty (gasoline tax) by itself, cannot hope to cover the costs in upgrading roads, repairing potholes, resurfacing the routes and the bridge maintenance, especially on the busiest routes. A new model is needed that is socially equitable, can be implemented according to well-understood principles, such as the congestion charge in London.

THE 'HOW': TRANSPORTATION DEMAND MANAGEMENT SOLUTION

The one technology that can meet these needs is energy efficiency through ridesharing. The wider and more difficult issue has been how to make it efficient, reasonable and palatable for people on a daily basis.

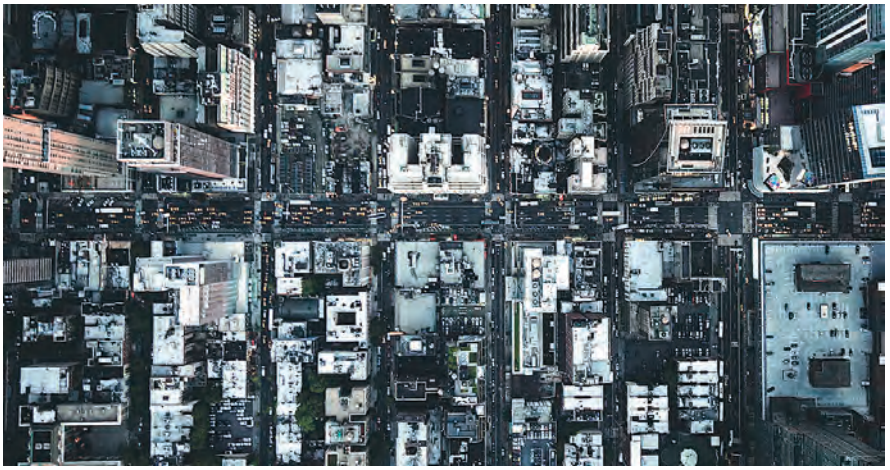
To begin with, roads must be treated as a scarce resource that is contended in both space and time. The general public already accepts the reality and need to pay for parking to rent a certain amount of roadspace for a certain amount of time: this idea simply builds on that perception.

TRANSIT EXCHANGE

A Transit Exchange is a means to

Instruments of change

The exchange would get the required liquidity from investors who put into value at risk for a small return. This can happen since the Market Makers operating on the exchange will have a statistically certain outcome for grouping operations and they must pay a fee to the exchange to operate. Much in the same way as any national government issues bonds, notes and bills to pay for operations, so would the road system via the transit exchange. The added benefit of free-flowing traffic, cheaper transit and social equity would be a great return even apart from the financials.



rationalise contended access to any "transportspace" (roadspace, waterway or airspace system) based on the construct of a **Commodity Futures Exchange**. Most simply it enables real-time, dynamic ridesharing on a very large scale in any type of vehicle that carries passengers or freight.

The Transit Exchange operates below the level of the application layer (it is not an "app") sending trip packages to the end users on whichever app platforms (e.g. Uber, Lyft or Didi). It also creates iso-dapanes (demand maps) that can be consumed by any market maker operating on the exchange.

The Transit Exchange is akin to the overall water system (pipes, reservoirs, sewers, pumps). Taxi or RideHailing apps for users are akin to the taps in the house. They may be the only thing the user sees, but behind the tap there is an entire infrastructure which must manage demand and generate income for the whole system to be able to function.

It is intended to be an operating system for the transport cloud in any locality and provide funding to municipal operators. Like Air Traffic Control or an Automatic Dependent Surveillance Broadcast (ADS-B) system but for all vehicles at whatever altitude.

Using mathematical optimisation techniques (based on heuristics and genetic algorithms) the Processing Layer of the Transit Exchange examines and aggregates origin-destination requests for transport from dispersed users in both space and time (who may or may not know one another) and applies operational concepts and know-how garnered from successful prior deployments, the Transit Exchange provides timely relevant trip package suggestions for ridesharing to those users and the vehicle operators in the locality.

The Transit Exchange also generates income for municipal road operators from the very market making functions on the **Commodity Futures Exchange for Transport** used to fill the empty seats in the fleet or vehicles operated in the "transportspace". Now congestion pricing, road pricing and vehicle pricing charges can all be applied to users and a negative congestion charge implemented to not adversely affect the poorest in society.

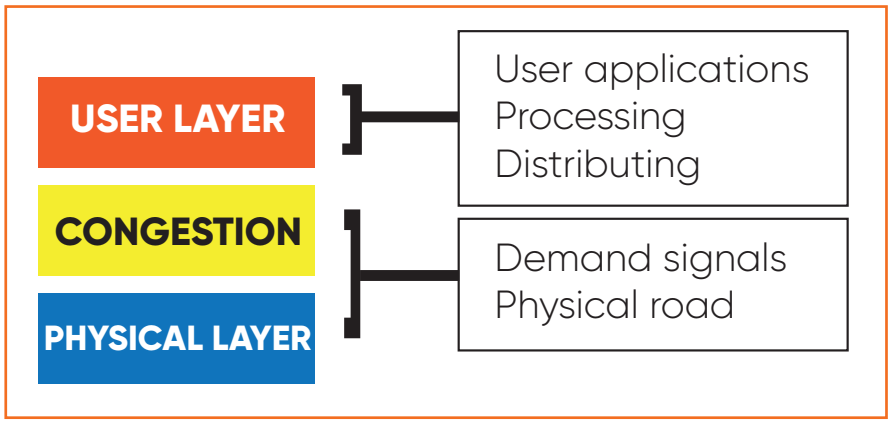
Predictive Analytics permit the transport users to choose when to travel and the transport service providers to place their assets in the most logical positions to best serve demand.

If an investor was to deploy an amount of money into the Transit Exchange, then through the market making protocols in solving NP-hard problems related to Large Scale Dynamic Real-Time Ridesharing a set of returns with varying yield-to-maturities can be replicated, providing an alternative to money-market funds and instantiated through the mechanism of a blockchain coin offering.

Demand Backed Blockchain: Rather than relying on the rather nebulous promise of perpetual cryptographic security of a blockchain ledger, the provable work done has solved a pressing and current problem in the real world and done so in a manner that was transparent. Even then, homomorphisms could be applied to anonymise the transport data.

Highly Liquid investable security instruments (Transit Exchange Bill or TE-Bills) can thus be made available

"To begin with, roads must be treated as a scarce resource that is contended in both space and time..."



via the Transit Exchange. Its original purpose is to store value represented by demand for travel in a locality. Hence we will have a **Computational-Crypto-Currency** backed by an inspectable commodity called "transport demand".

The Transit Exchange model seeks to provide the basis for trading 'roadspacetime' packets in a futures exchange construct. The Road Pricing model itself is built of three layers – PHYSICAL, CONGESTION and VEHICLE.

The **PHYSICAL LAYER** is the actual road itself. This is what vehicle licensing and road tax pays for with the flat licence fee per vehicle. While this number can be set at anything, in order for the system to be fair, each road, based on how it was constructed, could feasibly have a different charge. We see this already in many countries with toll roads. This is the base layer – the access price – or **ROAD PRICING**.

The **CONGESTION LAYER** is the variable pricing layer, which is most adaptive to real-time demand conditions. Most cities charge one rate for parking during the busiest hours and another rate for overnight. Based on demand patterns and adapting to demand, any road could have variable congestion charging, which could also

be negatively set by rewarding people who have scheduled to use the road, but stay off it at the busiest times. They could receive payment in tokens that can pay for other infrastructure uses like parking on the network.

The **VEHICLE LAYER** is where differential pricing related to fuel type, energy efficiency and recyclability comes in. Vehicles that are more polluting would pay more, but if the operator fills the vehicle with as many people as is permitted, this cost is thus rational. This also encourages larger capacity vehicles up to a given size for most trips and would thus promote ridesharing.

Access to the roadspace at a given time is purchased in exactly the same way as traders buy other commodity futures or forwards – via an exchange. This construct has worked semi-miracles for food production over 170 years – and it can work just as well for 21st century transportation and mobility.

FYI
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Higher purchase

Why should Smart City procurement be any different from any other procurement exercise? **David Bonn** highlights the potential pitfalls that it's imperative to avoid

The traditional approach to procurement has in the past involved the development of a set of client requirements followed by a supplier selection exercise and the raising of a purchase order – sounds a simple process but it is typically more involved than that. What then is the difference in procuring for a Smart City?

The challenges come early in this process. Given the innovative nature of Smart City requirements, they may not be fully understood and as a result can't be documented in a set of "M" statements in a prescriptive specification. Today, many clients prefer the produced specifications to be "output" based. This way their needs are expressed as a set of objectives leaving the supplier to determine how best to meet them. For many suppliers this is a preferred approach giving them the flexibility to deliver a solution using their products in a way that they have already built rather than having to adapt an existing product to meet different prescriptive needs. This delivers benefits to a client in that they are getting a standard product alongside application specific configuration that should lead to a reduced procurement cost and a lower cost of through-life ownership given it is a standard supported product.

Supplier selection is the next challenge as there may not be many offering solutions in the area the client is interested in. They may also not be able to meet the client's objectives in full using the products they have available today. This

presents a challenge on both sides. With the client rules frequently stating a supplier must submit a compliant response before a non-compliant response is considered, it means that suppliers will be unable to respond and the client will miss out on a good but partial solution.

If non-compliant bids offering partial solution are all that is available, does a client say cancel procurement, do they try to evaluate different partially complaint offerings or do they go back to the suppliers and undertake a product comparison?

IT'S ALL ABOUT THE JOURNEY

In today's Smart City environment, many clients recognise that they can't procure in the way they have in the past and that they need the help of the suppliers to help formulate their ideas as to what is possible.

Frequently this is referred to as going on the "Smart City journey" together. You will see and hear many clients talking about "collaborative", "partnership", "innovation driven", "risk-sharing" approaches to delivering contracts. All of these are sensible approaches and ones generally welcomed by suppliers and can deliver very successful outcomes. Why is there reservation in adopting them much more widely? A simple answer – Terms & Conditions!

Innovation, a key element in the successful delivery of Smart City solutions, is the development or delivery of what is a new or significantly improved product, process or service.

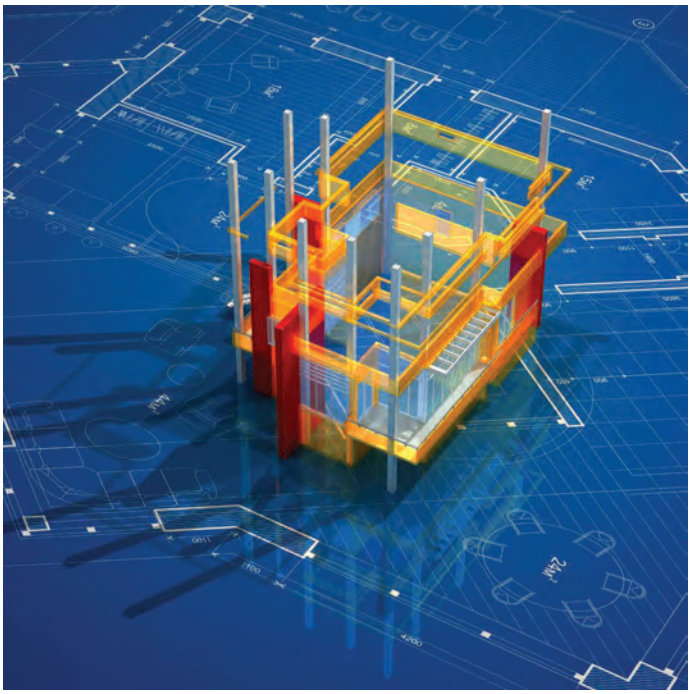
Innovation can be linked to performance and growth through improvements in efficiency, productivity, quality, faster response times, etc. Innovation can also involve both the creation of entirely new knowledge, as well as the diffusion of existing knowledge. Innovative solutions are therefore new and better solutions to meet the evolved needs of today's environment. In public procurement seeking innovative solutions can be the seeking of a new product, process or service or an improved approach to the delivery of the service. In essence it's about purchasing new, better and more efficient solutions in a new way - and in that lies the challenge.

Many procurement departments in buying organisations are struggling to adapt their proven procurement processes to allow their own delivery teams to work in such ways. Even before the contract award stage, the procurement processes struggle to recognise the required collaborative nature of delivering innovation, especially to meet high level objectives in

an evolving environment.

Many T&Cs that are issued as part of a "collaborative" tender have onerous delivery measurement requirements with punitive financial penalties for failing to deliver. How these can be applied in an innovative environment against evolving requirements remains a challenge. In their defence, not many organisations apply such punitive penalties however a commercial organisation has to consider the possibility that they will be applied and will therefore adopt a suitable risk mitigation strategy.

This can take the form of no bidding, increasing their price or working in a very contractual change management manner with significant levels of governance being applied - quite the opposite of a collaborative approach.



ASSESSING THE DANGER

Risk is an inherent element when buying something innovative as part of a Smart City procurement exercise. Procurement of an innovative product, process or service will usually promise a higher return but it may also entail higher risk than buying off the shelf. Risks can differ in scale and impact, e.g. failure may be total, if a supplier is simply unable to deliver; or partial if performance falls below expectations, or delivery is late. Failure can also come from practical difficulties in applying a new solution and integrating it within the organisation, sometimes outside of the supplier's ability to control and influence. It is therefore necessary to have a clear policy on how to deal with these risks which isn't simply to pass them onto the supplier or worse still ignore them.

Many of the suppliers into the Smart City domain are SMEs and as such they are unable to accept high levels of risk for nominal returns and tight margins. Moving forward, the clients need to find a way to procure Smart City solutions from the SME domain as well as the mainstream suppliers in a supportive way to maintain the flow of innovative solutions – it's the lifeblood of the Smart City domain.

Clients need to find a way to procure Smart City solutions from the SME domain as well as the mainstream suppliers in a supportive way to maintain the flow of innovative solutions – it's the lifeblood of the Smart City domain...

How then do we move to enable a more flexible contract delivery approach that provides the client with value for money, delivery assurance and risk management where it needs to lie and at the same time allows the supplier to bring innovation and a collaborative working approach to the contract without the fear of punitive penalties being applied.

We don't want an environment where there are "two sides" with different success criteria. The need has never been greater than it is today to ensure greater value for money and efficiencies, without curtailing the quality of service provision. Improved procurement practices should result in substantial savings to client organisations, while at the same time stimulating enterprise development.

In my experience, where a client engages with the market prior to tendering to find out what the market can provide will help engender a collaborative working approach.

It will enable the client to understand what is currently available, what is planned in the near term and what longer term plans are. It does also enable the market to understand the thinking behind a client's needs, their timescales enabling the market to shape their road maps accordingly especially if multiple clients express the same needs.

This is a critical step in the procurement process as it enables the procurer to understand and identify what is available in the market and whether alternative solutions are available now or in the timescales of their needs. While procurers are sensitive to the issues of transparency

and fairness, engagement with the market prior to tendering can be carried out if it takes place in a structured and open manner.

Consideration as to the costs to both sides in such an exercise needs to be considered. In general terms, suppliers are happy to participate in such exercises, but they do need something in return. In my opinion, a supplier should provide written feedback to responders of market sounding exercises.

LOOSE CHANGE

Having gone through the procurement approach and selected one or more suppliers to deliver the overall solution clients need to act as the intelligent client and be an integral part of the delivery process. The supply chain needs to adopt a proactive and collaborative approach.

Reaching consensus as to what the final solution to be delivered will be involves a collaborative approach or "give and take" on both sides. Suppliers must accept changes are inevitable to meet objectives that were not able to be defined in absolute details at the tender stage. Clients can't expect to change their minds as to what they wanted nor can they say change for the sake of change.

There is a financial and timescale impact to change and both need to be considered and jointly managed. Is the change really necessary and who should bear the cost? In an ideal world, it would be good to assign a "changes pot" early as part of the collaborative working approach. Debits and credits would be added to this pot, managed by representatives of the client and supply chain in a way that engenders the identification of innovation knowing that the ideas will be handled fairly, irrespective of who identifies it.

So, to answer the original question - is Smart City procurement different from any other procurement exercise? My answer would be "not necessarily in today's environment".

"The procuring bodies and the suppliers involved in Smart City procurement (and other domains) need to adopt changes to what has been 'the norm' for many years..."

What I would say is that the procuring bodies and the suppliers involved in Smart City procurement (and other domains) need to adopt changes to what has been "the norm" for many years.

There are significant benefits for all involved to adopt new approaches to procurement, coupled with a more collaborative approach to delivery to ensure the Smart City domain is built on innovation to meet the needs of tomorrow.

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Track and feel

Evelien Bossuyt on changing travel behaviour with new technology

Changing travel behaviour is difficult. People are stuck in their ways, choosing the way of travelling that requires the least effort, being strongly influenced by peers and ignoring information that does not fit with their ideas. Behaviour change campaigns traditionally cause little more than a 7 per cent modal shift. Recent technological developments have announced a new era in behaviour change initiatives. The emergence and market uptake of new smartphone technology allows behaviour change campaigns to be rolled out on a much larger scale, for longer periods of time and collecting more relevant information on the target audience.

The European Horizon 2020 Research and Innovation project TRACE explored how tracking apps can support behaviour change initiatives in the domain of sustainable mobility. Smartphone apps have proven to be valuable add-ons to behaviour change campaigns in the health domain.

Operating right from the pocket of the target audience, the apps nudge behaviour through smart notifications and segmented feedback. Be it quitting smoking, exercising or eating healthy, people let apps inform them about their bodily state and tell them what to do. Yet the question remained how similar apps can be used to promote sustainable travel behaviour. European Horizon 2020 Research and Innovation project TRACE explored how tracking apps can support behaviour change initiatives in the domain of sustainable mobility. The project outlined three promising strategies for using apps to facilitate behaviour change.

REWARDING TRAVEL BEHAVIOUR

A successful behaviour change campaign typically involves rewarding the new behaviour. Until recently, behaviour change campaigns could only measure and reward sustainable travel behaviour by asking people how they travelled. Tracking apps have caused a paradigm shift by accurately discriminating whether a person is walking, cycling or using motorized transport, depending on the speed and the acceleration of the movement. By implementing an in-app rewarding system, sustainable travels can be instantly rewarded. Although more research is needed for an algorithm to accurately discriminate car travels from using public transport, rewarding the use of active sustainable travel modes is something than can be done on a large-scale as of today.

Critics of reward campaigns argue that the rewarded behaviour is typically short-lived and that rewards in the long run decrease the intrinsic motivation to perform the behaviour. In other words, critics would argue that rewarding bicycle use in a city is not desirable because

Critics would argue that rewarding bicycle use in a city is not desirable because new cyclists will stop cycling once the reward is discontinued and people that cycled before the campaign will be less motivated to keep cycling

new cyclists will stop cycling once the reward is discontinued and people that cycled before the campaign will be less motivated to keep cycling. A recent research paper called Pervasive negative effects of rewards on intrinsic motivation: the myth continues, summarizes 145 studies and shows that rewards are not harmful to motivation. On the contrary, rewarding on the basis of performance (eg, a reward for each cycled kilometre) had a positive effect on intrinsic motivation.

As for the new cyclists, when people try out something new they can discover unknown advantages of the new behaviour. People that start cycling may experience that they are faster at their destination, feel more fit and can spend their money on more exciting things than gasoline. If cycling often turns out to be a win, the behaviour will survive even when the external rewards are discontinued.

A second criticism on reward campaigns is that they fail to reach the intended target audience, which are citizens with intensive car use. The TRACE project offers a number of recommendations to reach these citizens. First, it is important to use a multimodal app that includes car travels. Multimodal apps are much more successful in reaching car users than designated bicycle or walking apps.

The Positive Drive app (piloted in the city of Hasselt during the TRACE project) rewarded cycling and walking but also rewarded parking a car at the outer edge of the city. By rewarding cycling and walking more than rewarding car usage, users were nudged to switch travel modes. Second, it is important to use rewards that are appealing to car users.

This may sound trivial but a lot of pro-cycling campaigns offer rewards that are not of interest to the average car user, such as cycle bags, cycle lights and rain jackets. None of these items are useful to an average car user. With the right communication strategy, the option of administering in-app rewards for sustainable travels has a huge potential for behaviour change towards sustainable mobility.

MEASURING TRAFFIC FLOWS AND USER NEEDS

A second class of tracking apps can establish a modal shift on the mid-long term. These apps measure travel behaviour and collect user feedback on the travelled routes. A good example from Brussels is the Ping If You Care project (see pages 28-31), in which cyclists have a Bluetooth button that is connected to an app on their smartphone. Cyclists press the button to signal that a traffic situation is unsafe and the location of the unsafe situation is pinned on a map of the city. In addition, the app tracks the cyclists' routes and shows policymakers where the cyclists go and which routes are avoided. These evidence-based policy recommendations produced by large groups of users help policymakers make the right infrastructural changes to promote sustainable modes of transport.

For apps used for evidence-based policy making, it is important that the user group is an accurate reflection of the city's population. Although many people have smartphones today, there are subgroups of the population in which smartphone usage is much less common. Children, elderly and people in poverty are important target groups that might get overlooked when new technology is used to assess user needs. This is why the TRACE project made tracking technology available for new target groups. GPS devices were developed to collect data on the home-school travels of primary school children. The tracked travel routes were combined with information on traffic safety, obtained by a questionnaire for parents. This allowed the city to prioritize infrastructural changes according to (a)

The Traffic Snake Game was developed to encourage safe and sustainable trips to school

Photo: Mobiel 21

Bike Citizens Analytics with left, a heat map and right, the 'pings' for unclear or no cycling infrastructure

the streets that were intensively used for home-school travels, (b) the streets that yielded the most complains with regard to traffic safety, and (c) the streets with a high potential of delivering a modal shift when becoming more walkable or cycle-friendly.

EVALUATE AND LEARN

A third promising way of using tracking apps for behaviour change is for evaluation purposes. To date, only a handful of behaviour change initiatives collect data on their effectiveness. In addition, data quality is generally low. Effectiveness measures typically rely only on before and after measurements that do not rule out other explanations for changes in travel behaviour, such as weather conditions.

Tracking apps can play an important role in increasing knowledge on the triggers to change travel behaviour. For instance, tracking apps can be used for A/B campaigns in which two groups receive slightly different notifications and feedback. For example, in Group A the app could focus on sustainability (saving CO_2) and in Group B the app could focus on health (burning kcal). By randomly assigning users to the A or B campaign, you can measure which campaign message is the most successful in changing travel behaviour.

In a similar way, tracking apps can be used to evaluate experiments with public space and traffic situations. For instance, one of the TRACE cities wanted to install a new cycling lane and a one-way street in the surroundings of a TRACE school. By first making a temporary set-up and repeating the tracking campaign before, during and after the experimental setup (ideally in similar weather conditions), the school can learn how traffic flows change when the new design would be implemented definitively.

TEAMWORK

New technology offers many new possibilities for a shift towards more sustainable mobility, but new technology also makes behaviour change campaigns much more complex. The success of a high-tech behaviour change initiative therefore depends on the strength of the multidisciplinary team behind it. Technical staff and city planners will need to work side-by-side with communication experts and psychologists to make the blend of technology and behaviour change work.

Effectiveness measures typically rely only on before and after measurements that do not rule out other explanations for changes in travel behaviour, such as weather conditions

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How do Turda, Manchester and Milan integrate shared mobility into their Sustainable Urban Mobility Plans and why do they believe it can help address their transport problems? Polis' **Chloe Mispelon** took a closer look.

Share's greatest hits

The Romanian town of Turda won the European Sustainable Urban Mobility Plan Award this year. European Commissioner for Transport, Violeta Bulc, presented the award in March at a ceremony in Brussels.

This 6th edition of the SUMP Awards evaluated how local authorities addressed shared mobility in their transport plans. Turda managed to convince the jury that shared mobility can also help smaller towns to achieve their transport objectives, beating the other finalist cities, Manchester and Milan.

Shared mobility is understood as services that require an intermediate platform, usually a website or an app for mobile devices, where users can book a car pool ride, pay to use a vehicle or use a shared taxi. Shared mobility is part of the wider 'sharing economy' concept, where the emphasis is on using goods rather than owning them. Conventional public transport and traditional car rental are not considered part of the shared mobility concept.

Turda: an ambitious yet accurate first SUMP from a mid-sized East European city

Turda, Transylvania, Romania

Turda is located in Transylvania, in the north west of Romania and home to 55,000 inhabitants. It used to be an industrial city until the end of the communist era. Today, Turda is an important touristic destination with over 600,000 visitors annually and a logistic hub at the regional level, being located at the intersection of two major national mobility corridors.

This influx of tourists has had an impact on local and transit traffic volume and is challenging the livability of the city. Irregular car parking and high traffic (the motorization rate is higher than the Romanian average) take their toll on road safety and Turda witnessed an increase in serious injuries of 30 per cent between 2012 and 2015.

IN ACTION

Turda's first SUMP delivers a clear planning vision and concrete measures to be implemented in the short term, and it includes financing plans that make use of European structural funds. The plan is a source of inspiration for small/medium size cities with little experience in sustainable urban mobility planning.

Turda has organized its strategy on five pillars: accessibility, integration, sustainability attractiveness and smart city. The targets of the plans are as follows: an increase in public transport usage from 21 per cent to 30 per cent, an increase of cycling modal share from 6.7 per cent to 13 per cent, an increase in the share of pedestrian travel from 19 per cent to 27 per cent and a decrease of usage of personal cars 53 per cent to 30 per cent.

To reach these goals, facilitating shared mobility services is one key area of action for Turda:

- Turda will implement an automated bike-sharing system of 27 stations and 356 bikes integrated with the public transport service. It is estimated that the implementation of this system will reach 200 daily users of which 10 per cent will be using it in conjunction with local public transport.
- Car-pooling will be encouraged through parking incentives. A parking policy for the city centre shall decrease car pressure and illegal parking. The target is 1000 daily "users" by 2023 that shall lead to a 25 per cent decrease in the number of cars in the inner city.
- Car sharing will be implemented based on the system running in the neighbouring city of Cluj. A fleet of 10 electric cars will be available in Turda.
- A fleet of 10 vending bicycles will be rented to local entrepreneurs in order to steer the attractiveness of the city centre for pedestrians.

Turda's planning approach and use of shared mobility services convinced the jury to present them with the 6th SUMP Award. You can see a video about the SUMP measures here: **www.youtube.com/watch?v=_tG4yfQat2Q**

What is the SUMP Award?

The European Commission's award for sustainable urban mobility planning was launched in 2012. The aim of the award is to encourage the adoption of Sustainable Urban Mobility Plans (SUMPs) by local authorities across Europe and to reward outstanding achievements in each year's thematic priority area.

www.mobilityweek.eu/sump-award

Photo: Comune di Milano

Shared mobility enabled via MaaS in **Milan**

The city of Milan has just adopted its Sustainable Urban Mobility Plan after 3 and a half years of preparation. The process involved several public consultations under the supervision of a Scientific Steering Committee. The SUMP is based on an appropriate Environmental Impact Assessment (EIA) and a Cost Benefit Analysis. The Plan aims at reshaping Milan's overall mobility over the next 10 years, redefining the boundaries of the metropolitan city and serving large suburban areas.

Milan is the second-most populated Italian city, with 1.35 million inhabitants. Every day, 850,000 people enter Milan and 270,000 exit the city – resulting in a total of 5.3 million trips per day. Although most people use public transport to get around Milan (57 per cent of all trips in Milan are taken by public transport, 30 per cent by cars, 7 per cent by motorbike and 6 per cent by bicycle), the city has one of the highest rates of car ownership in Europe's cities: 50.5 cars are owned by every 100 inhabitants, while for example London counts 31 cars per 100 inhabitants, Berlin 29, Paris 25. Milan also has one of the highest concentrations of particulate matter among large European cities. The high demand of individual motorised transport is also due to the functional separation between the city centre and the suburbs.

IN ACTION

The objective of Milan's SUMP is to reach an optimal balance between efficient mobility demand, quality of life, environment and health protection.

Among the mobility measures to achieve this are traffic calming, traffic reduction and promoting the use of shared mobility services. For instance, the new free-floating sharing system includes cars, bikes and scooters and shall complement the local public transport services: People are encouraged to use bike, scooter or car-sharing to cover the last mile or to reach areas with weak demand and insufficient public transport service. To fully integrate their sharing services and deploy the benefits of shared services, Milan is working hard on its Mobility as a Service (MaaS) system.

RESULTS

The number of alternatives to the private car has risen: nearly 3,000 shared cars (27 per cent fully electric) and more than 600,000 subscribers, 4,650 bikes (among which

Photo: Comune di Milano

1,000 electric) from traditional station based bike sharing system and almost 60,000 yearly subscribers, 12,000 free-floating shared bikes since October 2017 and 100 fully electric shared scooters are currently circulating in Milan.

The number of daily rentals continues to rise. As for the car sharing, 15,340 are the average daily rentals and each shared vehicle is rented 5.6 times a day on average. According to first data from the car sharing user's survey, about 12 per cent of respondents have already decided to give up their first or second private car, while about 8 per cent is oriented to do so in the future. This translates into 15,000 vehicles since car sharing services started in Milan.

Visit link to view the Milan video:
www.youtube.com/watch?v=xNj8YR-2GBM

Agency for Mobility Environment and Territory – City of Milan
www.amat-mi.it/it/

Manchester SUMP: a user centric and ambitious approach setting the path for the next 20 years

Greater Manchester (GM) is a large,polycentric city region of 2.73 million residents. It represents 10 local authorities, working together to address strategic challenges, chaired by a directly elected mayor. Land use is mostly urban, the product of concentric urbanisation and industrialisation which occurred mostly during the 19th century when the region flourished as the global centre of the cotton industry.

Today, whereas 52 per cent of trips shorter than 2km are made by walking and cycling and 82 per cent of public transport users are fairly or very satisfied, only 27 per cent of GM residents use another mode than private car to go to work and only 16 per cent of departing passengers use public transport to access the

airport. Greater Manchester has a higher percentage of motorway network than any other county in the UK.

IN ACTION

GM's Transport Vision strives for world-class connections that are not an end unto themselves, but a means to achieve wider policy goals of long-term, sustainable economic growth and access to opportunity for all. The Transport Strategy 2040 sets a mutually supportive transport and spatial policy framework.

Recognizing the ever-changing economic, societal, environmental and political landscape, the 2040 Transport Strategy is accompanied by five-year delivery plans, that allow GM to adjust course depending on issues such as available funding and emerging political priorities

The 2040 Transport Strategy contains a comprehensive set of policies where shared mobility services are embedded to fill the gaps and strengthen the effectiveness of public transport network.

This is supported by several multi-modal integration elements that are critical to an effective shared mobility package as part of Mobility as a Service (MaaS), including:

- Real-time information and journey planning tools;
- Comprehensive travel choices programmes;
- GM wayfinding system;
- Car clubs/cycle hire;
- Cashless personal travel accounts.

Critical to this is integration is an integrated fares and ticketing structure, supported by a "travel choices" programme, which enables customers to make informed decisions about a genuinely comprehensive travel offer available to them.

TfGM has an advanced and well-funded innovation programme that includes measures to further develop and improve shared mobility solutions, linked to the aspirations of its 2040 Strategy. TfGM works in direct collaboration with over 140 organisations (from Universities, to large scale private companies to SMEs, to transport authorities and policy working groups) across Europe.

Projects range from Car Share model and tender development; to Cycle Share demonstrators and mapping of a long-term approach to cycle share; to opportunities commercialising the electric vehicle charging network (to support expansion); to CityVerve, an Internet of Things city-scale demonstrator with a series of projects under the transport thematic, including talkative bus stops, shared e-cargo bicycles for businesses, air quality sensors and open data API development.

Greater Manchester's progressive and ambitious planning made GM a finalist for the 6th SUMP Award, whose jury also appreciated GM's vision to use and share transport data, its pro-active activities regarding the automation of vehicles and the cooperation with the private sector/industry and NGOs.

A video presentation of the Greater Manchester strategy is available here:
www.youtube.com/watch?v=cl6fiVWFNTY

A video of the SUMP award can be found via this link:
www.youtube.com/watch?v=h_A6LBgJkQM

TfGM is the current president of Polis.

FYI
Chloe Mispelon is a project officer at Polis.
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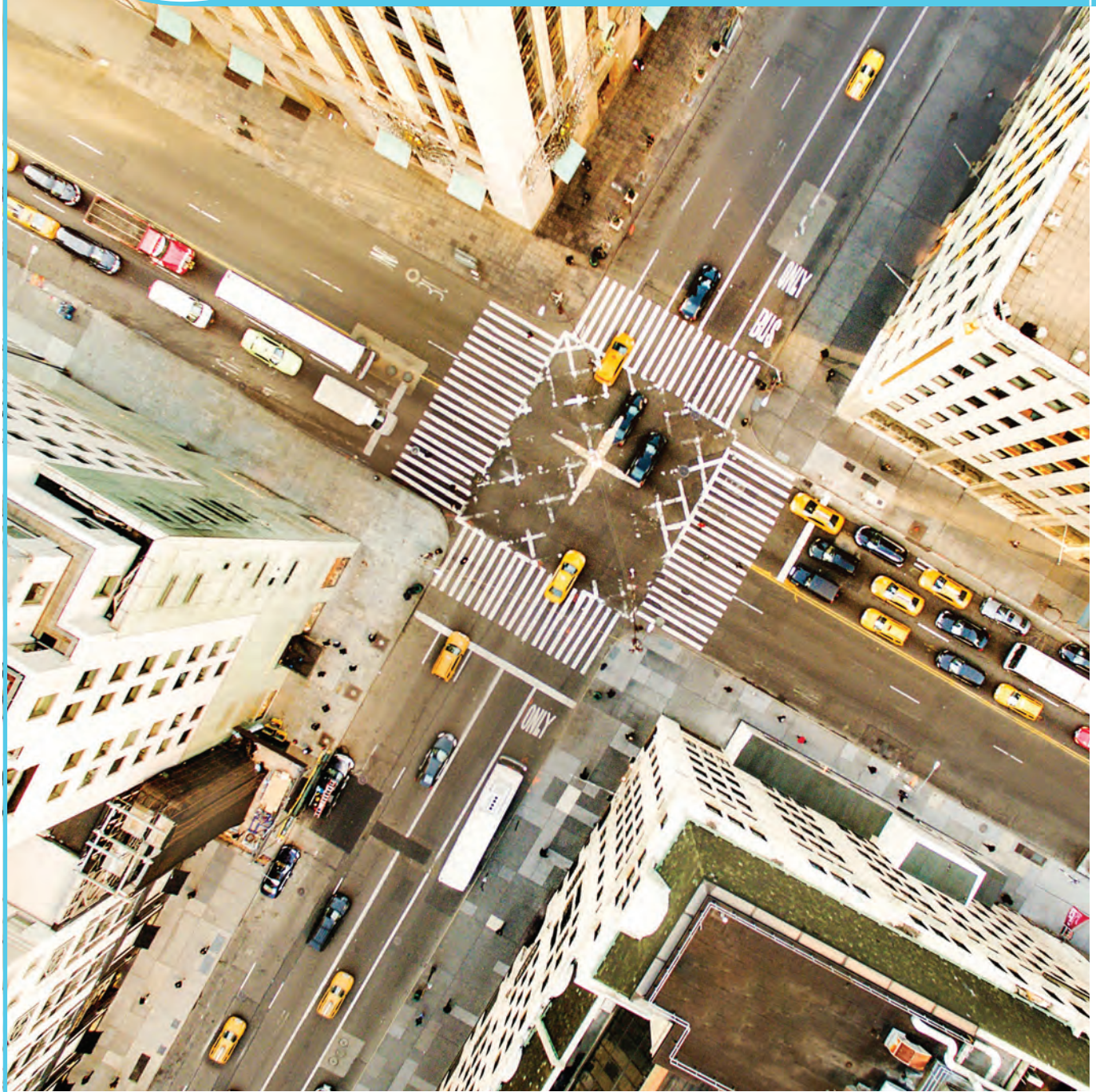
Road Safety & Health in Transport

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



The Apple bites back

Boosting traffic safety and sustainable transport with Vision Zero in New York City, by **Michael Replogle** and **Julia Kite**

Flatiron Plaza in the heart of Manhattan. Inset: Mayor Bill de Blasio

New Yorkers' obsession with boosting their city is legendary, with "only in New York" said by locals more often as a badge of honor than a frustrated complaint. When it comes to street safety, however, we have actually earned the boast: since 2013, New York City has experienced a 27 per cent decline in traffic fatalities, led by a 44 per cent decline in pedestrian fatalities, all while traffic fatalities have risen over 15 per cent across the United States as a whole. These figures are the product of strong mayoral leadership, inter-agency cooperation, data-driven policy, targeted investment and efforts to bring about cultural change.

New York has unique status among large United States cities, as fewer than half of households here own a motor vehicle. More than two-thirds of all New York City trips are by walking, cycling and public transport

Bill de Blasio made street safety a cornerstone of his first Mayoral campaign in 2013, spurred by activist families who had lost loved ones in traffic crashes and who cited the approaches being adopted in similar crash-prone cities around the world. Soon after the Mayor's

inauguration in 2014, New York City formally adopted Vision Zero, recognizing that traffic crashes that cause serious injury and death are not inevitable "accidents," but rather preventable incidents that can be systematically addressed and reduced.

New York has unique status among large United States cities, as fewer than half of households here own a motor vehicle. More than two-thirds of all New York City trips are by walking, cycling and public transport. High pedestrian volumes lead to high exposure to motor vehicles and the doubling of cycling in the last decade has presented new challenges and opportunities for street engineering. New York City was a natural fit for an initiative that emphasized the safety of vulnerable road users and confronted assumptions about the primacy of drivers on city streets.

To ensure the plans for Vision Zero were comprehensive as well as equitable, Mayor de Blasio and Transportation Commissioner Polly Trottenberg insisted on a data-driven community engagement plan to create Pedestrian Safety Action Plans designating priority areas, corridors and intersections based on pedestrians killed or seriously injured. Local communities were engaged through workshops and online portals through which residents could provide input on places in their neighborhoods that felt unsafe. This humanized an initiative that could otherwise seem very top-down and explained, in layperson's terms, the often-opaque processes behind traffic engineering.

HEART OF THE MATTER

The first wave of street engineering interventions under Vision Zero focused on these priority areas. They became the proving grounds for signal re-timings aligned with a newly enacted 25 mph (40 kph) city-wide speed limit, the installation of leading pedestrian intervals (LPIs) that give people walking across the street a head start before turning vehicles and the creation of street geometry changes like curb extensions.

All images : NYC DOT

Queens Boulevard has witnessed a major leap in road safety. Below: the Vision Zero campaign

Thanks to these interventions, pedestrian deaths and serious injuries declined 30 per cent at priority locations. In addition, four major arterial roads in the outer boroughs were designated "Vision Zero Great Streets" and were intensively redesigned. One of the four, Queens Boulevard, for years was known as "the Boulevard of Death," with 18 pedestrians killed there in 1997 alone. Since reconstruction began three years ago, no pedestrians have been killed on Queens Boulevard and this once-forbidding artery now hosts a well-used bicycle lane.

A combination of citywide policies and targeted interventions where they are needed most have made Vision Zero relevant to all New Yorkers. Soon after the city-wide default speed limit was lowered, the New York City Police Department (NYPD) dramatically increased enforcement of traffic laws. The City Department of Transportation (DOT) gained authorization from the State government to use automated

A combination of citywide policies and targeted interventions where they are needed most have made Vision Zero relevant to all New Yorkers

In 2018, NYC DOT installed nearly 25 miles of protected bicycle lanes, implemented left-turn traffic calming interventions at 110 intersections, activated 832 leading pedestrian intervals and completed 114 distinct safety improvement projects

speed enforcement cameras in 140 school zones during limited times tied to school opening and closing hours. Today, about two-thirds of all traffic summonses are for "Vision Zero offenses" most likely to injure or kill – speeding, failure to yield the right of way to pedestrians, failure to stop at a signal, improperly turning, using a mobile phone (including texting while driving) and disobeying signs. The City has been seeking greater local authority for speed camera use. Approximately 85 per cent of serious crashes happen at times and places where State law now prohibits camera use. Where cameras do operate, speeding summonses have fallen over 60 per cent.

LOOK AND LEARN

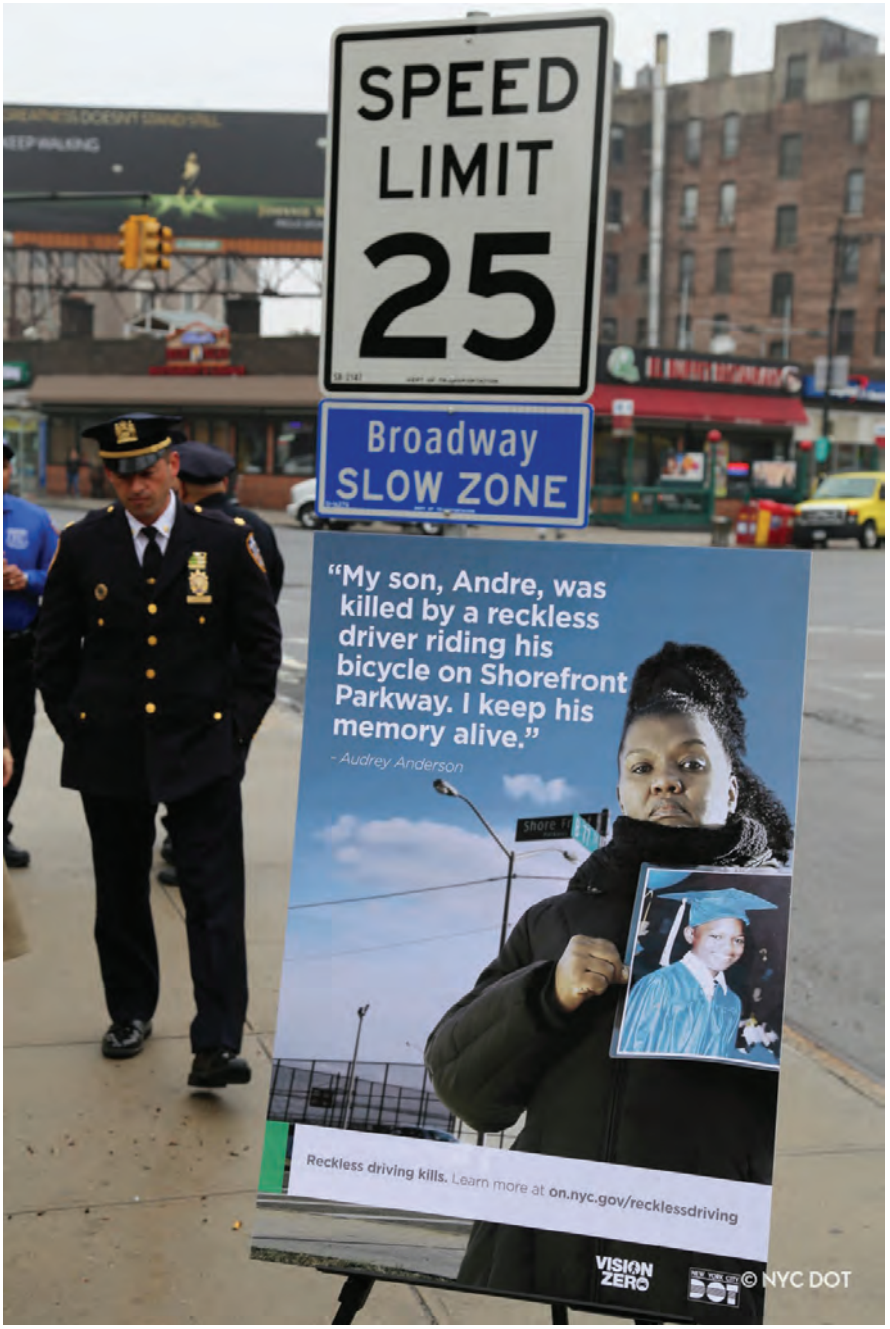
Marketing and education have also been key. Hard-hitting public advertising campaigns remind drivers that their choices matter, greeting locals and visitors alike on TV screens, in the backseats of taxis, on the rear panels of city buses and on billboards throughout the five boroughs. A new pedestrian safety curriculum was adopted by New York City public schools while traffic safety educators conduct training programs at more than 600 schools a year, as well as dozens of senior citizen centers.

From the start, New York City's approach integrated the work of numerous individual government agencies working together. The Vision Zero Task Force consists of representatives from the City's DOT, NYPD, taxi and limousine commission and departments dealing with administrative and fleet services, health, law, and management and budget. In addition, representatives from the District Attorneys, the state Metropolitan Transportation Authority, and other agencies attend Task Force meetings to help cut traffic fatalities. Agencies have worked together to follow data and formulate responses to new challenges.

New York City has committed US$1.6 billion through 2021 to Vision Zero initiatives. In 2018, the City DOT installed nearly 25 miles (40 km) of protected bicycle lanes, implemented left-turn traffic calming interventions at 110 intersections, activated 832 leading pedestrian intervals (LPIs) and completed 114 distinct safety improvement projects.

Achieving Vision Zero is also seen as a key way to advance the City's ambitious greenhouse gas reduction goals – this will require increasing the share of trips by walking, cycling, public transport, and shared modes, improving traffic management and decarbonizing vehicle mobility through electrification.

In year five of NYC's Vision Zero initiative, new challenges are emerging. Despite tremendous progress in reducing pedestrian deaths, the number of older pedestrians suffering serious or fatal injuries remains stubbornly high. New interventions will do more to protect senior citizens. The City is collecting and analyzing data regarding pedestrians walking on limited-access highways to understand how they end up in these dangerous situations. Education and outreach teams are formulating new programs to dissuade drivers under age 25 from operating recklessly and looking for better ways to identify and reduce



Hard-hitting public advertising campaigns like these above and opposite remind drivers of their responsibilities

aggressive driving.

The development of highly automated vehicles (HAVs) presents both a challenge and an opportunity to advance Vision Zero. National legislation could require HAVs to be designed and programmed to comply with traffic laws, except where necessary for safe and effective operation, and could require that HAVs demonstrate capacity to reliably recognize and safely interact with cyclists and pedestrians. But pending federal legislation could bar state or local regulation of HAV performance and undermine safety.

A fusion of leadership, policy, and investment have ensured that New York City will not only continue to buck the national trend, but that improvements here will persist for many years

MAINTAINING MOMENTUM

A fusion of leadership, policy and investment have ensured that New York City will not only continue to buck the national trend, but that improvements here will persist for many years and contribute to a long-term culture of safe streets. While New Yorkers fiercely defend their city, they are certainly not insular with regard to policy. New York City has always welcomed the world. Having built a strong foundation for safer streets, the City's next challenge is to sustain momentum by learning more from global peers, exchanging best practices, and managing emerging technologies so they support continued progress for traffic safety and sustainable mobility.

FYI

Michael Replogle is Deputy Commissioner for Policy, New York City Department of Transportation.

Julia Kite is Director of Strategic Initiatives, New York City Department of Transportation.

The analytics of everything

Smart cities need smart data management - but is that easier said that done, asks **Bob McQueen**?

The Smart Cities movement around the globe continues to go from strength to strength. There is a big emphasis on making use of advanced technology to improve connectivity between systems and between people. While the typical vision focuses on connecting networks such as roads, power grids, utilities and other infrastructure that compose the fabric of a smart city, there is another aspect of connectivity while worth considering. The ability to bring smart city data together from multiple sources and make a coherent and structured use of that data to convert it to information and on to insight and finally to action to improve transportation service delivery and smart cities. In my opinion this requires a Smart Data Management approach.

Smart Data Management helps agencies evolve from standalone or narrowly focused Smart City projects to highly integrated, business-driven operations. This requires in-depth experience with different IoT and other related applications, intimate knowledge of the smart city context, and broad expertise with complex analytics at scale. This combination of skills and experience help cities derive sustainable value from Smart City investments.

Whether your initial city focus is on mobility/transportation, energy, or public safety, you need an approach that can help you develop and deploy a solid foundation that is your Smart Data Management solution.

MOBILITY/TRANSPORTATION

One of the essential elements of a smart city will be next generation mobility. "Next-generation" will mean new technologies and new combinations of public and private sector

activities. Connected and autonomous vehicles, Mobility as a Service, movement analytics and smart phone apps that connect citizens and travelers, will deliver enhanced mobility in the smart city environment. This will ensure that urban citizens and visitors will be offered an equitable value proposition that enables them to achieve the levels of mobility required to support access to job opportunities, healthcare, education, and leisure activities. Inhabitants of the future smart city will have advanced levels of mobility to support economic wellbeing and their chosen lifestyles.

ENERGY

An important objective of smart cities relates to managing and mitigating the effect of transportation on the environment. Carbon reduction and renewable energy targets are being set along with the adoption of advanced technologies to change our carbon footprint. This can be achieved by better management of congestion to minimize acceleration and deceleration, hence reducing emissions and energy consumption on existing modes.

They can also come through the introduction of electric vehicles that reduce energy consumption and emissions and move the emissions to central power plants where they can be better handled. More than 20% of the energy generated in the US is used to fuel transportation. City leaders are recognizing that transportation efficiency is important and an integrated energy strategy is a crucial factor in delivering improved city services.

PUBLIC SAFETY

Smart Cities and public safety go hand in hand. A combination of sensing and intelligence can be applied to make smart city transportation smarter and safer. Metros, buses and trains can have sensors that monitor prevailing conditions and the current demand for transportation. This can provide input into the most effective operational management for transportation modes. The same connectivity that link sensors to back office infrastructure can also alert emergency services as required. The sensors can include close circuit TV that provides additional contextual information regarding platform, station or bus stop conditions TV cameras can be installed at the boarding and alighting point or on the vehicle. So, what exactly is "Smart Data Management "and why is it valuable?

"More than 20% of the energy generated in the US is used to fuel transportation. City leaders are recognizing that an integrated energy strategy is a crucial factor in delivering improved city services..."

Smart Data Management is a purposeful and structured approach to the development of data management capabilities for a smart city. I believe that it is the only way to extract the maximum value from investments in data collection and data management. Smart Data Management can take you in the most cost-effective way from data to information, to insight, to insight, to actionable strategies for smart city planning and operations.

From my perspective, Smart Data Management features the following:

- A series of planned investments thatdeliver immediate and clear value, while providing the business justification for further investments
- A coordinated and coherent data stream from multiple sources including sensors, other automated sources, and anecdotal data, ingested into a single platform using advanced automation
- The establishment and management of a centralized repository or data lake that enables data to be both shared and persisted
- Support for multi-genre analytics that can be shared across the enterprise
- A scalable approach that provides immediate value and benefits, while delivering a framework that is easily expandable for future needs
- Support for a data market approach that enables data to be valued from a public and private perspective and provides a mechanism for a "freemium" approach to data sharing

Smart data management will also feature the ability to have unified and contextual views of critical data, the delivery of analytics scale and the repositioning of smart data management as a key smart city asset.

The best approaches to smart city data management will feature a unified data architecture that provides the foundation of an "analytic ecosystem". Smart cities need to make sense of enormous and fast-moving IoT sensor data flows. Sensor data is exponentially more valuable when viewed in a wider context. A unified data architecture will combine the best of open-source technologies, such as Hadoop and Spark, with the performance of data warehouses. Better solutions can be provided by combining open-source with robust, well proven products.

That means the ability to distinguish between useful information and worthless noise. Further, a

unified data architecture will establish an effective environment for joining sensor and IoT data with other types of business-critical information (inventory, supply chain, customer, and pricing data) to identify root cause for problems and plan the next best action. This is where Big Data including IoT data translates into big ROI. Of course, the combination of data will also include the provision of a bridge to enable data to be collected across departments and across silos within a smart city enterprise.

There is no question that smart cities will mean big data. The best solutions will be delivered by providers that have a long history of consolidating and integrating data at scale to support effective advanced analytics. "At scale," means systems ranging from a few terabytes to 50 petabytes in a single machine – without having to scale the people and labor to match.

A Smart Data Management approach can be a key asset for Smart cities to establish and manage a "data lake" containing a wide variety of traditional and nontraditional data. The Smart Data Management system will make a wide range of data accessible to enable advanced analytics to be applied to extract the insight and understanding needed to define appropriate action.

A practical approach to Smart Data Management will begin by addressing a few key problems, but be flexible enough to address a wider range of problems that will emerge. The system may begin with a focus on one particular aspect such as transportation, but should have the flexibility to accommodate other aspects of the smart city in the future. These aspects might also include energy, education, public safety and enhancing the places where we live and work, and eGovernment initiatives among others.

It is also worth defining what Smart Data Management does not do and what we are trying to avoid. It does not support silos of data. It does not support a "cockpit" of data and tools that enable specific job functions. It does not grow without a plan. One of the challenges in the application of advanced technology to smart cities is that it is essential to achieve early, bottom-up results.

However, the best results are obtained overall when these early actions are part of a larger plan that aligns and converges all activities. The experience of developing and applying a Smart Data Management system must be engineered with the forethought and insight for the vision that the city wants to become and allow it to change and adapt as that vision broadens and learns from its new ability to exponentially learn from its data.

Smart Data Management delivers value by addressing challenges and opportunities associated with big data and smart cities.

Here are a few of the challenges that can be addressed by applying Smart Data Management:

- Avoiding data silos and providing an enterprise wide view of all data. - one of the

Smart Data Management does not grow without a plan and it must change and adapt as its vision broadens

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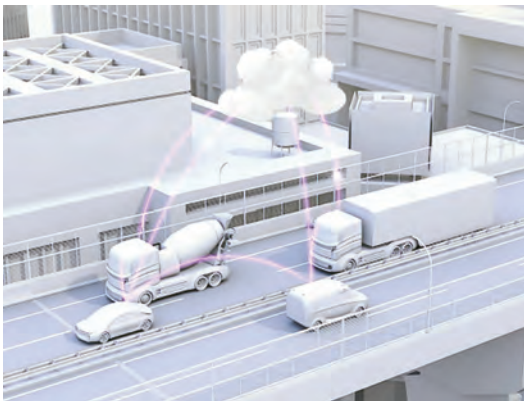
features of the typical and traditional methods to store and manage data is a fragmentation of the overall data assets for an agency. Typically, key technical staff build cockpits of data and tools around themselves and do not look to the organization to provide data as a tool or resource

- Avoiding organic system growth that fragments data and investments, raising the cost of using data - taking a deliberately engineered and scalable approach sets the scene for future success
- Duplicate investment in multiple parallel data management systems - starting out with an agreed architecture that encompasses multiple data management systems avoids parallel operation
- Increasing the cost of answering important questions because of inefficient data management infrastructure and data storage techniques
- Total reliance on open source approaches, while not taking advantage of robust products

Here is a brief snapshot of opportunities that can be addressed by applying Smart Data Management:

- The tendency for smart city programs to become fragmented and become "a collection of photo opportunities "can be avoided by using data as the "glue" to hold the program together
- Taking an enterprise wide view of data provides the fullest opportunity for new insight and understanding that can drive the performance of the smart city
- The opportunity to monetize data and engage the private sector in effective partnerships
- The use of advanced analytics to understand mechanisms and relationships that enable improved smart city service delivery



I believe that data is a new 'oil' and will be a significant part of the success of a smart city...

- New scientific approaches based on data and results for smart city planning and operations

In seeking the expertise to support Smart Data Management within your smart city it is important to identify support resources that do not try to be everything to everyone when it comes to Smart Cities. The best assistance can be defined in companies that are focused on data and analytics – period, end of story. All day, every day, the best smart city big data and analytics resources help agencies make sense of their data, so they can use it to advance business objectives. Specifically, the delivery of Smart Data Management requires expertise to support the following activities:

- Devise and prioritize the right Smart City strategies
- Build the business case for effective analytic solutions
- Quickly design and deploy pilots and proof-of-concepts
- Select the right options for analytic architecture and IoT technologies so the organization can support scalable data integration, data sharing, and multi-genre analytics
- Embrace Analytics of Things (AoT) to make sense of enormous data volumes
- Help bridge the divide between operational technology and information technology functions and process
- Prepare for and drive transformational change across your organization

The results? Smart City initiatives that lead to cost savings, improvements in operational efficiency, and identification of new revenue streams.

Today, big data and analytics specialists design solutions that produce sophisticated and scalable analytics for all your data, all the time. Separating business-critical information from the noise is the first step. Such expertise can put a flood of IoT data into low-cost data lakes. Relevant sensor data can be sent to data warehouses where data scientists and analysts can experiment with it. Costs go down, benefits go up. With countless valuable insights within reach, analytics will drive business value. Diverse agency data sources can be consolidated into a single view of your data to help drive value out of the data. This in turn can help you quickly expand and improve your Smart city initiatives.

I believe that data is a new "oil" and will be a significant part of the success of a smart city. Unleashing the power of data will be an essential element in improving the quality of life in the smart city of tomorrow.

FYI
Bob McQueen is principal of Bob McQueen & Associates and is also North American Bureau Chief for H3B Media
bob@bobmcqueenandassociates.com

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Patrizia Portmann
Federal Roads Office (FEDRO), Switzerland Federal Authority

Barry Sheerman
MP, UK Parliament

Trevor Hall
Managing Director, Road Safety Support

Nicholas Worrell
Director, Office of Safety Advocacy

Brian Ursino
Director of Law Enforcement, AAMVA

Antonio Avenoso
Executive Director, European Transport Safety Council

Brendan Halleman
Vice-President, Europe and Central Asia

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A PUBLICATIONS UK EVENT

Better cities, one street at a time

Skye Duncan and **Melinda Hanson** outline the global benefits brought about by the publication of the Global Street Design Guide

There hasn't been a single traffc death along New York City's Queens Boulevard since the city made safety changes

Photo: Wikimedia Commons

In 2014, Queens Boulevard in New York City got a makeover. Travel lanes were narrowed, crosswalks shortened, and signals updated to give pedestrians priority. There hasn't been a single traffic death along the 11-kilometer corridor since the city made these changes and ramped up speed enforcement, a dramatic improvement for a stretch of road that was previously referred to as the "Boulevard of Death" and once saw 19 pedestrian deaths in a single year.

This retrofit project is, unfortunately, not yet the norm. Streets around the world have been designed for motor vehicles. Inequitable distribution of space and general lack of pedestrian infrastructure make streets dangerous places to walk, cycle, or board transit: according to recent estimates, more than 1.3 million people die each year in traffic crashes. It's no wonder that when given a choice, many people seek refuge in a car.

The current street design paradigm has been shaped by volumes of design standards that focus on increasing throughput of cars, with little thought given to pedestrians, cyclists, or transit riders. For example, the "Green Book" *(A Policy on Geometric Design of Highways and Streets)* released by the American Association of State Highway and Transportation Officials has been a go-to resource for engineers around the world. The Green Book, and others like it, approach

The Global Street Design Guide has been endorsed by 22 organizations and 37 cities

All other images :NACTO-GDCI

Each street is a blank slate: new streets offer opportunities to get design right from the beginning, and existing streets provide a chance for transformation

street design from the lens of a motor vehicle, recommending wide travel lanes, broad turning radii, and open roads free of obstacles.

Applying these recommendations in urban areas can create hostile conditions for anyone not in a car. These designs invite speeding, a leading contributor to injuries and fatalities in cities. They send a message that our streets belong to car owners, and that a person in a car is more important than a person on the sidewalk. Finally, these designs continue to support an inefficient transportation system that ties countless millions in kilometers-long traffic jams, taking away valuable time that could otherwise be better spent.

BETTER BY DESIGN

Street design guidebooks are invaluable resources that capture lessons learned by traffic engineers and planners. They help urban practitioners to design for the outcomes they want and avoid repeating past mistakes. Each street is a blank slate: new streets offer opportunities to get design right from the beginning, and existing streets provide a chance for transformation.

There are many decisions to be made around width, markings, signals and geometries, each of which will change the way a street is used. For example, it's been well documented that a street with straight and wide travel lanes and little street-level activity will invite cars to speed, while a narrow street that includes a cycle track, sidewalks and trees will invite cycling and encourage cars to drive slowly.

In recent years, new volumes of street design guidance developed by cities from Copenhagen to New York to London have prioritized human-centered design, considering the vulnerabilities and needs of people and designing streets to prioritize public space, active transportation, and transit over private vehicle throughput.

Recognizing the power of these guidebooks and wanting to make them globally applicable, our organization, the National Association of City Transportation Officials' Global Designing Cities Initiative (NACTO-GDCI) published the *Global Street Design Guide* in 2016. Building upon NACTO's urban street design guides, and thanks to generous support from Bloomberg Philanthropies, the *Global Street Design Guide* was developed with input from experts in 72 cities and 42 countries – making it applicable to diverse urban contexts around the world. The Guide approaches design through a people and place-based approach and offers case studies and technical details to inform street designs that prioritize walking, cycling, and transit, while making streets safer and more inviting. To date, it's been endorsed by 36 cities and 26 organizations.

PEOPLE-CENTRIC DESIGN

The *Global Street Design Guide* supports practitioners as they move toward street designs that put people first, with real-world examples of designs that have been successfully implemented in cities around the world. The *Guide* also shows how to engage the numerous stakeholders involved in city-making and provides a methodology for metrics collection and evaluation so that cities can

Before and after photos of LeGare intersection in Addis Ababa, Ethiopia. The intersection was transformed to improve pedestrian safety.

We've heard from practitioners that the Global Street Design Guide serves as a permission slip to re-imagine what's possible and innovate

Above: the Global Street Design Guide offers strategies to shift the traditional hierarchy and plan streets that prioritize pedestrians, cyclists, and transit riders over private motor vehicles.

Left: in Fortaleza, Brazil, the Guide is helping to implement low-speed zones

set goals, measure impact, and get the most out of projects.

In practice, the *Guide* is helping local officials to identify impediments to urban design best practice and update local standards and policies accordingly. In Brazil, the *Global Street Design Guide* played a crucial role in inspiring Sao Paulo's transport engineers to reconsider common practice in traffic circle design and inspired the city of Fortaleza to implement low-speed zones around the city. In Mumbai, the *GSDG* is being used to train local engineers.

In Bogota, Colombia, the *Guide* is helping to inform a new city-level street design manual. And in Addis Ababa, Ethiopia, the guide has become the go-to resource for local transportation agencies looking to improve safety and efficiency at the city's intersections – including at Sebategna intersection, where an interim intervention underscored the need to expand sidewalks, improve crossings, and add signals to improve pedestrian safety at the intersection.

This is just the start. We've heard from practitioners that the *Global Street Design Guide* serves as a permission slip to re-imagine what's possible and innovate. As more cities begin to implement their visions using the practical standards set forth in the *Global Street Design Guide*, we'll begin to see even more improvements on our streets. We invite you to join in on this effort by endorsing the *Global Street Design Guide* and letting other practitioners know that it's available online for free. Let's work together to create better cities, one street at a time.

FYI
Skye Duncan is Director NACTO-GDCI and **Melinda Hanson** Deputy Director NACTO-GDCI

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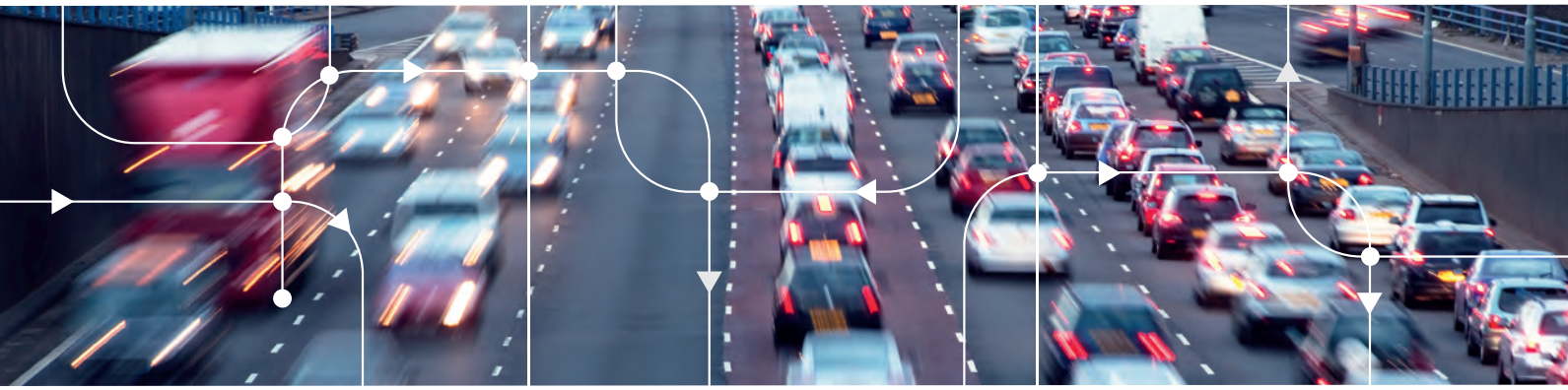

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Help is at hand for the travelling man

2018 will be an important year for vehicle safety in Europe, says **Graziella Jost**, making the European Transport Safety Council's case for Intelligent Speed Assistance

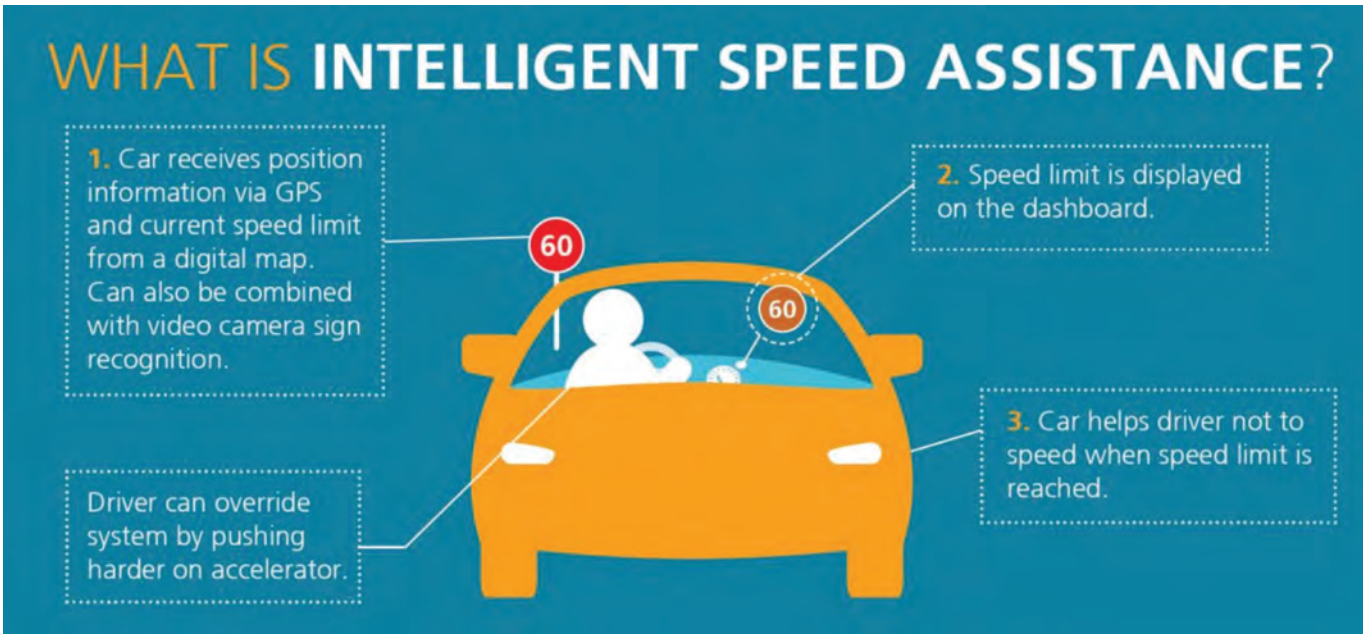
Some 25,300 people lost their lives on EU roads in 2017 – a figure that has hardly budged in four years. A further 135,000 people are seriously injured each year. It's a devastating human toll. But this year, the EU could take a major step forward in tackling the problem.

The European Commission is set to revise the General Safety Regulation 661/2009 and the Pedestrian Protection Regulation 78/2009. These vitally important vehicle safety regulations represent the most direct and effective measures the EU has to further reduce road deaths and injuries because every new car, van, lorry and bus sold in Europe has to meet these standards.

These regulations also offer an opportunity to improve the road safety of other road users. The share of deaths of unprotected road users is increasing as car occupants have been the main beneficiaries of improved vehicle safety in recent years. A focus on vulnerable road users is now needed. Pedestrians represent around 21 per cent of total EU road deaths - around two thirds of these occur in urban areas. Cyclists comprise around 8 per cent of total EU road deaths.

Consumers may think that all new cars sold on the EU market are safe because they have to meet EU type approval requirements. But EuroNCAP, the European New Car Assessment Programme, reveals that the safety levels differ between models and that this difference could make the crucial difference between life and death in the event of a collision. A car that just meets the minimum EU legal requirements would not be eligible for any stars. However, not all models sold in Europe are tested by EuroNCAP because of limited resources and not all models of the same type are sold with the same standards of safety equipment[1].

Minimum vehicle safety standards in the EU have not been updated since 2009 and as a result Europe risks losing its leadership position in safety technology



The car industry is rapidly developing automated driving functionality where the ability of the car to obey the current speed limit will be essential and the carmaker will be responsible for any error

It took automotive innovations such as anti-lock braking, airbags and even seat-belts several decades from being introduced in cars in the premium segment until they trickled down to all models. Regulation is needed to ensure that safety benefits are spread faster among the entire fleet of new vehicles and that safety improvements are not limited to better informed or wealthier consumers.

Many of the technologies and sensors used for driver assistance systems will be required for autonomous vehicles. But proven technologies should be adopted as today. Policymakers should not wait for driverless vehicles, or hope that they will be a panacea for road safety in the near future.

NO TIME TO LOSE

Minimum vehicle safety standards in the EU have not been updated since 2009 and as a result Europe risks losing its leadership position in safety technology. The European Parliament, in a resolution passed in November 2017, said "more effective" vehicle safety measures are needed in order to reach the long-term goal of "no fatalities". In March 2017, EU Transport Ministers from all 28 Member States also backed a revision of the standards with the Valletta Declaration on Road Safety. So what are the priority technologies that ETSC would like to see in all new vehicles?

INTELLIGENT SPEED ASSISTANCE (ISA)

ISA is probably the single most effective new vehicle safety technology currently available in terms of its life-saving potential. A study for the European Commission found the other main positive impacts include: encouraging walking and cycling due to increased perceived safety of cars vis-à-vis vulnerable road users, a traffic calming effect, reductions in insurance costs, higher fuel efficiency and reduced CO_2 emissions.

Intelligent Speed Assistance (ISA) helps drivers comply with speed limits. It uses GPS, a database of speed limit locations as well as sign-recognition cameras to provide haptic feedback on the accelerator pedal when a driver reaches the speed limit. The system can be overridable by continued pushing on the pedal for those rare occasions where increased acceleration may be necessary.

ETSC recommends fitting all new commercial vehicles with assisting ISA systems by 2020. The system should be overridable up to 100km/h for buses and 90km/h for lorries, in line with existing EU legislation on speed limiters. ETSC also recommends fitting all new cars and vans with an overridable assisting Intelligent Speed

ETSC recommends introducing uniform standards for alcohol interlocks in Europe which ensure that vehicle interfaces make it possible to fit an alcohol interlock [when needed] into any new vehicles by 2020

Car fitted with ISA could reduce CO_2 emissions by 8%

Assistance system that defaults to being switched on by 2020[2].

The car industry is rapidly developing automated driving functionality where the ability of the car to obey the current speed limit will be essential and the carmaker will be responsible for any error. ISA's rapid adoption will therefore aid development of a robust approach.

AUTOMATED EMERGENCY BRAKING (AEB)

Automated Emergency Braking (AEB) systems can help avoid crashes or mitigate their severity by warning the driver and supporting braking response and/or applying the brakes independently of the driver.

ETSC recommends mandatory installation of AEB systems with pedestrian and cyclist detection in 2020 for all new types of vehicle including for new heavy goods vehicles.

There are substantial synergies between ISA, AEB and pedestrian protection. Restriction of speeds will result in a higher probability that AEB can prevent crash occurrence as opposed to mitigating crash severity. This synergistic effect is likely to be particularly relevant to collisions with vulnerable road users, where the risk of a fatal outcome is high even when collisions occur at speeds below 50km/h. The cost benefit ratio of ISA, AEB and pedestrian protection are higher if the three are working together.

PEDESTRIAN PROTECTION REQUIREMENTS

Driver assistance systems such as advanced emergency braking should be seen as a complement to, not a replacement for, pedestrian safety testing requirements. Cyclist injuries from collisions with cars are an oft-neglected subject.

In addition to preserving the existing test requirements for pedestrian protection, ETSC is recommending

Advanced emergency braking should be seen as a complement to, not a replacement for, pedestrian safety testing requirements

several changes to add new tests and improve the current ones to ensure vulnerable road users are better protected in collisions.

ALCOHOL INTERLOCKS

Alcohol interlocks are connected to the vehicle ignition system and require the driver to take a breath test in order to drive the vehicle. If the driver is found with alcohol above the national legal Blood Alcohol Concentration (BAC) limit the engine will not start.

ETSC recommends introducing uniform standards for alcohol interlocks in Europe that ensure that vehicle interfaces make it possible to fit an alcohol interlock [when needed] into any new vehicles by 2020.

LANE KEEP ASSISTANCE

Current Lane Keep Assistance (LKA) systems help the driver to stay in their lane. They function at speeds typically from 65 km/h and work by monitoring the position of the vehicle with respect to the lane boundary, typically via a camera mounted behind the windscreen sited behind the rear view mirror. When the vehicle drifts out of the lane the LKA system gently guides the vehicle back into the lane by the application of torque to the steering wheel or one-sided braking.

ETSC recommends introducing Lane Keep Assistance by 2020 to cars and light trucks and vans.

DISTRACTION AND FATIGUE

Driving whilst using a mobile phone and other electronic devices significantly impairs driving ability and is thought to play a role in 20-30 per cent of all road collisions. Fatigue is also a road safety challenge.

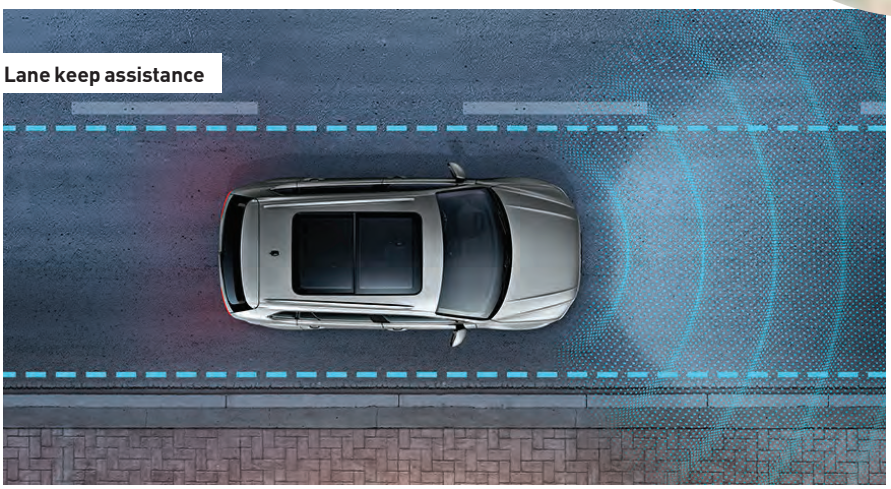
A wide range of technologies may be used to identify distraction or drowsiness in drivers in order to minimise collisions. Systems may employ physiological monitoring, physical monitoring or behavioural indices and patterns.

ETSC would also like to see manufacturers publish test results to show whether their infotainment systems are in compliance with the HMI (human machine interface) Guidance Statement of Principle on in-vehicle information and infotainment systems to ensure that these built-in systems do not worsen distraction.

EVENT DATA RECORDERS

Event Data Recorders (EDR) record a range of vehicle data over a short timeframe before, during and after a triggering threshold and are typically used to record information about road collisions which cannot be reliably identified by the usual police investigations. Most new cars and vans have EDR functionality already although the data it not easily accessible.

ETSC recommends requiring Event Data Recorders in all new vehicles by 2020 with a high level of specification in order to record the status of all in-car safety systems (when fitted) in the moments leading up to a collision, and also record data surrounding a collision with a pedestrian or cyclist.



Lane keep assistance

NOTES

[1] https://www.euroncap.com/en
[2] http://etsc.eu/wp-content/uploads/2017-09-isa-briefing_final.pdf

FYI

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The European Transport Safety Council (ETSC) is a Brussels-based independent non-profit organisation dedicated to reducing the numbers of deaths and injuries in transport in Europe.

www.etsc.eu

Watch ISA in action on ETSC's website at **http://etsc.eu/isa**

Suzanne Hoadley examines the wider implications of an automated future for cities and regions

Prepare for impact

Vehicle automation is possibly the most talked about development in the transport domain in recent decades. Headlines are not confined to the transport specialised press; they are widespread in the general media too. If you were to believe everything you read and heard about vehicle automation, you would be forgiven for thinking that driverless vehicles will be on our roads in the next 5-10 years and they will solve the main transport problems of congestion and safety. Is it so simple? Polis does not believe so.

Polis is concerned about the optimism bias in terms of what automated vehicles can deliver by way of benefits and when they will actually hit the roads. While automation may bring benefits, there is also the possibility that their widespread introduction in urban areas could lead to increased congestion, negative environmental impacts and negative health impacts, if walking and cycling are discouraged.

It relies on wider factors such as willingness to give up the convenience and comfort of a private car and car-sharing economics - a fleet owner will want a fleet of vehicles operating all the time, even when demand is low

This was the backdrop for the discussions among Polis members over the course of 2017, which culminated in a Polis discussion paper setting out the perspective of its member cities and regional transport authorities on the theme of road vehicle automation. Some 22 Polis members contributed directly to this 12-page document, issued on 23 January 2018, which

It is not inconceivable that a future of market-led shared automated vehicle service provision could lead to different levels of service access depending on ability to pay

was subsequently endorsed by the full membership. In publishing this paper, Polis hopes that research, technology development and policy-making in this area will take account of some of the concerns, issues and questions raised.

The paper is not intended to reflect a position as such, rather it explores the potentials impacts of driverless cars across a wide range of transportation domains and identifies some issues that city and regional transport authorities need to address and engage on as automated motoring advances. Given the uncertainties around when driverless cars will enter the market, in what form and the level of public acceptance, it is very difficult to predict the impacts. The paper therefore highlights potentially positive and negative outcomes across the domains that are relevant to city and regional transport authorities, particularly their policies of promoting sustainable mobility. In conducting such an exercise, Polis members are better equipped to think about the policies and measures they could adopt to achieve positive outcomes and to avert or mitigate negative ones.

SPECTRUM ANALYSIS

The impact of AVs on travel behaviour is one area that holds great unknowns. At one end of the spectrum where the car (whether in private or shared ownership) remains an important mode of transport, there is growing consensus that there will be an increase in traffic and in kilometres travelled. This would be to the detriment of public transport, walking and cycling. Indeed, such a scenario could lead to the end of high capacity public transport as we know it today. At the other end of the spectrum, where vehicle automation leads to a reduction in private car use/ownership in favour of a positive mix of active travel (walking and cycling), high capacity modes (train, tram and bus) and shared mobility, the outcomes could be positive. While this latter scenario appears attractive, it relies on wider factors such as willingness to give up the convenience and comfort of a private car and car-sharing economics - a fleet owner will want a fleet of vehicles operating all the time, even when demand is low.

At a spatial level, self-driving vehicles are expected to free up road space and other land as a big part of on-street and off-street parking becomes redundant. However, any freed-up road space would need to be put to other uses, otherwise it would no doubt be taken up by vehicles. This creates an opportunity to redesign streets and to use that space more efficiently, such as different usages depending on time of day and type of demand. A downside to vehicle automation could be longer commuting trips by car since this time could be spent doing other things such as reading, working or sleeping, even in congested conditions.

Vehicle automation holds the potential to enhance transport accessibility among those population groups and areas that most need it, by reducing the cost of passenger transport provision in areas

Road authorities are unlikely to invest in C-ITS today purely for the purpose of enabling automation in the future

of low and dispersed demand (rural areas and suburbs) and for special transport services for the elderly and disabled. Current service provision may be fragmented and/or reliant on voluntary services. On the flip side of the social coin, it is not inconceivable that a future of market-led shared automated vehicle service provision could lead to different levels of service access depending on ability to pay, ie, a premium subscriber could gain access to better and faster services, leading to increased social division and inequality.

SAFER CITIES

Improving road safety is one of the key drivers for automating the driving task. Accidents due to driver distraction, a leading cause of accidents, should become a thing of the past in an automated future.

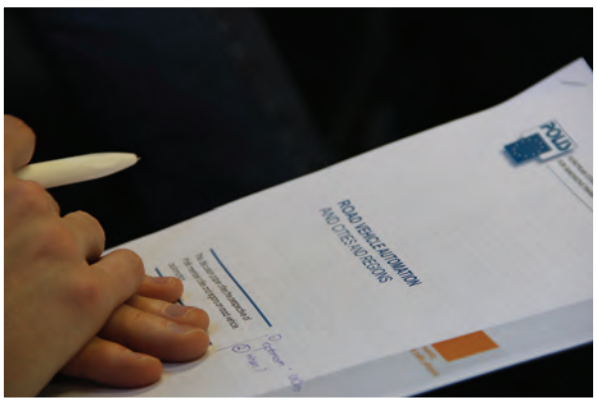
Cities and regions see great benefit in vehicles programmed to comply with traffic rules, such as speed limits, as they promise to be more cost-effective and efficient than current engineering measures (speed bumps, traffic calming, cameras, etc). However, since traffic rules and regulations can be specific to a given context and interpretation of those rules may differ from one city to another, a strong dialogue between industry and the public sector is required. With policies to promote active travel, cities and regions are particularly keen to know how automation can improve the safety of pedestrians and cyclists.

Given the complexity of the urban environment, with its short links, pedestrian crossings, on-street parking and range of road users – which is not the case for the 'simpler' motorway environment – there is concern that the safe operation of driverless vehicles on urban roads could in fact become an impediment to traffic efficiency. Will the sensors be so sensitive as to stop the vehicle regularly? What would be the impact on traffic flow of a mixed traffic environment involving vehicles of different levels of automation and active modes? The assumption today is that efficiency gains will only materialise once most (if not all) vehicles are highly automated – the long interim period could be painful. Further insight on this issue is needed.

With research and development mainly focusing on the vehicle environment, the requirements in terms of infrastructure are less clear. Ensuring a high level of service of the physical infrastructure, such as clear road markings and road signs, is difficult for a road authority today, not just because of the cost involved but also the fact that a utility company (telecoms operator, energy provider, water company) can dig up a road at little notice and may not leave the road as they found it once their job is finished.

Building the required digital infrastructure may also be expensive. There are expectations that many of the tools, such as digital maps and communication networks, will be developed and funded by the private sector, who will then need to find applications for them. Where the public sector is needed to make an investment, the cost and benefit will need to be carefully analysed. For instance, road authorities are unlikely to invest in C-ITS today purely for the purpose of enabling automation in the future. However, they are considering where C-ITS can play a role in supporting the traffic management task today, such as floating vehicle data and enhancing driver awareness of traffic rules.

Malin Andersson of the City of Gothenburg's Head of Development and International Affairs, Urban Transport Administration



LAW AND ORDER

A final domain of concern to city and regional transport authorities relates to legal aspects. While there are many discussions occurring at national and international levels, these are mainly focused on the vehicle and on creating the legal framework to allow automated vehicles to be piloted and even deployed on public roads. Such a discussion is missing at local/regional level, yet it is expected that new traffic rules will be needed for automated vehicles and new regulation may be required for the roll-out of automated car-sharing clubs. Specifically concerning the infrastructure, the liability issue needs to be clarified and EU rules may be needed regarding data sharing.

The above provides a snapshot of some of the themes that need further attention as vehicle automation progresses. Building on these themes, Polis members have identified a number of areas that they will give more attention to in the coming years:

- Build the right policy and planning framework to ensure they are prepared for and can steer the arrival of automated vehicles to ensure maximum benefit.
- Adopt a holistic framework, focusing on the services that automation can enable which lead to positive outcomes for city/regional transport goals and on most suitable road environment for such services.
- Anticipate the potential changes in travel behaviour that driverless vehicles may induce and introduce measures to ensure this is in line with sustainable mobility goals.
- Be prepared for changes to the role and responsibility of the road/transport authority that will arise on the path towards the increasing connectivity and automation of vehicles.
- Ensure personal security and safety of those using automated vehicles, in terms of trust, intimidation and hacking.

While the Polis discussion paper marks an important milestone in discussions among its members, it in fact represents the start of a process of reflection and action on how to move forward on the topic of road vehicle automation in a constructive way that harnesses the opportunity that automation offers in a way that supports the liveability and inclusiveness of Europe's cities and regions.

FYI

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Polis published a discussion paper on road vehicle automation in January 2018.

www.polisnetwork.eu/automation

www.polisnetwork.eu/uploads/Modules/PublicDocuments/polis_discussion_paper_automated_vehicles.pdf

Vision Zero City San Francisco: protected bicycle lane, coloured transit lanes *(City of San Francisco)*

No one needs to die

Andreas Kossak delves into the *Sustainable & Safe - A Vision and Guidance for Zero Road Deaths* report's extended call to action

In January 2018 the World Resource Institute (WRI)/Ross Center, in cooperation with the Global Road Safety Facility (GRSF) of the World Bank and the Bloomberg Philan-thropies Foundation, published a report entitled *Sustainable & Safe - A Vision and Guidance for Zero Road Deaths*. The report was particularly aimed at the extremely critical situation regarding road fatalities and heavy injuries in low- and middle-income countries. According to the Foreword: "Road traffic fatalities are the 10th lead-ing cause of death worldwide, claiming 1.25 million lives each year. Ninety per cent of these deaths are in low- and middle-income countries. Rather than improving, the problem is getting even worse".

It is explicitly emphasized, however, that the intention and the content of the report is relevant for and applicable to high-income and highly developed countries as well. The Introduction and Purpose reads: "This report recommends that countries and cities adopt policies and practices that embrace a more comprehensive approach to road safety, known as a Safe System. The Safe System approach to road safety has different names in different places, and it comes in varying iterations, but it is generally based on a common set of principles that focus on creating a mobility system that is forgiving of human error." The main summaries in the report refer to the description of The Safe System to Road Safety and the Conclusion.

THE SAFE SYSTEM APPROACH TO ROAD SAFETY

"The Safe System approach recognizes road safety as the outcome of the interaction between many components that form a dynamic system that influences the way people travel and behave on the roads and thus their level of exposure to the risk of a collision. When the mobility system offers a high degree of safety, it also generates many wider societal benefits, related to the broader public health concerns of acces-sibility, physical activity, air quality, climate change, and environmental sustainability."

In this context it is appropriate to quote the "Principles of a Safe System" drawn from a report published by the International Transport Forum (ITF) of the OECD:

1. People make mistakes that can lead to road crashes.
2. The human body has a limited ability to tolerate crash forces before harm occurs.
3. A shared responsibility exists among the people who design, build, manage and use roads and

Vision Zero country Sweden: intercity main roads, separated single lanes

vehicles and provide post-crash care to prevent crashes that result in serious injury or death.
4. A proactive approach should be taken to making the mobility system safe, rather than waiting for events to occur and reacting. All parts of the system must be strengthened to multiply their effects, so that if one part falls, road users are still protected.
5. No death or serious injury should be accepted in the mobility system. Lack of safety should not be a trade-off for faster mobility. Rather, the mobility system should be both safe and efficient.

The first four principles are more or less taken from the Swedish approach. Sweden has been the forerunner regarding "Vision Zero" – starting in the early 1990s and achieving exemplary success to date on all levels. The Swedish Vision Zero Program is based on the following three fundamental principles (Belin):
(i) People make mistakes that can lead to road crashes. The human body has a lim-ited physical ability to tolerate crash forces before harm occurs. *Consequence:* The design of the road transport system should guide the road user to as safe a behavior as possible but still mitigate the consequences of common human errors since they still will occur.
(ii) All parts of the system must be strengthened to multiply their effect, and if one part falls, road users are still protected. *Consequence:* Speed limits and speed management, driver assistance systems, injury mitigating properties of the vehicles etc. must be combined in an optimized way.
(iii) A shared responsibility exists amongst those who design, build, manage and use roads and vehicles and provide post-crash care to prevent crashes resulting in serious injury and death.

To date several countries, regions, cities, institutions and organizations worldwide have followed the Swedish example – including the European Commission and the OECD. Some examples:

- Sustainable Safety (the Netherlands, since the early 1990s)
- Safe System (Australia, concrete programs since the late 1990s)
- Safer Journeys (New Zealand, since 2011)
- Towards Zero Deaths (various US Federal States since the early 2000s: Wash-ington 2000, Minnesota 2003, etc)
- Vision Zero (New York City, plans starting in 2002; actions since 2014 – an increasing number of US cities have adopted the title Vision Zero City)
- Every Accident Is One Too Many (Danish Road Safety Commission, 2013)

A special text box in the report is dedicated to the necessity/advantage of a compre-hensive integrated institutional organization of the Safe System activities; it is entitled "Adopting the Safe System Approach at all Levels of Government". In the introduction it is stated that: "aligning the safe system approach across all governmental levels can significantly increase the impact. Doing so usually requires a national plan or policy respectively and complementary sub-national policies at the state or provin-cial/ regional and city levels."

MAKING CONNECTIONS

What has clearly been of extraordinary importance for the authors and publishers of the report has been the link of the Safe System approach to other important social and environmental complexes. The respective sub-chapter is entitled: "The Connection between a Safe System and Sustainable Mobility and Health". It starts with the following paragraph:

"A well-designed Safe System can yield benefits beyond saving lives from traffic crashes. It can help address other issues common to cities all over the world, reducing carbon dioxide emissions and positively affecting air quality, physical activity, and quality of life. A Safe System approach to land use can affect trip length and mode; good road design and infrastructure generate safe motorized vehicle speeds and provide for walking, cycling, and mass public transport. Reducing vehicle

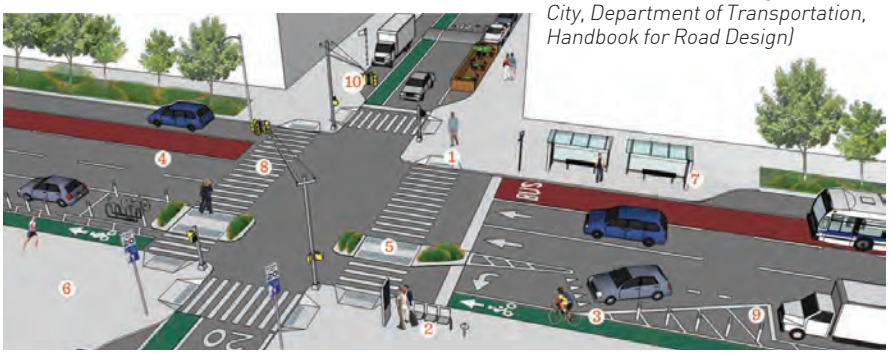
travel and speeds to improve safety also reduces other negative externalities generated by unconstrained use of private motor vehicles."

In context with the focus on Vision Zero, the twin concepts of "reducing carbon dioxide emissions" and "positively affecting air quality" are to be underscored in particular. According to the European Commission, at present about 400,000 people per year are dying in its member states as a result of poor air quality that is, to a substan-tial degree, caused by motorized road traffic; that is the manifold quantity of fatalities caused by crashes. Because the context between effects and consequences is not that direct, timely and obvious as in the case of crashes, the respective fact is much less widely recognized. That is not acceptable any more.

Regarding automobile technology, the Vision Zero approach has so far been focused on advanced driver assistance systems (ADAS), structural vehicle stability and pas-senger protection systems. In terms of air quality it has been primarily focused on the reduction of motorized road traffic. However, the latter should be explicitly and with high priority directed to the exhaust technology – not least since the massive fraud of major parts of the automobile industry in this context came to light.

According to the International Traffic Safety Data and Analysis Group (IRTAD – a subdivision of OECD and ITF) the number of (direct) road traffic fatalities decreased in the 32 Member States for which the relevant data has been available, by 42 per cent during the time-period 2000-2013. Those countries that systematically follow up the Safe System approach and the Vision Zero respectively are taking the lead in this regard.

The activities and progress in New York City, San Francisco and London have gar-nered particular press attention, not just in trade and technical journals, but in the mainstream media



Vision Zero City New York: 10 elements of Vision Zero road design *(New York City, Department of Transportation, Handbook for Road Design)*

too. In New York City, for example, the number of road traffic fatalities decreased by 28 per cent from 2014 (when the first measures had been introduced) to 2017; this equates to 64 less fatalities in 2017 compared to 2013. In 2014 the number of fatalities decreased for the first time compared to the year before and has subsequently decreased every year since.

THE EXCEPTION THAT PROVES THE RULE

Completely different to this is the situation in the City of Hamburg, Germany, where the number of road traffic fatalities most recently increased significantly. On the other side there were substantial successes in reducing the consequences of traffic accidents in Germany based on the "conventional" approach.

In the time span from 1992 to 2016 the number of fatalities decreased by nearly 72 per cent and the number of serious injuries by about 22 per cent - while the car-passenger-km increased by about 30 per cent. Nevertheless Germany is not (yet) listed as one of the Top Performing Countries for Road Safety like Norway, Sweden, Great Britain, Switzerland, Denmark, Ireland, Spain and The Netherlands (European countries in order of road traffic fatalities per inhabitants – according to a picture in the Safe System report).

CONCLUSION

The Conclusion of the report reads: the key to real change in road safety is shifting responsibility from people who use the roads to people who design, set policy, execute operations and otherwise contribute to the mobility system. An overemphasis on victim behavior and personal responsibility has long relieved pressure on governments to take responsibility and act to protect their citizens. This mindset needs to change, in terms of both public expectation and political and professional perceptions of responsibility."

That is primarily based on the following key findings:

- "The safe system approach has been shown to be more effective in reducing traffic deaths and serious injuries than more traditional approaches.
- The action areas of a Safe System approach are based on evidence-based measures
- Countries of all income levels can adopt the Safe System Approach.
- A Safe System is sustainable".

Regarding the last point, that is underscored again that the Safe System "can help meet broader environmental, social and health goals. By promoting public transport, walking, and bicycling it can help mitigate climate change and improve air quality by reducing carbon dioxide emissions from transport..."

In this context, the systematic and comprehensive worldwide application of the Safe System approach is explicitly connected to the 17 "Sustainable Development Goals" (SDG) set by the United Nations

- including the reduction of the number of road fatalities worldwide by 50 per cent until 2030 compared to 2015. The UN-SDGs refer, for example, to: "Zero Hunger", "Clean Water and Sanitation", "Sustainable Cities and Communities", "Climate Change".

Among the examples for appropriate/necessary measures are explicitly named:

- Speed-Reduction – in particular in rural areas;
- Urban development strategies for a safer life in cities;
- Efficient protection of cyclists and pedestrian;
- Design of main streets aimed at preventing frontal collisions;
- Strict enforcement of safety laws and regulations;
- Improvement of vehicle safety;
- Minimizing the reaction time in cases of emergency etc.

The main characteristics of the Safe System can be summarized as follows:

- A Safe System for all road users is not limited to questions of road design, enforcement, education, car-safety and emergency procedures. It includes land-use planning as well as taking into account new transport- and vehicle-technologies, new mobility models, changes in mobility behaviour, etc.
- The execution of the Safe System approach needs a permanent check of the ef-fectiveness of the implemented measures and prospective actions because the mobility patterns are changing extremely dynamically. Adaptations are often necessary, even shortly after certain measures have been implemented. Multiple evidences of the effectiveness of Safe System components in other locations may facilitate it for planners and administrations taking them over and adapting them to the specific circumstances.
- The vision of zero deaths on roads is not only a slogan. It is a precious ambition, recognizing that road fatalities can be avoided, if the numerous measures having yet been proven to be effective are applied. A Safe System approach regarding road traffic safety must include the extension of planning-capacities, improved management-systems, integrated planning processes, strict regulations, laws as and design standards. Without such a network, the effectiveness of a Safe System could get lost.
- The key for a real change in the road traffic safety is the shift of the responsibility from the road user to those designing the roads, being responsible for the traffic policy and the traffic management and all others influencing the conditions of the road mobility system. The over-accentuation of the victim behavior and their personal responsibility has for too long taken the pressure off the governments and administrations to take over the responsibility for protecting the citizen.

Finally it is explicitly stressed that the consequent conversion of all relevant systems in the context of the Safe System approach is not simple. It needs a comprehensive institutional self-conception married to a set of appropriate actions, ambitious goals, economical analyses, problem-oriented priority-setting, intensive control and progress checks. Each country, state/region and city should use the manifold available data and research results in order to be able to identify the main risks as well as the priorities. That is the precondition for being able to concentrate on the most efficient instruments and the most significant influences while working holistically in making the mobility system as a whole as safe as possible. In order to achieve a long-time efficient change an integrated procedure is necessary using all available instruments.

The comprehensive adaptation of the road safety strategies based on the Safe System approach is stated to be the only adequate answer to the scale of fatalities and severe injuries on the roads worldwide.

CONSEQUENCES

Despite all the substantial successes in fighting road traffic fatalities and heavy injuries based on conventional measures, the Safe System/Vision Zero approach should be adapted as soon as possible in all European states/regions and cities. In view of the horrible number of fatalities caused by air-pollution from automobiles, the approach should be extended by all means to a substantial reduction of the respective pollution to the technological roots. That is long overdue. The experience shows that the respective measures have to be (politically) mandated; violations must be pun-ished harshly.

The potential and the hitherto success of the Vision Zero/Safe System approaches should at least be connected to the arguments of the automobile industry and its supporters/believers regarding the promises of autonomous automobiles. The oft-stated assertion of reducing the number of road traffic fatalities by 90 per cent compared to the actual situation is totally unrealistic. This has been proved by numerous highly qualified independent experts and institutes all over the world. The probability of an increase of fatalities and serious injuries would be even higher than the opposite; that is in particular true when taking into account the by far not yet fully exploited potential of the Vision Zero/Safe System approach.

FYI
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New light through old windows

Bus Safety Standard: A research programme for improving bus safety in London, by **Dr Alix Edwards**

The Transport Research Laboratory (TRL) has been commissioned by Transport for London (TfL) to deliver a programme of research to develop a Bus Safety Standard (BSS). The BSS will be a safety-focused standard for vehicle design and system performance. This is in support of the Mayor of London's Transport Strategy that sets a target to achieve zero road collision deaths for buses in London by 2030.

The research work is centred on the amendment of TfL's Bus Vehicle Specification, which is currently used in the bus contracting process. This specification sets out many aspects of what a London bus should look like, how it should provide passenger capacity and support passenger's needs, meet emissions standards and a host of other engineering requirements. The new research will develop this to provide a greater emphasis on the safety performance of the bus.

HOW WILL SAFETY IMPROVEMENTS BE ASSESSED?

TfL has specified 13 safety measures of interest and these form the basis of the research. For each measure, a thorough review of the current regulations and standards and a review of the current bus fleet and available supplier solutions has been conducted.

Trials are currently being conducted and these have two purposes: firstly to evaluate the solutions in a realistic environment in order to ensure that a safety improvement is actually feasible; and secondly to inform the development of an independent test and assessment protocol. The exact evaluation methods depend upon each of the 13 measures being developed and are tailored to suit each one. The ratings developed will be simple pass/fail and/or a more complex performance rating; again, tailored to suit the nature of each safety measure. Injury and collision data will be used to derive the scenarios and/or injury mechanisms to be addressed; as such it will be an independent, performance-based assessment.

As an illustration of the range of approaches being used, for Automated Emergency Braking (AEB) evaluation, we will include track testing and on-road driving, whereas for crashworthiness protection of Vulnerable Road Users (VRUs) we will use computer simulation. The engineering aspects are being accompanied by human factors assessments. For example, visual and acoustic conspicuity measures

> ***Competing technologies will not be tested or rated against each other; only one technology or vehicle will be used for each trial***

(that aim to help VRUs better identify the path and speed of approaching buses) will be assessed by a representative population of VRUs. High risk, but thankfully rare, events such as runaway buses and pedal confusion will be assessed using prototype vehicles and a representative sample of London bus drivers.

As a minimum, each technology will need to demonstrate significant improvement in safety performance against the baseline in controlled testing for scenarios that are representative of real service. However, translating this into an assessment of casualty reduction is challenging. Many of the measures do not exist yet in the bus market, so a predictive analysis will be undertaken if necessary. This will predict the numbers and severities of casualties prevented, and look at how well each technology can reduce them.

Competing technologies will not be tested or rated against each other; only one technology or vehicle will be used for each trial.

Of course, it is possible that TfL will want to carry out comparative testing in the future to assess technologies/vehicles against the newly developed BSS tests, but that is not within the scope of the current project.

WHAT ELEMENTS FORM PART OF BSS RESEARCH?

The results of the trials will feed into the new BSS that will be incorporated into bus operator contracts from the end of 2018, however It's unlikely that all 13 measures will be included in the 2018 requirements.

A business case will be developed for each safety measure based on an economic valuation of the predicted casualty reduction. This will be balanced against the costs of adding the feature into the specification and any other operational costs or benefits.

The key output for the research is the amended and extended Bus Vehicle Specification for TfL to use in the bus contracting process. These revisions will be additionally peer-reviewed by independent safety experts external to TRL too. Accompanying the specification there will be guidance notes to help inform the bus operators and

manufacturers of what the specification is aiming to achieve and some practical tips on how to meet the requirements.

A road map has been developed by TRL to provide a guide for future developments of the BSS, and this is currently out for consultation with the bus industry. This road map will become a key tool for bus manufacturers and operators in understanding TfL's requirements, and will be a rolling document with regular updates so as to remain relevant. The timescales will be challenging but realistic. Euro NCAP's road map for passenger car safety has been used as the model for our approach.

Similarly, Euro NCAP is being used as a model to inform the development of an overall safety rating system. This will allow operators and TfL to select the buses with highest safety ratings when balanced against their other economic and operational concerns.

The Euro NCAP Advanced Reward system is another approach that will be used to help develop a framework for assessing other safety features that are not currently part of the 13 measures of the BSS. After all, the bus industry and its supply chain can offer a vast range of safety improvements and these should be given some form of independent assessment and recognition reward if they are deemed worthy. Applicants will need to provide a dossier of evidence describing a safety system and its effectiveness, so that an independent panel of safety experts can assess it.

The bus industry and its supply chain can offer a vast range of safety improvements and these should be given some form of independent assessment and recognition reward if they are deemed worthy

THE CHALLENGE

Ultimately, the goal of the research is to develop an independent standard and framework for assessing the safety of TfL's buses. Bringing all the safety measures together and ensuring that they are working in a complementary manner is complex. The programme has a tight schedule and is promising to deliver some novel research into new areas of bus safety. Strong steps towards safer buses for London are achievable through this Bus Safety Standard, which we would hope will grow in subsequent years to become a world-leading benchmark for bus safety.

FYI

Dr. Alix Edwards is the Technical Lead for the Bus Safety Standard research at the Transport Research Laboratory (TRL)

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